Package 'FlowRegEnvCost'

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Type Package

Title The Environmental Costs of Flow Regulation

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Description An application to calculate the daily environmental costs of river flow regulation by dams based on García de Jalon et al. 2017 <doi:10.1007/s11269-017-1663-0>.

Depends R (>= 2.10)

URL https://github.com/garciadejalon/FlowRegEnvCost

BugReports https://github.com/garciadejalon/FlowRegEnvCost/issues

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Contents

`adm_range` *Calculates the admissible range of flow variability*

Description

Calculates the admissible range of flow variability

Usage

```
adm_range(First_year, Last_year, Year_impact)
```

Arguments

`First_year`	First year to consider in the analysis starting on October 1st (e.g.: First_year = 1964)
`Last_year`	First year to consider in the analysis finishing on September 30th (e.g.: Last_year = 2011)
`Year_impact`	Year when the human impact started (the construction of a dam) (e.g.: Year_impact = 1988)

Value

Calculates the admissible range of flow variability based on the flow data during the pre-impact period.

Examples

```
data(flowdata)
adm_range(First_year=1964, Last_year=2011, Year_impact=1988)
```

`adm_range_plot` *Plots the admissible range of flow variability*

Description

Plots the admissible range of flow variability

Usage

```
adm_range_plot(River_name, First_year, Last_year, Year_impact)
```

Arguments

River_name	Name of the river as character (e.g.: River_name = "Esla")
First_year	First year to consider in the analysis starting on October 1st (e.g.: First_year = 1964)
Last_year	First year to consider in the analysis finishing on September 30th (e.g.: Last_year = 2011)
Year_impact	Year when the human impact started (the construction of a dam) (e.g.: Year_impact = 1988)

Value

Plots the admissible range of flow variability based on the flow data during the pre-impact period.

Examples

```
data(flowdata)
adm_range_plot(River_name = "Esla", First_year=1964, Last_year=2011, Year_impact=1988)
```

---

daily_cost *Calculates the daily environmental costs of flow regulation*

Description

Calculates the daily environmental costs of flow regulation

Usage

```
daily_cost(First_year, Last_year, Year_evaluated, Year_impact, a_low, a_high,
  b_low, b_high)
```

Arguments

First_year	First year to consider in the analysis starting on October 1st (e.g.: First_year = 1964)
Last_year	First year to consider in the analysis finishing on September 30th (e.g.: Last_year = 2011)
Year_evaluated	Year when the environmental impact is evaluated (e.g.: Year_evaluated = 2010)
Year_impact	Year when the human impact started (the construction of a dam) (e.g.: Year_impact = 1988)
a_low	Coefficient a of Low-flow impact of function ku (e.g.: a_low = 0.05)
a_high	Coefficient a of High-flow impact of function ku (e.g.: a_high = 0.01)
b_low	Coefficient b of Low-flow impact of function ku (e.g.: b_low = 2)
b_high	Coefficient b of High-flow impact of function ku (e.g.: b_high = 2)

Value

Calculates the daily environmental costs of flow regulation for a specific year evaluated.

Examples

```
data(flowdata)
daily_cost(First_year=1964, Last_year=2011,Year_evaluated=2010,
Year_impact=1988, a_low = 0.05, a_high = 0.01, b_low = 2, b_high = 2)
```

---

daily_cost_plot *Plots the daily environmental costs of flow regulation*

Description

Plots the daily environmental costs of flow regulation

Usage

```
daily_cost_plot(River_name, First_year, Last_year, Year_evaluated, Year_impact,
  a_low, a_high, b_low, b_high)
```

Arguments

River_name	Name of the river written as character (e.g.: River_name = "Esla")
First_year	First year to consider in the analysis starting on October 1st (e.g.: First_year = 1964)
Last_year	First year to consider in the analysis finishing on September 30th (e.g.: Last_year = 2011)
Year_evaluated	Year when the environmental impact is evaluated (e.g.: Year_evaluated = 2010)
Year_impact	Year when the human impact started (the construction of a dam) (e.g.: Year_impact = 1988)
a_low	Coefficient a of Low-flow impact of function ku (e.g.: a_low = 0.05)
a_high	Coefficient a of High-flow impact of function ku (e.g.: a_high = 0.01)
b_low	Coefficient b of Low-flow impact of function ku (e.g.: b_low = 2)
b_high	Coefficient b of High-flow impact of function ku (e.g.: b_high = 2)

Value

Plots the daily environmental costs of flow regulation for a specific year evaluated.

Examples

```
data(flowdata)
daily_cost_plot(River_name = "Esla", First_year=1964, Last_year=2011,
Year_evaluated=2010, Year_impact=1988, a_low = 0.05, a_high = 0.01,
b_low = 2, b_high = 2)
```

flowdata — *River water flow data.*

Description

A dataset containing daily river water flow data for the Esla river at the Riaño dam (Northern Spain) from 01/10/1964 to 30/09/2011. The library adds missing days within the whole period automatically with NA flow values when you enter your own time series data.

Usage

```
flowdata
```

Format

An example data frame with 17166 rows and 2 variables:

Date Date (dd/mm/yyyy)

Flow Water flow, in m^3/s

Source

Source: https://doi.org/10.1007/s11269-017-1663-0

impact_reg — *Calculates the daily environmental impact of flow regulation (high- and low-flow impact)*

Description

Calculates the daily environmental impact of flow regulation (high- and low-flow impact)

Usage

```
impact_reg(First_year, Last_year, Year_evaluated, Year_impact)
```

Arguments

First_year	First year to consider in the analysis starting on October 1st (e.g.: First_year = 1964)
Last_year	First year to consider in the analysis finishing on September 30th (e.g.: Last_year = 2011)
Year_evaluated	Year when the environmental impact is evaluated (e.g.: Year_evaluated = 2010)
Year_impact	Year when the human impact started (the construction of a dam) (e.g.: Year_impact = 1988)

Value

Calculates the daily environmental impact of flow regulation (high- and low-flow impact).

Examples

```
data(flowdata)
impact_reg(First_year=1964, Last_year=2011,Year_evaluated=2010,Year_impact=1988)
```

`impact_