

# Package ‘hyd1d’

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**Type** Package

**Version** 0.5.3

**Date** 2025-02-26

**Title** 1d Water Level Interpolation along the Rivers Elbe and Rhine

**Description** An S4 class and several functions which utilize internally stored datasets and gauging data enable 1d water level interpolation. The S4 class (WaterLevelDataFrame) structures the computation and visualisation of 1d water level information along the German federal waterways Elbe and Rhine. 'hyd1d' delivers 1d water level data - extracted from the 'FLYS' database - and validated gauging data - extracted from the hydrological database 'WISKI7' - package-internally. For computations near real time gauging data are queried externally from the 'PEGELONLINE REST API' <<https://pegelonline.wsv.de/webservice/dokuRestapi>>.

**Depends** R (>= 4.1.0)

**Imports** methods, utils, Rdpack, httr2, curl

**Suggests** DBI (>= 0.4-9), RPostgreSQL (>= 0.6-1), testthat, knitr, rmarkdown, stringr, devtools, pkgdown, roxygen2, revealjs, shiny, shiny.i18n, shinyTime, lubridate, usethis, yaml, desc

**RdMacros** Rdpack

**License** GPL (>= 2)

**Encoding** UTF-8

**LazyData** true

**RoxygenNote** 7.3.2

**Collate** 'Class-WaterLevelDataFrame.R' 'WaterLevelDataFrame-methods.R'  
'data.R' 'getGaugingDataW.R' 'getPegelonlineW.R'  
'hyd1d-internal.R' 'hyd1d.R' 'plotShiny.R'  
'updateGaugingData.R' 'waterLevel.R' 'waterLevelFlood1.R'  
'waterLevelFlood2.R' 'waterLevelFlys3.R'  
'waterLevelFlys3InterpolateX.R' 'waterLevelFlys3InterpolateY.R'  
'waterLevelFlys3Seq.R' 'waterLevelPegelonline.R' 'zzz.R'

**VignetteBuilder** knitr

**BugReports** <https://github.com/bafg-bund/hyd1d/issues/>

**URL** <https://hyd1d.bafg.de>, <https://github.com/bafg-bund/hyd1d>

**NeedsCompilation** no

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`as.data.frame.WaterLevelDataFrame`*Coerce a `WaterLevelDataFrame` to a `data.frame`*

---

## Description

A function to coerce an object of class `WaterLevelDataFrame` to a `data.frame`.

## Usage

```
## S3 method for class 'WaterLevelDataFrame'  
as.data.frame(x, ...)
```

## Arguments

|                  |                                                                                                |
|------------------|------------------------------------------------------------------------------------------------|
| <code>x</code>   | an object of class <code>WaterLevelDataFrame</code> .                                          |
| <code>...</code> | additional arguments to be passed to the internally used <code>as.data.frame</code> -function. |

## Value

`as.data.frame` returns a `data.frame`.

## See Also

`WaterLevelDataFrame`, `data.frame`, `as.data.frame`

## Examples

```
wldf <- WaterLevelDataFrame(river = "Elbe",  
                             time  = as.POSIXct("2016-12-21"),  
                             station = seq(257, 262, 0.1))  
df <- as.data.frame(wldf)
```



## Details

The naming of the water levels is river-specific:

### Elbe:

'0.5MNQ', 'MNQ', '0.5MQ', 'a', '0.75MQ', 'b', 'MQ', 'c', '2MQ', '3MQ', 'd', 'e', 'MHQ', 'HQ2', 'f', 'HQ5', 'g', 'h', 'HQ10', 'HQ15', 'HQ20', 'HQ25', 'HQ50', 'HQ75', 'HQ100', 'i', 'HQ150', 'HQ200', 'HQ300', 'HQ500'

### Rhine:

'Ud=1', 'Ud=5', 'GIQ2012', 'Ud=50', 'Ud=80', 'Ud=100', 'Ud=120', 'Ud=183', 'MQ', 'Ud=240', 'Ud=270', 'Ud=310', 'Ud=340', 'Ud=356', 'Ud=360', 'MHQ', 'HQ2', 'HQ5', 'HQ5-10', 'HQ10', 'HQ10-20', '~HQ20', 'HQ20-50', 'HQ50', 'HQ50-100', 'HQ100', 'HQ100-200', 'HQ200', 'HQ200-ex', 'HQextr.'

Both lists of water levels are ordered from low to high water levels.

## References

Busch N, Hammer M (2009). "Einheitliche Grundlage für die Festlegung der Bemessungswasserspiegellagen der Elbe auf der frei fließenden Strecke in Deutschland." doi:10.5675/bfg1650.

HKV Hydrokontor (2014). "Erstellung eines SOBEK-River Modells für den Rhein von Iffezheim bis Pannerdense Kop als Weiterentwicklung bestehender SOBEK-RE Modelle."

Bundesanstalt für Gewässerkunde (2013). "FLYS goes WEB: Eröffnung eines neuen hydrologischen Fachdienstes in der BfG." doi:10.5675/BfG\_Veranst\_2013.4, [https://doi.bafg.de/BfG/2013/Veranst4\\_2013.pdf](https://doi.bafg.de/BfG/2013/Veranst4_2013.pdf).

Bundesanstalt für Gewässerkunde (2016). "FLYS – Flusshydrologischer Webdienst." [https://www.bafg.de/DE/5\\_Informiert/1\\_Portale\\_Dienste/FLYS/flys\\_node.html](https://www.bafg.de/DE/5_Informiert/1_Portale_Dienste/FLYS/flys_node.html).

DELTA RES (2018). "SOBEK." <https://download.deltares.nl/en/sobek/>.

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df.flys\_sections

Reference gauging stations according to FLYS3

---

## Description

This dataset relates the reference gauging stations to river stationing as used within FLYS3

## Usage

```
df.flys_sections
```

## Format

A data.frame with 24 rows and 4 variables:

**river** name of the FLYS3 water body (type character).

**gauging\_station** name of the reference gauging station (type character).

**from** uppermost station of the river section (type numeric).

**to** lowermost station of the river section (type numeric).

**uuid** name of the reference gauging station (type character).

## References

Bundesanstalt für Gewässerkunde (2016). “FLYS – Flusshydrologischer Webdienst.” [https://www.bafg.de/DE/5\\_Informiert/1\\_Portale\\_Dienste/FLYS/flys\\_node.html](https://www.bafg.de/DE/5_Informiert/1_Portale_Dienste/FLYS/flys_node.html).

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|                 |                                                                           |
|-----------------|---------------------------------------------------------------------------|
| df.gauging_data | <i>Gauging data for all WSV-run gauging stations along Elbe and Rhine</i> |
|-----------------|---------------------------------------------------------------------------|

---

## Description

This dataset contains all **daily-averaged** gauging data for the gauging stations along **Elbe** and **Rhine** operated by the waterway and shipping administration (Wasserstraßen- und Schifffahrtsverwaltung (WSV)) since 1960-01-01. Data from 1960-01-01 until 2023-12-31 are validated and were queried from (**WISKI7**)-database and supplied by <Datenstelle-M1@bafg.de>. Data after 2023-12-31 are continuously collected from <https://pegelonline.wsv.de/gast/start> and are not officially validated. Unvalidated recent data will be replaced annually and distributed through package and/or internal dataset updates.

The latest version is stored locally under `paste0(options()$hyd1d.datadir, "/df.gauging_data_latest.RDS")`. To modify the location of your locally stored gauging data set using `options()` prior to loading the package, e.g. `options("hyd1d.datadir" = "~/hyd1d"); library(hyd1d)`. The location can be determined through the environmental variable `hyd1d_datadir`.

## Usage

```
df.gauging_data
```

## Format

A data.frame with 1379334 (rows and 3 variables):

**gauging\_station** name of the gauging station (type character). It is used as JOIN field for dataset [df.gauging\\_station\\_data](#).

**date** of the measurement (type Date).

**w** water level relative to the gauge zero (cm, type numeric).

## References

Wasserstraßen- und Schifffahrtsverwaltung des Bundes (WSV) (2024). “Pegeldaten für Elbe und Rhein.”

Wasserstraßen- und Schifffahrtsverwaltung des Bundes (WSV) (2022). “PEGELONLINE.” <https://pegelonline.wsv.de/gast/start>.

## See Also

[updateGaugingData](#)

## Examples

```
options("hyd1d.datadir" = tempdir())
updateGaugingData(paste0(options()$hyd1d.datadir,
                          "/df.gauging_data_latest.RDS"))
```

---

```
df.gauging_station_data
```

*Gauging station data for all WSV-run gauging stations along Elbe and Rhine*

---

## Description

This dataset contains gauging station data for the gauging stations along **Elbe** and **Rhine** operated by the waterway and shipping administration (Wasserstraßen- und Schifffahrtsverwaltung (WSV)). The data were originally obtained from <https://pegelonline.wsv.de/gast/start> and are updated annually.

## Usage

```
df.gauging_station_data
```

## Format

A data.frame with 70 rows and 13 variables:

**id** continuous numbering (type integer).

**gauging\_station** name of the gauging station (type character). It is used as JOIN field for dataset [df.gauging\\_data](#).

**uuid** of the gauging station in the PEGELONLINE system (type character).

**agency** of the waterway and shipping administration in charge of the respective gauging station (type character).

**km** official stationing of the gauging station (type numeric).

**longitude** of the gauging stations location (WGS1984, type numeric).

**latitude** of the gauging stations location (WGS1984, type numeric).

**mw** mean water level of the gauging station (m relative to the gauge zero, type numeric).

**mw\_timespan** timespan used to derive the gauging stations mean water level (type character).

**pnp** the gauge zero relative to sea level (NHN (DHHN92), type numeric).

**data\_present** logical to separate TRUE (real) from section structuring FALSE gauging stations.

**km\_qps** corrected stationing used for the water level computations of [waterLevel](#) and [waterLevelPegelonline](#) (type numeric).

**river** the gauging station is located on (type character).

## References

Wasserstraßen- und Schifffahrtsverwaltung des Bundes (WSV) (2022). "PEGELONLINE." <https://pegelonline.wsv.de/gast/start>.

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|                 |                                                                                               |
|-----------------|-----------------------------------------------------------------------------------------------|
| getGaugingDataW | <i>Get W from internal dataset df.gauging_data for the specified gauging station and time</i> |
|-----------------|-----------------------------------------------------------------------------------------------|

---

## Description

Extract the daily mean water level data from `df.gauging_data` for specific gauging station and date.

## Usage

```
getGaugingDataW(gauging_station, time, uuid)
```

## Arguments

`gauging_station`

must be type character with a length of one. Permitted values are: 'SCHOENA', 'PIRNA', 'DRESDEN', 'MEISSEN', 'RIESA', 'MUEHLBERG', 'TORGAU', 'PRETZSCH-MAUKEN', 'ELSTER', 'WITTENBERG', 'COSWIG', 'VOCKERODE', 'ROSSLAU', 'DESSAU', 'AKEN', 'BARBY', 'SCHOENEBECK', 'MAGDEBURG-BUCKAU', 'MAGDEBURG-STROMBRUECKE', 'MAGDEBURG-ROTHENSEE', 'NIEGRIPP AP', 'ROGAETZ', 'TANGERMUENDE', 'STORKAU', 'SANDAU', 'SCHARLEUK', 'WITTENBERGE', 'MUEGGENDORF', 'SCHNACKENBURG', 'LENZEN', 'GORLEBEN', 'DOEMITZ', 'DAMNATZ', 'HITZACKER', 'NEU DARCHAU', 'BLECKEDE', 'BOIZENBURG', 'HOHNSTORF', 'ARTLENBURG', 'GEESTHACHT', 'IFFEZHEIM', 'PLITTERSDORF', 'MAXAU', 'PHILIPPSBURG', 'SPEYER', 'MANNHEIM', 'WORMS', 'NIERSTEIN-OPPENHEIM', 'MAINZ', 'OESTRICH', 'BINGEN', 'KAUB', 'SANKT GOAR', 'BOPPARD', 'BRAUBACH', 'KOBLENZ', 'ANDERNACH', 'OBERWINTER', 'BONN', 'KOELN', 'DUESSELDORF', 'RUHRORT', 'WESEL', 'REES', 'EMMERICH'.

`time`

must be type `c("POSIXct", "POSIXlt")` or `Date` and in the temporal range between 1960-01-01 and now (`Sys.time()` or `Sys.Date()`).

`uuid`

must be type character with a length of one. Permitted values are: '7cb7461b-3530-4c01-8978-7f676b8f71ed', '85d686f1-55b2-4d36-8dba-3207b50901a7', '70272185-b2b3-4178-96b8-43bea330dcae', '24440872-5bd2-4fb3-8554-907b49816c49', 'b04b739d-7ffa-41ee-9eb9-95cb1b4ef508', '16b9b4e7-be14-41fd-941e-6755c97276cc', '83bbaedb-5d81-4bc6-9f66-3bd700c99c1f', 'f3dc8f07-c2bb-4b92-b0b0-4e01a395a2c6', 'c093b557-4954-4f05-8f5c-6c6d7916c62d', '070b1eb4-3872-4e07-b2e5-e25fd9251b93', '1ce53a59-33b9-40dc-9b17-3cd2a2414607', 'ae93f2a5-612e-4514-b5fd-9c8aecdd73c7', 'e97116a4-7d30-4671-8ba1-cdce0a153d1d', '1edc5fa4-88af-47f5-95a4-0e77a06fe8b1', '094b96e5-caeb-46d3-a8ee-d44182add069', '939f82ec-15a9-49c8-8828-dc2f8a2d49e2', '90bcb315-f080-41a8-a0ac-6122331bb4cf', 'b8567c1e-8610-4c2b-a240-65e8a74919fa', 'ccccb57f-a2f9-4183-ae88-5710d3afaefd', 'e30f2e83-b80b-4b96-8f39-fa60317afcc7', '3adf88fd-fd7a-41d0-84f5-1143c98a6564', '133f0f6c-2ca1-4798-9360-5b5f417dd839', '13e91b77-90f3-41a5-a320-641748e9c311', 'de4cc1db-51cb-4b62-bee2-9750cbe4f5c4', 'f4c55f77-ab80-4e00-bed3-aa6631aba074', 'e32b0a28-8cd5-4053-bc86-fff9c6469106', 'cbf3cd49-91bd-49cc-8926-ccc6c0e7eca4', '48f2661f-f9cb-4093-9d57-da2418ed656e',



'550e3885-a9d1-4e55-bd25-34228bd6d988', 'c80a4f21-528c-4771-98d7-10cd591699a4',  
'ac507f42-1593-49ea-865f-10b2523617c7', '6e3ea719-48b1-408a-bc55-0986c1e94cd5',  
'c233674f-259a-4304-b81f-dce1f415d85b', 'a26e57c9-1cb8-4fca-ba80-9e02abc81df8',  
'67d6e882-b60c-40d3-975c-a6d7a2b4e40a', '6aa1cd8e-e528-4bcb-ba8e-705b6dcb7da2',  
'33e0bce0-13df-4ffc-be9d-fla79e795e1c', 'd9289367-c8aa-4b6a-b1ad-857fec94c6bb',  
'b3492c68-8373-4769-9b29-22f66635a478', '44f7e955-c97d-45c8-9ed7-19406806fb4c',  
'b02be240-1364-4c97-8bb6-675d7d842332', '6b774802-fcb5-49ae-8ecb-ecaf1a278b1c',  
'b6c6d5c8-e2d5-4469-8dd8-fa972ef7eaea', '88e972e1-88a0-4eb9-847c-0925e5999a46',  
'2cb8ae5b-c5c9-4fa8-bac0-bb724f2754f4', '57090802-c51a-4d09-8340-b4453cd0e1f5',  
'844a620f-f3b8-4b6b-8e3c-783ae2aa232a', 'd28e7ed1-3317-41c5-bec6-725369ed1171',  
'a37a9aa3-45e9-4d90-9df6-109f3a28a5af', '665be0fe-5e38-43f6-8b04-02a93bdbbeeb4',  
'0309cd61-90c9-470e-99d4-2ee4fb2c5f84', '1d26e504-7f9e-480a-b52c-5932be6549ab',  
'550eb7e9-172e-48e4-ae1e-d1b761b42223', '2ff6379d-d168-4022-8da0-16846d45ef9b',  
'd6dc44d1-63ac-4871-b175-60ac4040069a', '4c7d796a-39f2-4f26-97a9-3aad01713e29',  
'5735892a-ec65-4b29-97c5-50939aa9584e', 'b45359df-c020-4314-adb1-d1921db642da',  
'593647aa-9fea-43ec-a7d6-6476a76ae868', 'a6ee8177-107b-47dd-bcfd-30960ccc6e9c',  
'8f7e5f92-1153-4f93-acba-ca48670c8ca9', 'c0f51e35-d0e8-4318-afaf-c5fcbc29f4c1',  
'f33c3cc9-dc4b-4b77-baa9-5a5f10704398', '2f025389-fac8-4557-94d3-7d0428878c86',  
'9598e4cb-0849-401e-bba0-689234b27644'.

Details

This functions queries package-internal gauging data ([df.gauging\\_data](#)).

Value

If gauging data exist for the specified gauging station and time, a water level is returned. If no data exist, NA is returned.

References

Wasserstraßen- und Schifffahrtsverwaltung des Bundes (WSV) (2024). “Pegeldaten für Elbe und Rhein.”

Examples

```
getGaugingDataW(gauging_station = "DESSAU", time = as.Date("2016-12-21"))
```

|                    |                                                       |
|--------------------|-------------------------------------------------------|
| getGaugingStations | Extract a WaterLevelDataFrame's slot gauging_stations |
|--------------------|-------------------------------------------------------|

Description

A function to extract the slot gauging\_stations from an object of class [WaterLevelDataFrame](#).

**Usage**

```
getGaugingStations(x)

## S4 method for signature 'WaterLevelDataFrame'
getGaugingStations(x)
```

**Arguments**

x                      an object of class [WaterLevelDataFrame](#).

**Value**

The function above extracts the slot `gauging_stations` and returns an object of class [data.frame](#), which might contain gauging station data that have been used for the interpolation of a water level for the specified date.

**See Also**

[setGaugingStations<--method](#)

**Examples**

```
wldf <- WaterLevelDataFrame(river = "Elbe",
                             time  = as.POSIXct("2016-12-21"),
                             station = seq(257, 262, 0.1))

wldf <- waterLevel(wldf)
getGaugingStations(wldf)
```

---

`getGaugingStationsMissing`

*Extract a [WaterLevelDataFrame](#)'s slot `gauging_stations_missing`*

---

**Description**

A function to extract the slot `gauging_stations_missing` from an object of class [WaterLevelDataFrame](#).

**Usage**

```
getGaugingStationsMissing(x)

## S4 method for signature 'WaterLevelDataFrame'
getGaugingStationsMissing(x)
```

**Arguments**

x                      an object of class [WaterLevelDataFrame](#).

**Value**

The function above extracts the slot `gauging_stations_missing` and returns an object of class `character`, which might contain a vector with gauging stations without gauging data for the specified date.

**See Also**

`setGaugingStationsMissing<--method`

**Examples**

```
wldf <- WaterLevelDataFrame(river = "Elbe",
                             time  = as.POSIXct("1991-12-16"),
                             station = seq(500, 501, 0.1))
wldf <- waterLevel(wldf)
getGaugingStationsMissing(wldf)
```

---

|                              |                                                                                                                          |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| <code>getPegelonlineW</code> | <i>Get W from <a href="https://pegelonline.wsv.de">pegelonline.wsv.de</a> for the specified gauging station and time</i> |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------|

---

**Description**

Download and temporarily interpolate or average water level data from <https://pegelonline.wsv.de/gast/start>.

**Usage**

```
getPegelonlineW(gauging_station, time, uuid)
```

**Arguments**

`gauging_station`

must be type `character` with a length of one. Permitted values are: 'SCHOENA', 'PIRNA', 'DRESDEN', 'MEISSEN', 'RIESA', 'MUEHLBERG', 'TORGAU', 'PRETZSCH-MAUKEN', 'ELSTER', 'WITTENBERG', 'COSWIG', 'VOCKERODE', 'ROSSLAU', 'DESSAU', 'AKEN', 'BARBY', 'SCHOENEBECK', 'MAGDEBURG-BUCKAU', 'MAGDEBURG-STROMBRUECKE', 'MAGDEBURG-ROTHENSEE', 'NIEGRIPP AP', 'ROGAETZ', 'TANGERMUENDE', 'STORKAU', 'SANDAU', 'SCHARLEUK', 'WITTENBERGE', 'MUEGGENDORF', 'SCHNACKENBURG', 'LENZEN', 'GORLEBEN', 'DOEMITZ', 'DAMNATZ', 'HITZACKER', 'NEU DARCHAU', 'BLECKEDE', 'BOIZENBURG', 'HOHNSTORF', 'ARTLENBURG', 'GEESTHACHT', 'WEHR GEESTHACHT UP', 'ALTENGAMME', 'ZOLLENSPIEKER', 'BUNTHAUS', 'HAMBURG ST. PAULI', 'SEEMANNSHOEFT', 'BLANKENESE UF', 'SCHULAU', 'LUEHORT', 'STADERSAND', 'KOLLMAR', 'GLUECKSTADT', 'BROKDORF', 'BRUNSBUETTEL MPM', 'OSTERIFF MPM', 'OTTERNDORF MPM', 'CUXHAVEN STEUBENHOEFT',

|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|      | 'MITTELGRUND', 'SCHARHOERN', 'BAKE Z', 'HERBRUM HAFENDAMM',<br>'RHEDE', 'PAPENBURG', 'WEENER', 'LEERORT', 'TERBORG', 'POGUM',<br>'EMDEN NEUE SEESCHLEUSE', 'KNOCK', 'DUKEGAT', 'EMSHOERN',<br>'BORKUM FISCHERBALJE', 'NORDERNEY RIFFGAT', 'LANGE OOG', 'SPIEKEROOG',<br>'IFFEZHEIM', 'PLITTERSDORF', 'MAXAU', 'PHILIPPSBURG', 'SPEYER',<br>'MANNHEIM', 'WORMS', 'NIERSTEIN-OPPENHEIM', 'MAINZ', 'OESTRICH',<br>'BINGEN', 'KAUB', 'SANKT GOAR', 'BOPPARD', 'BRAUBACH', 'KOBLENZ',<br>'ANDERNACH', 'OBERWINTER', 'BONN', 'KOELN', 'DUESSELDORF',<br>'RUHRORT', 'WESEL', 'REES', 'EMMERICH', 'GROENHUDE', 'BREIT-<br>ENBERG', 'ITZEHOF HAFEN', 'STOER-SPERRWERK BP'.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| time | must be type c("POSIXct", "POSIXt") or Date and be in the temporal range<br>between 31 days ago <code>Sys.time() - 2678400</code> or <code>Sys.Date() - 31</code> and now ( <code>Sys.time()</code> )<br>or yesterday ( <code>Sys.Date() - 1</code> ).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| uuid | must be type character with a length of one. Permitted values are: '7cb7461b-<br>3530-4c01-8978-7f676b8f71ed', '85d686f1-55b2-4d36-8dba-3207b50901a7', '70272185-<br>b2b3-4178-96b8-43bea330dcae', '24440872-5bd2-4fb3-8554-907b49816c49',<br>'b04b739d-7ffa-41ee-9eb9-95cb1b4ef508', '16b9b4e7-be14-41fd-941e-6755c97276cc',<br>'83bbaedb-5d81-4bc6-9f66-3bd700c99c1f', 'f3dc8f07-c2bb-4b92-b0b0-4e01a395a2c6',<br>'c093b557-4954-4f05-8f5c-6c6d7916c62d', '070b1eb4-3872-4e07-b2e5-e25fd9251b93',<br>'1ce53a59-33b9-40dc-9b17-3cd2a2414607', 'ae93f2a5-612e-4514-b5fd-9c8aecdd73c7',<br>'e97116a4-7d30-4671-8ba1-cdce0a153d1d', '1edc5fa4-88af-47f5-95a4-0e77a06fe8b1',<br>'094b96e5-caeb-46d3-a8ee-d44182add069', '939f82ec-15a9-49c8-8828-dc2f8a2d49e2',<br>'90bcb315-f080-41a8-a0ac-6122331bb4cf', 'b8567c1e-8610-4c2b-a240-65e8a74919fa',<br>'ccccb57f-a2f9-4183-ae88-5710d3afaefd', 'e30f2e83-b80b-4b96-8f39-fa60317afcc7',<br>'3adf88fd-fd7a-41d0-84f5-1143c98a6564', '133f0f6c-2ca1-4798-9360-5b5f417dd839',<br>'13e91b77-90f3-41a5-a320-641748e9c311', 'de4cc1db-51cb-4b62-bee2-9750cbe4f5c4',<br>'f4c55f77-ab80-4e00-bed3-aa6631aba074', 'e32b0a28-8cd5-4053-bc86-fff9c6469106',<br>'cbf3cd49-91bd-49cc-8926-ccc6c0e7eca4', '48f2661f-f9cb-4093-9d57-da2418ed656e',<br>'550e3885-a9d1-4e55-bd25-34228bd6d988', 'c80a4f21-528c-4771-98d7-10cd591699a4',<br>'ac507f42-1593-49ea-865f-10b2523617c7', '6e3ea719-48b1-408a-bc55-0986c1e94cd5',<br>'c233674f-259a-4304-b81f-dce1f415d85b', 'a26e57c9-1cb8-4fca-ba80-9e02abc81df8',<br>'67d6e882-b60c-40d3-975c-a6d7a2b4e40a', '6aa1cd8e-e528-4bcb-ba8e-705b6dcb7da2',<br>'33e0bce0-13df-4ffc-be9d-f1a79e795e1c', 'd9289367-c8aa-4b6a-b1ad-857fec94c6bb',<br>'b3492c68-8373-4769-9b29-22f66635a478', '44f7e955-c97d-45c8-9ed7-19406806fb4c',<br>'0f7f58a8-411f-43d9-b42a-e897e63c4faa', '2ee12b9a-f7fd-4856-82b9-6bdd850c2bba',<br>'3de8ea26-ab29-4e46-adad-06198ba2e0b7', 'ae1b91d0-e746-4f65-9f64-2d2e23603a82',<br>'d488c5cc-4de9-4631-8ce1-0db0e700b546', '816affba-0118-4668-887f-fb882ed573b2',<br>'bacb459b-0f24-4233-bb35-cd224a51678e', 'f3c6ee73-5561-4068-96ec-364016e7d9ef',<br>'8d18d129-07f1-4c4d-adba-a985016be0b0', '80f0fc4d-9fc7-449d-9d68-ee89333f0eff',<br>'3ed90357-4b01-4119-b1c5-bd2c62871e7b', '1f1bbbed7-c1fa-45b4-90d3-df94b50ad631',<br>'610ab204-d3c4-4a11-a38b-e31461fdcf27', 'd4f5f719-8c52-4f8d-945d-1c31404cc628',<br>'eb90bd3f-5405-412d-81e0-7a58be52dcef', '5140295e-b93e-4081-a920-642d89c7ca8b',<br>'aad49293-242a-43ad-a8b1-e91d7792c4b2', '3ff99b92-4396-4fa7-af73-02b9c015dcad',<br>'f0197bcf-6846-4c0a-9659-0c2626a9bcf0', '104fdc24-1dc6-4cb7-b44f-10bd02e13f40',<br>'8177a148-5674-4b8f-8ded-050907f640f3', '16508b11-4349-48f7-be51-1227b7888585',<br>'ec4a598d-773d-44c1-935e-2053b54e45a3', 'aa6af4e6-a44f-46c4-abf6-449f8a68bab1',<br>'abb23dad-0880-41ab-8d2d-dd33e11f148f', '244cae8b-ce75-4c2d-a66e-cb804f8335a2',<br>'5d1e4350-0f39-4428-84c3-6f8f0bbe80d4', 'edfdf747-be92-462f-87ed-53d228a33172', |

```
'438b565e-f293-43c8-8771-377e555ed5ec', '7753c1fa-34d8-4d09-a7c7-38024079117c',
'c8af067c-ba6a-4a76-86d8-1ce8e532ef8b', '8727ebfd-e2e1-43da-ab3d-fee48cff9acc',
'c0244c0e-6ae6-40cb-a967-4039b2a0ce7c', 'a0c1dcb6-7812-48e6-8c01-f7edad7a2caf',
'662c4b5e-0241-456d-ac7d-9f62fd95c0d1', 'b02be240-1364-4c97-8bb6-675d7d842332',
'6b774802-fcb5-49ae-8ecb-ecaf1a278b1c', 'b6c6d5c8-e2d5-4469-8dd8-fa972ef7eaea',
'88e972e1-88a0-4eb9-847c-0925e5999a46', '2cb8ae5b-c5c9-4fa8-bac0-bb724f2754f4',
'57090802-c51a-4d09-8340-b4453cd0e1f5', '844a620f-f3b8-4b6b-8e3c-783ae2aa232a',
'd28e7ed1-3317-41c5-bec6-725369ed1171', 'a37a9aa3-45e9-4d90-9df6-109f3a28a5af',
'665be0fe-5e38-43f6-8b04-02a93bdbbeeb4', '0309cd61-90c9-470e-99d4-2ee4fb2c5f84',
'1d26e504-7f9e-480a-b52c-5932be6549ab', '550eb7e9-172e-48e4-ae1e-d1b761b42223',
'2ff6379d-d168-4022-8da0-16846d45ef9b', 'd6dc44d1-63ac-4871-b175-60ac4040069a',
'4c7d796a-39f2-4f26-97a9-3aad01713e29', '5735892a-ec65-4b29-97c5-50939aa9584e',
'b45359df-c020-4314-adb1-d1921db642da', '593647aa-9fea-43ec-a7d6-6476a76ae868',
'a6ee8177-107b-47dd-bcfd-30960ccc6e9c', '8f7e5f92-1153-4f93-acba-ca48670c8ca9',
'c0f51e35-d0e8-4318-afaf-c5fcbc29f4c1', 'f33c3cc9-dc4b-4b77-baa9-5a5f10704398',
'2f025389-fac8-4557-94d3-7d0428878c86', '9598e4cb-0849-401e-bba0-689234b27644',
'15859426-834c-429e-9c41-2e097b717b1d', '24c6a014-864b-4d53-bd05-0b49106f5412',
'd863cbc3-5e5e-4095-855c-026f0850dd58', 'e5b8e9f3-f0cc-4ad7-8707-577ee1b25b3e'.
```

## Details

This functions queries online water level data through the **REST** service of **PEGELONLINE**. The gauging data from **PEGELONLINE** have a high temporal resolution of 15 minutes, enabling meaningful linear temporal interpolation if time is supplied with type `c("POSIXct", "POSIXt")`. If time is supplied with type `Date` water level data are aggregated to daily averages.

Since data from **PEGELONLINE** expire after 31 days, this function is only applicable to query unvalidated water level values for the last 31 days before function call. If you need older and validated data, feel free to contact the data service at the Federal Institute of Hydrology by email (<Datenstelle-M1@bafg.de>).

## Value

The returned output depends on the type of the input parameter time. If time is type `c("POSIXct", "POSIXt")` the returned object contains queried and interpolated water levels. If time is type `Date` the returned object contains daily averaged water levels.

## References

Wasserstraßen- und Schifffahrtsverwaltung des Bundes (WSV) (2022). "PEGELONLINE." <https://pegelonline.wsv.de/gast/start>.

## See Also

[waterLevelPegelonline](#)

## Examples

```
getPegelonlineW(gauging_station = "DESSAU", time = Sys.time() - 3600)
getPegelonlineW(gauging_station = "DESSAU", time = Sys.Date() - 1)
```

---

|          |                                                   |
|----------|---------------------------------------------------|
| getRiver | <i>Extract a WaterLevelDataFrame's slot river</i> |
|----------|---------------------------------------------------|

---

**Description**

A function to extract the slot river from an object of class [WaterLevelDataFrame](#).

**Usage**

```
getRiver(x)

## S4 method for signature 'WaterLevelDataFrame'
getRiver(x)
```

**Arguments**

x                      an object of class [WaterLevelDataFrame](#).

**Value**

The function above extracts the slot river and returns an object of class character.

**See Also**

[setRiver<--method](#)

**Examples**

```
wldf <- WaterLevelDataFrame(river = "Elbe",
                             time  = as.POSIXct("2016-12-21"),
                             station = seq(257, 262, 0.1))

getRiver(wldf)
```

---

|         |                                                  |
|---------|--------------------------------------------------|
| getTime | <i>Extract a WaterLevelDataFrame's slot time</i> |
|---------|--------------------------------------------------|

---

**Description**

A function to extract the slot time from an object of class [WaterLevelDataFrame](#).

**Usage**

```
getTime(x)

## S4 method for signature 'WaterLevelDataFrame'
getTime(x)
```

**Arguments**

x an object of class [WaterLevelDataFrame](#).

**Value**

The function above extracts the slot time and returns an object of type `c("POSIXct", "POSIXt")`.

**See Also**

[setTime<--method](#)

**Examples**

```
wldf <- WaterLevelDataFrame(river = "Elbe",
                             time  = as.POSIXct("2016-12-21"),
                             station = seq(257, 262, 0.1))

getTime(wldf)
```

---

hyd1d

*hyd1d - 1d Water Level Interpolation along the Rivers Elbe and Rhine*

---

**Description**

The hyd1d package provides an S4 class, relevant datasets and functions to compute 1d water levels along the German federal waterways Elbe and Rhine.

**S4 class WaterLevelDataFrame**

The detailed description of the S4 class WaterLevelDataFrame is available [here](#). This class structures the handling and computation of the 1d water levels.

**Datasets**

Datasets delivered with this package are:

- [df.gauging\\_data](#)
- [df.gauging\\_station\\_data](#)
- [df.flys](#)
- [df.flys\\_sections](#)

**Water level computation**

Water levels are either obtained from the [df.flys](#)-dataset by the functions [waterLevelFlys3](#) or [waterLevelFlys3Seq](#) or computed by the functions [waterLevel](#) and [waterLevelPegelonline](#). The later functions use the datasets [df.flys](#) and [df.gauging\\_station\\_data](#) and gauging data provided by [df.gauging\\_data](#) or <https://pegelonline.wsv.de/gast/start> to linearly interpolate continuous water levels intersecting with the measured water level data at the gauging stations.

**Author(s)**

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- Benjamin Eberhardt <eberhardt@bafg.de> [contributor]

**See Also**

Useful links:

- <https://hyd1d.bafg.de>
- <https://github.com/bafg-bund/hyd1d>
- Report bugs at <https://github.com/bafg-bund/hyd1d/issues/>

---

names<-, WaterLevelDataFrame, character-method

*Set names of a WaterLevelDataFrame*

---

**Description**

Function to get or set the column names of an object of class [WaterLevelDataFrame](#).

**Usage**

```
## S4 replacement method for signature 'WaterLevelDataFrame, character'
names(x) <- value
```

**Arguments**

|       |                                                                                                                                                                                                                                                                            |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| x     | an object of class <a href="#">WaterLevelDataFrame</a> .                                                                                                                                                                                                                   |
| value | a character vector of up to the same length as ncol(x). Since the names of the first three columns of an object of class <a href="#">WaterLevelDataFrame</a> are predetermined ("station", "station_int", "w") only the later names of additional columns can be modified. |

**Value**

For names, a character vector of the same length as ncol(x).

For names<-, the updated object. (Note that the value of names(x) <- value is that of the assignment, value, not the return value from the left-hand side.)



**Note**

To access the slot names of an object of class [WaterLevelDataFrame](#) the function [slotNames](#) has to be used.

**See Also**

[names](#), [slotNames](#)

**Examples**

```
wldf <- WaterLevelDataFrame(river = "Elbe",
                             time  = as.POSIXct("2016-12-21"),
                             station = seq(257, 262, 0.1))
wldf <- waterLevel(wldf, TRUE)
names(wldf) <- c(names(wldf)[1:5], "WEIGHT_Y")
```

---

plotShiny

---

*Plot a WaterLevelDataFrame in Shiny*


---

**Description**

This convenience function enables the easy visualisation of interpolated water levels stored as [WaterLevelDataFrame](#) using the R package [shiny](#). The results of functions like [waterLevel](#) and [waterLevelPegelonline](#) can be plotted interactively so that the computation process itself becomes visible.

**Usage**

```
plotShiny(
  wldf,
  add_flys = TRUE,
  add_flys_labels = TRUE,
  add_weighting = TRUE,
  ...
)
```

**Arguments**

|                 |                                                                                                       |
|-----------------|-------------------------------------------------------------------------------------------------------|
| wldf            | an object of class <a href="#">WaterLevelDataFrame</a> .                                              |
| add_flys        | logical determining whether the used <b>FLYS3</b> water levels should be plotted.                     |
| add_flys_labels | logical determining whether the used <b>FLYS3</b> water levels should be labelled.                    |
| add_weighting   | logical determining whether the weighting of gauging data at the gauging stations should be labelled. |
| ...             | further graphical parameters passed to <a href="#">plot.default</a> .                                 |

**Value**

A plot of a [WaterLevelDataFrame](#).

**References**

Bundesanstalt für Gewässerkunde (2016). “FLYS – Flusshydrologischer Webdienst.” [https://www.bafg.de/DE/5\\_Informiert/1\\_Portale\\_Dienste/FLYS/flys\\_node.html](https://www.bafg.de/DE/5_Informiert/1_Portale_Dienste/FLYS/flys_node.html).

**Examples**

```
wldf <- WaterLevelDataFrame(river = "Elbe",
                             time  = as.POSIXct("2016-12-21"),
                             station = seq(257, 262, 0.1))
wldf <- waterLevel(wldf, shiny = TRUE)
plotShiny(wldf, TRUE, TRUE, TRUE)
```

---

rbind.WaterLevelDataFrame

*Combine WaterLevelDataFrames by Rows*

---

**Description**

Take [WaterLevelDataFrames](#) that were produced for the same river and time and combine them by rows.

**Usage**

```
## S3 method for class 'WaterLevelDataFrame'
rbind(...)
```

**Arguments**

... objects of class [WaterLevelDataFrame](#).

**Value**

All supplied objects of class [WaterLevelDataFrame](#) will be combined to one object of class [WaterLevelDataFrame](#) which is returned.

**See Also**

[rbind](#)

## Examples

```
wldf1 <- WaterLevelDataFrame(river = "Elbe",
                             time  = as.POSIXct("2016-12-21"),
                             station = seq(257, 262, 0.1))
wldf2 <- WaterLevelDataFrame(river = "Elbe",
                             time  = as.POSIXct("2016-12-21"),
                             station = seq(262, 270, 0.1))
wldf <- rbind(wldf1, wldf2)
```

---

```
setGaugingStations<- Set a WaterLevelDataFrame's slot gauging_stations
```

---

## Description

A function to set the slot `gauging_stations` of an object of class [WaterLevelDataFrame](#).

## Usage

```
setGaugingStations(x) <- value

## S4 replacement method for signature 'WaterLevelDataFrame,data.frame'
setGaugingStations(x) <- value
```

## Arguments

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>x</code>     | an object of class <a href="#">WaterLevelDataFrame</a> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <code>value</code> | a new value of class <a href="#">data.frame</a> for the <code>gauging_stations</code> slot. <code>value</code> has to be a <a href="#">data.frame</a> with the following columns and column types: <code>id</code> (integer), <code>gauging_station</code> (character), <code>uuid</code> (character), <code>km</code> (numeric), <code>km_qps</code> (numeric), <code>water_shortname</code> (character), <code>longitude</code> (numeric), <code>latitude</code> (numeric), <code>mw</code> (numeric), <code>pnf</code> (numeric), <code>w</code> (numeric), <code>wl</code> (numeric), <code>n_wls_below_w_do</code> (integer), <code>n_wls_above_w_do</code> (integer), <code>n_wls_below_w_up</code> (integer), <code>n_wls_above_w_up</code> (integer), <code>name_wl_below_w_do</code> (character), <code>name_wl_above_w_do</code> (character), <code>name_wl_below_w_up</code> (character), <code>name_wl_above_w_up</code> (character), <code>w_wl_below_w_do</code> (numeric), <code>w_wl_above_w_do</code> (numeric), <code>w_wl_below_w_up</code> (numeric), <code>w_wl_above_w_up</code> (numeric), <code>weight_up</code> (numeric), <code>weight_do</code> (numeric). |

## Value

The function sets a new value for the slot `gauging_stations` and returns an object of class [WaterLevelDataFrame](#). Since `value` is normally generated inside the functions [waterLevel](#) or [waterLevelPegelonline](#) this function is of very little use outside these functions.

## See Also

[getGaugingStations-method](#)

**Examples**

```

wldf <- WaterLevelDataFrame(river = "Elbe",
                             time  = as.POSIXct("2016-12-21"),
                             station = seq(257, 262, 0.1))
wldf <- waterLevel(wldf)

df <- data.frame(id = integer(),
                 gauging_station = character(),
                 uuid            = character(),
                 km              = numeric(),
                 km_qps          = numeric(),
                 river           = character(),
                 longitude       = numeric(),
                 latitude        = numeric(),
                 mw              = numeric(),
                 mw_timespan     = character(),
                 pnp             = numeric(),
                 w               = numeric(),
                 wl              = numeric(),
                 n_wls_below_w_do = integer(),
                 n_wls_above_w_do = integer(),
                 n_wls_below_w_up = integer(),
                 n_wls_above_w_up = integer(),
                 name_wl_below_w_do = character(),
                 name_wl_above_w_do = character(),
                 name_wl_below_w_up = character(),
                 name_wl_above_w_up = character(),
                 w_wl_below_w_do = numeric(),
                 w_wl_above_w_do = numeric(),
                 w_wl_below_w_up = numeric(),
                 w_wl_above_w_up = numeric(),
                 weight_up       = numeric(),
                 weight_do       = numeric(),
                 stringsAsFactors = FALSE)
setGaugingStations(wldf) <- df

```

---

```
setGaugingStationsMissing<-
```

*Set a WaterLevelDataFrame's slot gauging\_stations\_missing*

---

**Description**

A function to set the slot `gauging_stations_missing` of an object of class [WaterLevelDataFrame](#).

**Usage**

```
setGaugingStationsMissing(x) <- value
```

```
## S4 replacement method for signature 'WaterLevelDataFrame,character'
setGaugingStationsMissing(x) <- value
```

### Arguments

x                    an object of class [WaterLevelDataFrame](#).  
 value                a new value of class character for the gauging\_stations\_missing slot.

### Value

The function above sets a new value for the slot gauging\_stations\_missing and returns an object of class [WaterLevelDataFrame](#).

### See Also

[getGaugingStationsMissing-method](#)

### Examples

```
wldf <- WaterLevelDataFrame(river = "Elbe",
                             time  = as.POSIXct("2016-12-21"),
                             station = seq(257, 262, 0.1))
setGaugingStationsMissing(wldf) <- as.character("VOCKERODE")
```

---

 setRiver<-

---

*Set a WaterLevelDataFrame's slot river*


---

### Description

A function to set the slot river of an object of class [WaterLevelDataFrame](#).

### Usage

```
setRiver(x) <- value

## S4 replacement method for signature 'WaterLevelDataFrame,character'
setRiver(x) <- value
```

### Arguments

x                    an object of class [WaterLevelDataFrame](#).  
 value                a new value of class character for the river slot. value has to have a length of one and has to be **Elbe** or **Rhine**.

**Value**

The function above sets a new value for the slot river and returns an object of class [WaterLevelDataFrame](#). Since river is a slot relevant for the computation of the `data.frame` column w, w is set to NA and needs to be recomputed by functions like [waterLevel](#) or [waterLevelPegelonline](#).

**See Also**

[getRiver-method](#)

**Examples**

```
wldf <- WaterLevelDataFrame(river = "Elbe",
                             time   = as.POSIXct("2016-12-21"),
                             station = seq(500, 501, 0.1))
setRiver(wldf) <- as.character("Rhine")
```

---

|           |                                              |
|-----------|----------------------------------------------|
| setTime<- | <i>Set a WaterLevelDataFrame's slot time</i> |
|-----------|----------------------------------------------|

---

**Description**

A function to set the slot time of an object of class [WaterLevelDataFrame](#).

**Usage**

```
setTime(x) <- value

## S4 replacement method for signature 'WaterLevelDataFrame,POSIXct'
setTime(x) <- value

## S4 replacement method for signature 'WaterLevelDataFrame,POSIXlt'
setTime(x) <- value

## S4 replacement method for signature 'WaterLevelDataFrame,Date'
setTime(x) <- value
```

**Arguments**

|       |                                                                                                                                                                                                                              |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| x     | an object of class <a href="#">WaterLevelDataFrame</a> .                                                                                                                                                                     |
| value | a new value of class <code>c("POSIXct", "POSIXt")</code> for the time slot. value has to have a length of one and has to be in the temporal range between 1960-01-01 00:00:00 CET and now ( <code>Sys.time()</code> ) or NA. |

**Value**

The function above sets a new value for the slot time and returns an object of class [WaterLevelDataFrame](#). Since time is a slot relevant for the computation of the `data.frame` column w, w is set to NA and needs to be recomputed by functions like [waterLevel](#) or [waterLevelPegelonline](#).

**See Also**[getTime-method](#)**Examples**

```
wldf <- WaterLevelDataFrame(river = "Elbe",
                             time  = as.POSIXct("2016-12-21"),
                             station = seq(257, 262, 0.1))
setTime(wldf) <- as.POSIXct("2016-12-22")
```

---

subset.WaterLevelDataFrame

*Subsetting WaterLevelDataFrames*


---

**Description**

Returns subsets of [WaterLevelDataFrames](#) which meet conditions.

**Usage**

```
## S3 method for class 'WaterLevelDataFrame'
subset(x, subset, select, drop = FALSE, ...)
```

**Arguments**

|        |                                                                                            |
|--------|--------------------------------------------------------------------------------------------|
| x      | object of class <a href="#">WaterLevelDataFrame</a> .                                      |
| subset | logical expression indicating elements or rows to keep: missing values are taken as false. |
| select | expression, indicating columns to select from a data frame.                                |
| drop   | passed on to [ indexing operator.                                                          |
| ...    | further arguments to be passed to or from other methods.                                   |

**Value**

An object similar to x, containing just the selected rows and columns. All other slots of the [WaterLevelDataFrame](#) remain unchanged.

**See Also**[subset](#)**Examples**

```
wldf <- WaterLevelDataFrame(river = "Elbe",
                             time  = as.POSIXct("2016-12-21"),
                             station = seq(257, 262, 0.1))
wldf <- subset(wldf, station >= 258 & station <= 261)
```

---

```
summary.WaterLevelDataFrame
```

*WaterLevelDataFrame summary*

---

### Description

Returns a list of descriptive statistics for an object of class [WaterLevelDataFrame](#).

### Usage

```
## S3 method for class 'WaterLevelDataFrame'
summary(object, ...)
```

### Arguments

**object**                    an object of class [WaterLevelDataFrame](#) for which a summary is desired.  
**...**                    additional arguments to be passed to internally used functions.

### Value

A list of summary statistics of the [WaterLevelDataFrame](#) and its slots.

### See Also

[summary](#)

### Examples

```
wldf <- WaterLevelDataFrame(river = "Elbe",
                             time  = as.POSIXct("2016-12-21"),
                             station = seq(257, 262, 0.1))

wldf <- waterLevel(wldf)
summary(wldf)
```

---

```
updateGaugingData            Update local copy of df.gauging data
```

---

### Description

Function to overwrite and update the internal dataset [df.gauging\\_data](#). This function is usually called during the initial loading of the package. If an update of [df.gauging\\_data](#) took place more than 8 days ago, an updated version of [df.gauging\\_data](#) will be downloaded and used.

### Usage

```
updateGaugingData(x)
```



**Arguments**

x path to the file containing `df.gauging_data` (type character).

**Value**

`invisible(logical)` notifying whether an updated version of `df.gauging_data` has been downloaded.

**Examples**

```
options("hyd1d.datadir" = tempdir())
updateGaugingData(paste0(options()$hyd1d.datadir,
                          "/df.gauging_data_latest.RDS"))
```

---

|            |                                         |
|------------|-----------------------------------------|
| waterLevel | <i>Compute a 1d water level dataset</i> |
|------------|-----------------------------------------|

---

**Description**

Functions to compute 1d water level information and store it as column w of an S4 object of type `WaterLevelDataFrame`.

**Usage**

```
waterLevel(wldf, shiny = FALSE)

waterLevelPegelonline(wldf, shiny = FALSE)
```

**Arguments**

wldf an object of class `WaterLevelDataFrame`.

shiny logical determing whether columns (section, weight\_x, weight\_y) relevant for the `plotShiny()`-function are appended to the resulting `WaterLevelDataFrame`.

**Details**

`waterLevel` interpolates 1d water level along the river axis of Elbe and Rhine based on daily averaged, mostly validated gauging data stored in the internal dataset `df.gauging_data`. Internally stored gauging data are available from 1960-01-01 until yesterday.

`waterLevelPegelonline` carries out the interpolation with gauging data obtained through a **REST** service from <https://pegelonline.wsv.de/gast/start>. The gauging data from **PEGELONLINE** have a high temporal resolution of 15 minutes, enabling meaningful linear temporal interpolation. Since data from **PEGELONLINE** expire after 31 days, this function is only applicable for `WaterLevelDataFrames` with a time-slot set to appropriate values within the last 31 days before function call.

**Value**

An object of class [WaterLevelDataFrame](#).

**References**

Busch N, Hammer M (2009). “Einheitliche Grundlage für die Festlegung der Bemessungswasser-spiegellagen der Elbe auf der frei fließenden Strecke in Deutschland.” doi:10.5675/bfg1650.

HKV Hydrokontor (2014). “Erstellung eines SOBEK-River Modells für den Rhein von Iffezheim bis Pannerdense Kop als Weiterentwicklung bestehender SOBEK-RE Modelle.”

Bundesanstalt für Gewässerkunde (2016). “FLYS – Flusshydrologischer Webdienst.” [https://www.bafg.de/DE/5\\_Informiert/1\\_Portale\\_Dienste/FLYS/flys\\_node.html](https://www.bafg.de/DE/5_Informiert/1_Portale_Dienste/FLYS/flys_node.html).

Wasserstraßen- und Schifffahrtsverwaltung des Bundes (WSV) (2022). “PEGELONLINE.” <https://pegelonline.wsv.de/gast/start>.

**See Also**

[plotShiny](#)

**Examples**

```
# waterLevel
wldf <- WaterLevelDataFrame(river = "Elbe",
                             time  = as.POSIXct("2016-12-21"),
                             station = seq(257, 262, 0.1))

wldf <- waterLevel(wldf)

# waterLevelPegelonline
wldf1 <- wldf
setTime(wldf1) <- Sys.time() - as.difftime(60, units = "mins")
wldf1 <- waterLevelPegelonline(wldf1)
```

---

|                     |                                         |
|---------------------|-----------------------------------------|
| WaterLevelDataFrame | <i>Initialize a WaterLevelDataFrame</i> |
|---------------------|-----------------------------------------|

---

**Description**

To initialize an object of class [WaterLevelDataFrame](#) this function should be used. It checks all the required input data and validates the final object.

**Usage**

```
WaterLevelDataFrame(
  river = c("Elbe", "Rhine"),
  time,
  gauging_stations = NULL,
  gauging_stations_missing = NULL,
```

```

    comment = NULL,
    id = NULL,
    station = NULL,
    station_int = NULL,
    w = NULL
  )

```

## Arguments

- |                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| river                    | a required argument to fill the <a href="#">WaterLevelDataFrame</a> -slot river. It has to be type character, has to have a length of one and can be either <b>Elbe</b> or <b>Rhine</b> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| time                     | a required argument to fill the <a href="#">WaterLevelDataFrame</a> -slot time. It has to be type <code>c("POSIXct", "POSIXt")</code> , has to have a length of one and must be in the temporal range between 1960-01-01 00:00:00 CET and now ( <code>Sys.time()</code> ) or be NA.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| gauging_stations         | a slot of class <code>data.frame</code> . <code>gauging_stations</code> has to be a <code>data.frame</code> with the following columns and column types: <code>id</code> (integer), <code>gauging_station</code> (character), <code>uuid</code> (character), <code>km</code> (numeric), <code>km_qps</code> (numeric), <code>river</code> (character), <code>longitude</code> (numeric), <code>latitude</code> (numeric), <code>mw</code> (numeric), <code>pnf</code> (numeric), <code>w</code> (numeric), <code>wl</code> (numeric), <code>n_wls_below_w_do</code> (integer), <code>n_wls_above_w_do</code> (integer), <code>n_wls_below_w_up</code> (integer), <code>n_wls_above_w_up</code> (integer), <code>name_wl_below_w_do</code> (character), <code>name_wl_above_w_do</code> (character), <code>name_wl_below_w_up</code> (character), <code>name_wl_above_w_up</code> (character), <code>w_wl_below_w_do</code> (numeric), <code>w_wl_above_w_do</code> (numeric), <code>w_wl_below_w_up</code> (numeric), <code>w_wl_above_w_up</code> (numeric), <code>weight_up</code> (numeric), <code>weight_do</code> (numeric). |
| gauging_stations_missing | an optional argument to fill the <a href="#">WaterLevelDataFrame</a> -slot <code>gauging_stations_missing</code> . It has to be type character and usually contains a vector with names of gauging stations for which no water level information was available for the specified time. This argument is used by the functions <a href="#">waterLevel</a> , <a href="#">waterLevelPegelonline</a> , <a href="#">waterLevelFlys3</a> and <a href="#">waterLevelFlys3Seq</a> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| comment                  | an optional argument to fill the <a href="#">WaterLevelDataFrame</a> -slot comment. It has to be type character and is used by the functions <a href="#">WaterLevelDataFrame</a> , <a href="#">waterLevel</a> , <a href="#">waterLevelPegelonline</a> , <a href="#">waterLevelFlys3</a> and <a href="#">waterLevelFlys3Seq</a> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| id                       | an optional argument to hand over the <code>row.names(wldf)</code> . <code>id</code> has to be type integer and has to have the same length as other optional arguments ( <code>station</code> , <code>station_int</code> and <code>w</code> ) forming the <code>data.frame</code> -component of a <a href="#">WaterLevelDataFrame</a> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| station                  | an optional argument to hand over the stationing along the specified river. If specified, it has to be type numeric and has to have the same length as other optional arguments ( <code>id</code> , <code>station_int</code> and <code>w</code> ) forming the <code>data.frame</code> -component of a <a href="#">WaterLevelDataFrame</a> . If both stationing arguments ( <code>station</code> and <code>station_int</code> ) are specified, all elements of <code>station</code> have to be equal to <code>as.numeric(station_int / 1000)</code> . Minimum and maximum allowed values of <code>station</code> are river-specific: Elbe (km 0 - 585.7), Rhine (km 336.2 - 865.7).                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| station_int              | an optional argument to hand over the stationing along the specified river. If specified, it has to be type integer and has to have the same length as other optional arguments ( <code>id</code> , <code>station</code> and <code>w</code> ) forming the <code>data.frame</code> -component of a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

**WaterLevelDataFrame.** If both stationing arguments (`station` and `station_int`) are specified, all elements of `station_int` have to be equal to `as.integer(station * 1000)`. Minimum and maximum allowed values of `station_int` are river-specific: Elbe (m 0 - 585700), Rhine (m 336200 - 865700).

**w** an optional argument to hand over the water level information along the stationing of the specified river for a given time. If specified, it has to be type numeric and has to have the same length as other optional arguments (`id`, `station` and `station_int`) forming the `data.frame`-component of a **WaterLevelDataFrame**. If not specified, the respective **WaterLevelDataFrame**-column `w` can be computed by the functions `waterLevel`, `waterLevelPegelonline`, `waterLevelFlys3` and `waterLevelFlys3Seq`. Minimum and maximum allowed values of `w` are river-specific: Elbe (m a.s.l. 0 - 130), Rhine (m a.s.l. 5 - 120).

## Value

The function produces an object of class **WaterLevelDataFrame** which might contain 1d water level data and information to recompute it.

## Examples

```
wldf <- WaterLevelDataFrame(river = "Elbe",
                           time   = as.POSIXct("2016-12-21"),
                           station = seq(257, 262, 0.1))

wldf <- waterLevel(wldf)
```

---

WaterLevelDataFrame-class

*S4 class for 1d water level data*

---

## Description

The S4 class **WaterLevelDataFrame** is inherited from the S3 class `data.frame` and stores 1d water level information together with the official stationing along the German federal waterways Elbe and Rhine.

## Details

In addition to the 1d water level data stored in the `data.frame` further slots contain necessary information used for or computed during the computation of water levels:

## Slots

`.Data` contains the `data.frame` with at least three columns: `station`, `station_int` and `w`. The columns `station` and `station_int` represent the official stationing along the waterways in two different formats. They are totally exchangeable since `station <- as.numeric(station_int / 1000)` and `station_int <- as.integer(station * 1000)`. The column `w` represents the

height of the water level relative to standard elevation zero (DHHN92). These first three columns are required, but further columns can be added.

`river` is a required slot clearly determining the location of a station. Possible values of `river` have to be type character, have to have a length of one and are either **Elbe** or **Rhine**.

`time` is a slot determining the time for which the water level has been computed. `time` has to be type `c("POSIXct", "POSIXt")`, has to have a length of one and be in the range between 1960-01-01 00:00:00 CET and now (`Sys.time()`) or NA.

`gauging_stations` possibly contains a `data.frame` with relevant information about gauging stations within the relevant river stretch and the closer surrounding up- and downstream of the relevant river stretch. It is usually filled by the functions `waterLevel` or `waterLevelPegelonline`.

`gauging_stations_missing` possibly contains a vector of type character with names of gauging stations for which no gauging data existed for the requested time. It is automatically filled by the functions `waterLevel`, `waterLevelPegelonline`, `waterLevelFlys3` and `waterLevelFlys3Seq`.

`comment` contains information on which function has been used to create (`WaterLevelDataFrame`) or compute (`waterLevel`, `waterLevelPegelonline`, `waterLevelFlys3` and `waterLevelFlys3Seq`) an object of class `WaterLevelDataFrame`.

---

|                               |                                                                                                                                        |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| <code>waterLevelFlood1</code> | <i>Compute 1d water level data from the FLYS3 water level MQ and a gauging station according to the INFORM 3-method Flood1 (Flut1)</i> |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|

---

## Description

This function computes a 1d water level according to the **INFORM** flood duration method Flood1 (Flut1) and stores it as column `w` of an S4 object of type `WaterLevelDataFrame`. First the function obtains the reference water level MQ from `df.flys`. This reference water level is then shifted by the difference between measured water and the FLYS3 water level for MQ at the specified gauging station. Here it is provided mainly for historical reasons and more advanced functions like `waterLevel` or `waterLevelPegelonline` should be used.

## Usage

```
waterLevelFlood1(wldf, gauging_station, w, uuid, shiny = FALSE)
```

## Arguments

`wldf` an object of class `WaterLevelDataFrame`.

`gauging_station` must be type character with a length of one. Permitted values are: 'SCHOENA', 'PIRNA', 'DRESDEN', 'MEISSEN', 'RIESA', 'MUEHLBERG', 'TORGAU', 'PRETZSCH-MAUKEN', 'ELSTER', 'WITTENBERG', 'COSWIG', 'VOCKERODE', 'ROSSLAU', 'DESSAU', 'AKEN', 'BARBY', 'SCHOENEBECK', 'MAGDEBURG-BUCKAU', 'MAGDEBURG-STROMBRUECKE', 'MAGDEBURG-ROTHENSEE',

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       | 'NIEGRIPP AP', 'ROGAETZ', 'TANGERMUENDE', 'STORKAU', 'SANDAU', 'SCHARLEUK', 'WITTENBERGE', 'MUEGGENDORF', 'SCHNACKENBURG', 'LENZEN', 'GORLEBEN', 'DOEMITZ', 'DAMNATZ', 'HITZACKER', 'NEU DARCHAU', 'BLECKEDE', 'BOIZENBURG', 'HOHNSTORF', 'ARTLENBURG', 'GEESTHACHT', 'IFFEZHEIM', 'PLITTERSDORF', 'MAXAU', 'PHILIPPSBURG', 'SPEYER', 'MANNHEIM', 'WORMS', 'NIERSTEIN-OPPENHEIM', 'MAINZ', 'OESTRICH', 'BINGEN', 'KAUB', 'SANKT GOAR', 'BOPPARD', 'BRAUBACH', 'KOBLENZ', 'ANDERNACH', 'OBERWINTER', 'BONN', 'KOELN', 'DUESSELDORF', 'RUHRORT', 'WESEL', 'REES', 'EMMERICH'.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| w     | If the wldf does not supply a valid non-NA time slot, it is possible to execute the function with the help of this optional parameter. Otherwise <a href="#">getGaugingDataW</a> or <a href="#">getPegelonlineW</a> provide gauging data internally.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| uuid  | must be type character with a length of one. Permitted values are: '7cb7461b-3530-4c01-8978-7f676b8f71ed', '85d686f1-55b2-4d36-8dba-3207b50901a7', '70272185-b2b3-4178-96b8-43bea330dcae', '24440872-5bd2-4fb3-8554-907b49816c49', 'b04b739d-7ffa-41ee-9eb9-95cb1b4ef508', '16b9b4e7-be14-41fd-941e-6755c97276cc', '83bbaedb-5d81-4bc6-9f66-3bd700c99c1f', 'f3dc8f07-c2bb-4b92-b0b0-4e01a395a2c6', 'c093b557-4954-4f05-8f5c-6c6d7916c62d', '070b1eb4-3872-4e07-b2e5-e25fd9251b93', '1ce53a59-33b9-40dc-9b17-3cd2a2414607', 'ae93f2a5-612e-4514-b5fd-9c8aecdd73c7', 'e97116a4-7d30-4671-8ba1-cdce0a153d1d', '1edc5fa4-88af-47f5-95a4-0e77a06fe8b1', '094b96e5-caeb-46d3-a8ee-d44182add069', '939f82ec-15a9-49c8-8828-dc2f8a2d49e2', '90bcb315-f080-41a8-a0ac-6122331bb4cf', 'b8567c1e-8610-4c2b-a240-65e8a74919fa', 'ccccb57f-a2f9-4183-ae88-5710d3afaefd', 'e30f2e83-b80b-4b96-8f39-fa60317afcc7', '3adf88fd-fd7a-41d0-84f5-1143c98a6564', '133f0f6c-2ca1-4798-9360-5b5f417dd839', '13e91b77-90f3-41a5-a320-641748e9c311', 'de4cc1db-51cb-4b62-bee2-9750cbe4f5c4', 'f4c55f77-ab80-4e00-bed3-aa6631aba074', 'e32b0a28-8cd5-4053-bc86-fff9c6469106', 'cbf3cd49-91bd-49cc-8926-ccc6c0e7eca4', '48f2661f-f9cb-4093-9d57-da2418ed656e', '550e3885-a9d1-4e55-bd25-34228bd6d988', 'c80a4f21-528c-4771-98d7-10cd591699a4', 'ac507f42-1593-49ea-865f-10b2523617c7', '6e3ea719-48b1-408a-bc55-0986c1e94cd5', 'c233674f-259a-4304-b81f-dce1f415d85b', 'a26e57c9-1cb8-4fca-ba80-9e02abc81df8', '67d6e882-b60c-40d3-975c-a6d7a2b4e40a', '6aa1cd8e-e528-4bcb-ba8e-705b6dcdb7da2', '33e0bce0-13df-4ffc-be9d-f1a79e795e1c', 'd9289367-c8aa-4b6a-b1ad-857fec94c6bb', 'b3492c68-8373-4769-9b29-22f66635a478', '44f7e955-c97d-45c8-9ed7-19406806fb4c', 'b02be240-1364-4c97-8bb6-675d7d842332', '6b774802-fcb5-49ae-8ecb-ecaf1a278b1c', 'b6c6d5c8-e2d5-4469-8dd8-fa972ef7eaea', '88e972e1-88a0-4eb9-847c-0925e5999a46', '2cb8ae5b-c5c9-4fa8-bac0-bb724f2754f4', '57090802-c51a-4d09-8340-b4453cd0e1f5', '844a620f-f3b8-4b6b-8e3c-783ae2aa232a', 'd28e7ed1-3317-41c5-bec6-725369ed1171', 'a37a9aa3-45e9-4d90-9df6-109f3a28a5af', '665be0fe-5e38-43f6-8b04-02a93bdbbeeb4', '0309cd61-90c9-470e-99d4-2ee4fb2c5f84', '1d26e504-7f9e-480a-b52c-5932be6549ab', '550eb7e9-172e-48e4-ae1e-d1b761b42223', '2ff6379d-d168-4022-8da0-16846d45ef9b', 'd6dc44d1-63ac-4871-b175-60ac4040069a', '4c7d796a-39f2-4f26-97a9-3aad01713e29', '5735892a-ec65-4b29-97c5-50939aa9584e', 'b45359df-c020-4314-adb1-d1921db642da', '593647aa-9fea-43ec-a7d6-6476a76ae868', 'a6ee8177-107b-47dd-bcfd-30960ccc6e9c', '8f7e5f92-1153-4f93-acba-ca48670c8ca9', 'c0f51e35-d0e8-4318-afaf-c5fcbc29f4c1', 'f33c3cc9-dc4b-4b77-baa9-5a5f10704398', '2f025389-fac8-4557-94d3-7d0428878c86', '9598e4cb-0849-401e-bba0-689234b27644'. |
| shiny | logical determing whether columns (section, weight_x, weight_y) relevant for the <a href="#">plotShiny()</a> -function are appended to the resulting <a href="#">WaterLevel-</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

[DataFrame](#).

## Details

This function computes a water level based on the reference water level MQ from [df.flys](#). Since the function only shifts this single reference water level to make it fit to the measured water level, no interpolation is needed. Therefore the shiny columns have constant values of `section <- 1`, `weight_x <- 1` and `weight_y <- shift`.

## Value

An object of class [WaterLevelDataFrame](#).

## References

Rosenzweig S, Giebel H, Schleuter M (2011). “Ökologische Modellierungen für die Wasser- und Schifffahrtsverwaltung – Das integrierte Flussauenmodell INFORM in seiner neuesten Fassung (Version 3). Bundesanstalt für Gewässerkunde, Koblenz, Germany.” doi:10.5675/bfg1667.

Bundesanstalt für Gewässerkunde (2016). “FLYS – Flusshydrologischer Webdienst.” [https://www.bafg.de/DE/5\\_Informiert/1\\_Portale\\_Dienste/FLYS/flys\\_node.html](https://www.bafg.de/DE/5_Informiert/1_Portale_Dienste/FLYS/flys_node.html).

## Examples

```
wldf <- WaterLevelDataFrame(river = "Elbe",
                             time  = as.POSIXct("2016-12-21"),
                             station = seq(257, 262, 0.1))
wldf1 <- waterLevelFlood1(wldf, "ROSSLAU")
wldf2 <- waterLevelFlood1(wldf, "DESSAU")

wldf1$w - wldf2$w
```

---

|                  |                                                                                                                                                   |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| waterLevelFlood2 | <i>Compute 1d water level data through linear interpolation with neighboring gauging stations according to the INFORM 3-method Flood2 (Flut2)</i> |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|

---

## Description

This function computes a 1d water level according to the **INFORM** flood duration method Flood2 (Flut2) and stores it as column w of an S4 object of type [WaterLevelDataFrame](#). Flood2 is designed to enable water level computation between gauging stations along waterways without reference water levels, provided for example by **FLYS3**. The function uses neighboring gauging stations for linear interpolation of gauging station water levels along the selected river stretch. Here it is provided mainly for historical reasons and more advanced functions like [waterLevel](#) or [waterLevelPegelonline](#) should be used.

**Usage**

```
waterLevelFlood2(wldf)
```

**Arguments**

wldf                    an object of class [WaterLevelDataFrame](#).

**Details**

This function computes a water level through simple linear interpolation of water levels at neighboring gauging stations. Historically it has been designed for rivers without 1d reference water levels provided by FLYS3 for [df.flys](#).

**Value**

An object of class [WaterLevelDataFrame](#).

**References**

Rosenzweig S, Giebel H, Schleuter M (2011). “Ökologische Modellierungen für die Wasser- und Schifffahrtsverwaltung – Das integrierte Flussauenmodell INFORM in seiner neuesten Fassung (Version 3). Bundesanstalt für Gewässerkunde, Koblenz, Germany.” [doi:10.5675/bfg1667](https://doi.org/10.5675/bfg1667).

**Examples**

```
wldf <- WaterLevelDataFrame(river = "Elbe",
                             time  = as.POSIXct("2016-12-21"),
                             station = seq(257, 262, 0.1))
wldf1 <- waterLevelFlood2(wldf)
wldf1
```

---

|                 |                                                           |
|-----------------|-----------------------------------------------------------|
| waterLevelFlys3 | <i>Obtain 1d water level data from the FLYS3 database</i> |
|-----------------|-----------------------------------------------------------|

---

**Description**

Obtain 1d water level data from the [FLYS3](#) database using either a predefined [WaterLevelDataFrame](#) or river, from and to arguments that enable the internal construction of a [WaterLevelDataFrame](#). The internally constructed [WaterLevelDataFrame](#) contains stations every 0.1 km or 100 m between the given range of from and to.

**Usage**

```
waterLevelFlys3(wldf, name)

waterLevelFlys3Seq(river = c("Elbe", "Rhine"), name, from, to)
```



## Arguments

|       |                                                                                                                                                                                                      |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| wldf  | an object of class <a href="#">WaterLevelDataFrame</a> .                                                                                                                                             |
| name  | a string with the name of a stationary <b>FLYS3</b> water level. It has to be type character, has to have a length of one and has to be an element of the river-specific names specified in Details. |
| river | a required argument to fill the <a href="#">WaterLevelDataFrame</a> -slot river. It has to be type character, has to have a length of one and can be either <b>Elbe</b> or <b>Rhine</b> .            |
| from  | numeric or integer for the upstream station. It has to have a length of one and has to be within the river-specific possible station range specified in Details.                                     |
| to    | numeric or integer for the downstream station. It has to have the same type as from, a length of one and has to be within the river-specific possible station range specified in Details.            |

## Details

Possible names of **FLYS3** water levels and ranges of from and to are river-specific:

### Elbe:

'0.5MNQ', 'MNQ', '0.5MQ', 'a', '0.75MQ', 'b', 'MQ', 'c', '2MQ', '3MQ', 'd', 'e', 'MHQ', 'HQ2', 'f', 'HQ5', 'g', 'h', 'HQ10', 'HQ15', 'HQ20', 'HQ25', 'HQ50', 'HQ75', 'HQ100', 'i', 'HQ150', 'HQ200', 'HQ300', 'HQ500'

Possible range of from and to: type numeric (km) 0 - 585.7, type integer (m) 0 - 585700.

### Rhine:

'Ud=1', 'Ud=5', 'GIQ2012', 'Ud=50', 'Ud=80', 'Ud=100', 'Ud=120', 'Ud=183', 'MQ', 'Ud=240', 'Ud=270', 'Ud=310', 'Ud=340', 'Ud=356', 'Ud=360', 'MHQ', 'HQ2', 'HQ5', 'HQ5-10', 'HQ10', 'HQ10-20', '~HQ20', 'HQ20-50', 'HQ50', 'HQ50-100', 'HQ100', 'HQ100-200', 'HQ200', 'HQ200-ex', 'HQextr.'

Possible range of from and to: type numeric (km) 336.2 - 865.7, type integer (m) 336200 - 865700.

Both lists of water levels are ordered from low to high water levels.

## Value

An object of class [WaterLevelDataFrame](#).

## References

Busch N, Hammer M (2009). "Einheitliche Grundlage für die Festlegung der Bemessungswasserspiegellagen der Elbe auf der frei fließenden Strecke in Deutschland." doi:10.5675/bfg1650.

HKV Hydrokontor (2014). "Erstellung eines SOBEK-River Modells für den Rhein von Iffezheim bis Pannerdense Kop als Weiterentwicklung bestehender SOBEK-RE Modelle."

Bundesanstalt für Gewässerkunde (2013). "FLYS goes WEB: Eröffnung eines neuen hydrologischen Fachdienstes in der BfG." doi:10.5675/BfG\_Veranst\_2013.4, [https://doi.bafg.de/BfG/2013/Veranst4\\_2013.pdf](https://doi.bafg.de/BfG/2013/Veranst4_2013.pdf).

Bundesanstalt für Gewässerkunde (2016). "FLYS – Flusshydrologischer Webdienst." [https://www.bafg.de/DE/5\\_Informiert/1\\_Portale\\_Dienste/FLYS/flys\\_node.html](https://www.bafg.de/DE/5_Informiert/1_Portale_Dienste/FLYS/flys_node.html).

**See Also**

[df.flys](#), [plotShiny](#)

**Examples**

```
wldf <- WaterLevelDataFrame(river = "Elbe",
                             time  = as.POSIXct("2016-12-21"),
                             station = seq(257, 262, 0.1))
wldf1 <- waterLevelFlys3(wldf, "MQ")

wldf2 <- waterLevelFlys3Seq("Elbe", "MQ", 257, 262)
```

---

waterLevelFlys3InterpolateX

*Interpolate FLYS3 water levels for given stations*

---

**Description**

Function to interpolate **FLYS3** water levels for selected stations and return it with the structure of [df.flys](#).

**Usage**

```
waterLevelFlys3InterpolateX(
  river = c("Elbe", "Rhine"),
  station = NULL,
  station_int = NULL
)
```

**Arguments**

|             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| river       | a required argument to fill the <a href="#">WaterLevelDataFrame</a> -slot river. It has to be type character, has to have a length of one and can be either <b>Elbe</b> or <b>Rhine</b> .                                                                                                                                                                                                                                                                                                                                                                                                 |
| station     | an optional argument to hand over the stationing along the specified river. If specified, it has to be type numeric and has to have the same length as other optional arguments (id, station_int and w) forming the <a href="#">data.frame</a> -component of a <a href="#">WaterLevelDataFrame</a> . If both stationing arguments (station and station_int) are specified, all elements of station have to be equal to <a href="#">as.numeric</a> (station_int / 1000). Minimum and maximum allowed values of station are river-specific: Elbe (km 0 - 585.7), Rhine (km 336.2 - 865.7).  |
| station_int | an optional argument to hand over the stationing along the specified river. If specified, it has to be type integer and has to have the same length as other optional arguments (id, station and w) forming the <a href="#">data.frame</a> -component of a <a href="#">WaterLevelDataFrame</a> . If both stationing arguments (station and station_int) are specified, all elements of station_int have to be equal to <a href="#">as.integer</a> (station * 1000). Minimum and maximum allowed values of station_int are river-specific: Elbe (m 0 - 585700), Rhine (m 336200 - 865700). |

## Details

`df.flys` contains 1d water level data computed with SOBEK for every second hectometer (every 200 m). This function provides a way to interpolate the 30 stationary water levels for selected stations inbetween these hectometers and returns them with the `data.frame`-structure of the original dataset.

## Value

An object of class `data.frame` with the structure of `df.flys`.

## References

Busch N, Hammer M (2009). “Einheitliche Grundlage für die Festlegung der Bemessungswasserspiegellagen der Elbe auf der frei fließenden Strecke in Deutschland.” doi:10.5675/bfg1650.

HKV Hydrokontor (2014). “Erstellung eines SOBEK-River Modells für den Rhein von Iffezheim bis Pannerdense Kop als Weiterentwicklung bestehender SOBEK-RE Modelle.”

DELTARES (2018). “SOBEK.” <https://download.deltares.nl/en/sobek/>.

## See Also

`df.flys`

## Examples

```
df.flys <- waterLevelFlys3InterpolateX("Elbe", 257.1)
```

---

`waterLevelFlys3InterpolateY`

*Compute a 1d water level dataset based on the FLYS3 algorithms*

---

## Description

Function to compute 1d water level information based on the original **FLYS3** algorithms and store it as column w of an S4 object of type `WaterLevelDataFrame`.

## Usage

```
waterLevelFlys3InterpolateY(wldf, gauging_station, w, uuid, shiny = FALSE)
```

**Arguments**

|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| wldf            | an object of class <a href="#">WaterLevelDataFrame</a> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| gauging_station | must be type character with a length of one. Permitted values are: 'SCHOENA', 'PIRNA', 'DRESDEN', 'MEISSEN', 'RIESA', 'MUEHLBERG', 'TORGAU', 'PRETZSCH-MAUKEN', 'ELSTER', 'WITTENBERG', 'COSWIG', 'VOCKERODE', 'ROSSLAU', 'DESSAU', 'AKEN', 'BARBY', 'SCHOENEBECK', 'MAGDEBURG-BUCKAU', 'MAGDEBURG-STROMBRUECKE', 'MAGDEBURG-ROTHENSEE', 'NIEGRIPP AP', 'ROGAETZ', 'TANGERMUENDE', 'STORKAU', 'SANDAU', 'SCHARLEUK', 'WITTENBERGE', 'MUEGGENDORF', 'SCHNACKENBURG', 'LENZEN', 'GORLEBEN', 'DOEMITZ', 'DAMNATZ', 'HITZACKER', 'NEU DARCHAU', 'BLECKEDE', 'BOIZENBURG', 'HOHNSTORF', 'ARTLENBURG', 'GEESTHACHT', 'IFFEZHEIM', 'PLITTERSDORF', 'MAXAU', 'PHILIPPSBURG', 'SPEYER', 'MANNHEIM', 'WORMS', 'NIERSTEIN-OPPENHEIM', 'MAINZ', 'OESTRICH', 'BINGEN', 'KAUB', 'SANKT GOAR', 'BOPPARD', 'BRAUBACH', 'KOBLENZ', 'ANDERNACH', 'OBERWINTER', 'BONN', 'KOELN', 'DUESSELDORF', 'RUHRORT', 'WESEL', 'REES', 'EMMERICH'.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| w               | If the wldf does not supply a valid non-NA time slot, it is possible to execute the function with the help of this optional parameter. Otherwise <a href="#">getGaugingDataW</a> or <a href="#">getPegelonlineW</a> provide gauging data internally.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| uuid            | must be type character with a length of one. Permitted values are: '7cb7461b-3530-4c01-8978-7f676b8f71ed', '85d686f1-55b2-4d36-8dba-3207b50901a7', '70272185-b2b3-4178-96b8-43bea330dcae', '24440872-5bd2-4fb3-8554-907b49816c49', 'b04b739d-7ffa-41ee-9eb9-95cb1b4ef508', '16b9b4e7-be14-41fd-941e-6755c97276cc', '83bbaedb-5d81-4bc6-9f66-3bd700c99c1f', 'f3dc8f07-c2bb-4b92-b0b0-4e01a395a2c6', 'c093b557-4954-4f05-8f5c-6c6d7916c62d', '070b1eb4-3872-4e07-b2e5-e25fd9251b93', '1ce53a59-33b9-40dc-9b17-3cd2a2414607', 'ae93f2a5-612e-4514-b5fd-9c8aecdd73c7', 'e97116a4-7d30-4671-8ba1-cdce0a153d1d', '1edc5fa4-88af-47f5-95a4-0e77a06fe8b1', '094b96e5-caeb-46d3-a8ee-d44182add069', '939f82ec-15a9-49c8-8828-dc2f8a2d49e2', '90bcb315-f080-41a8-a0ac-6122331bb4cf', 'b8567c1e-8610-4c2b-a240-65e8a74919fa', 'ccccb57f-a2f9-4183-ae88-5710d3afaefd', 'e30f2e83-b80b-4b96-8f39-fa60317afcc7', '3adf88fd-fd7a-41d0-84f5-1143c98a6564', '133f0f6c-2ca1-4798-9360-5b5f417dd839', '13e91b77-90f3-41a5-a320-641748e9c311', 'de4cc1db-51cb-4b62-bee2-9750cbe4f5c4', 'f4c55f77-ab80-4e00-bed3-aa6631aba074', 'e32b0a28-8cd5-4053-bc86-fff9c6469106', 'cbf3cd49-91bd-49cc-8926-ccc6c0e7eca4', '48f2661f-f9cb-4093-9d57-da2418ed656e', '550e3885-a9d1-4e55-bd25-34228bd6d988', 'c80a4f21-528c-4771-98d7-10cd591699a4', 'ac507f42-1593-49ea-865f-10b2523617c7', '6e3ea719-48b1-408a-bc55-0986c1e94cd5', 'c233674f-259a-4304-b81f-dce1f415d85b', 'a26e57c9-1cb8-4fca-ba80-9e02abc81df8', '67d6e882-b60c-40d3-975c-a6d7a2b4e40a', '6aa1cd8e-e528-4bcb-ba8e-705b6dc7b7da2', '33e0bce0-13df-4ffc-be9d-f1a79e795e1c', 'd9289367-c8aa-4b6a-b1ad-857fec94c6bb', 'b3492c68-8373-4769-9b29-22f66635a478', '44f7e955-c97d-45c8-9ed7-19406806fb4c', 'b02be240-1364-4c97-8bb6-675d7d842332', '6b774802-fcb5-49ae-8ecb-ecaf1a278b1c', 'b6c6d5c8-e2d5-4469-8dd8-fa972ef7eaea', '88e972e1-88a0-4eb9-847c-0925e5999a46', '2cb8ae5b-c5c9-4fa8-bac0-bb724f2754f4', '57090802-c51a-4d09-8340-b4453cd0e1f5', '844a620f-f3b8-4b6b-8e3c-783ae2aa232a', 'd28e7ed1-3317-41c5-bec6-725369ed1171', 'a37a9aa3-45e9-4d90-9df6-109f3a28a5af', '665be0fe-5e38-43f6-8b04-02a93bdbcbeeb4', '0309cd61-90c9-470e-99d4-2ee4fb2c5f84', '1d26e504-7f9e-480a-b52c-5932be6549ab', |

```
'550eb7e9-172e-48e4-ae1e-d1b761b42223', '2ff6379d-d168-4022-8da0-16846d45ef9b',
'd6dc44d1-63ac-4871-b175-60ac4040069a', '4c7d796a-39f2-4f26-97a9-3aad01713e29',
'5735892a-ec65-4b29-97c5-50939aa9584e', 'b45359df-c020-4314-adb1-d1921db642da',
'593647aa-9fea-43ec-a7d6-6476a76ae868', 'a6ee8177-107b-47dd-bcfd-30960ccc6e9c',
'8f7e5f92-1153-4f93-acba-ca48670c8ca9', 'c0f51e35-d0e8-4318-afaf-c5fcbc29f4c1',
'f33c3cc9-dc4b-4b77-baa9-5a5f10704398', '2f025389-fac8-4557-94d3-7d0428878c86',
'9598e4cb-0849-401e-bba0-689234b27644'.
```

shiny logical determining whether columns (section, weight\_x, weight\_y) relevant for the `plotShiny()`-function are appended to the resulting `WaterLevelDataFrame`.

## Value

An object of class `WaterLevelDataFrame`.

## References

Busch N, Hammer M (2009). "Einheitliche Grundlage für die Festlegung der Bemessungswasser-spiegellagen der Elbe auf der frei fließenden Strecke in Deutschland." doi:10.5675/bfg1650.

HKV Hydrokontor (2014). "Erstellung eines SOBEK-River Modells für den Rhein von Iffezheim bis Pannerdense Kop als Weiterentwicklung bestehender SOBEK-RE Modelle."

DELTARES (2018). "SOBEK." <https://download.deltares.nl/en/sobek/>.

## See Also

`df.flys`

## Examples

```
# waterLevelFlys3InterpolateY
wldf <- WaterLevelDataFrame(river = "Elbe",
                             time  = as.POSIXct("2016-12-21"),
                             station = seq(257, 263, 0.1))
wldf <- waterLevelFlys3InterpolateY(wldf, "ROSSLAU", w = 137)
```

---

[.WaterLevelDataFrame *Extract or replace parts of a WaterLevelDataFrame*

---

## Description

Extract or replace subsets of the `.Data` slot of an object of class `WaterLevelDataFrame`.

**Usage**

```
## S4 method for signature 'WaterLevelDataFrame'
x[i, j]

## S4 replacement method for signature 'WaterLevelDataFrame,ANY,ANY,data.frame'
x[i, j] <- value
```

**Arguments**

|       |                                                                                                                                                                                                                |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| x     | object of class <a href="#">WaterLevelDataFrame</a> .                                                                                                                                                          |
| i, j  | elements to extract or replace. For [, these are numeric or character or empty. Numeric values are coerced to integer as if by <a href="#">as.integer</a> . For replacement by [, a logical matrix is allowed. |
| value | A suitable replacement value: it will be repeated a whole number of times if necessary and it may be coerced: see the Coercion section. If NULL, deletes the column if a single column is selected.            |

**Details**

For details see [\[.data.frame\]](#).

**Value**

A new object of class [WaterLevelDataFrame](#) is returned. Since the extraction or replacement acts only on the .Data-slot of the object, all other slots remain unchanged.

**See Also**

[\[.data.frame\]](#)

**Examples**

```
wldf <- WaterLevelDataFrame(river = "Elbe",
                             time  = as.POSIXct("2016-12-21"),
                             station = seq(257, 262, 0.1))
wldf <- wldf[which(wldf$station >= 259 & wldf$station <= 261), ]
```

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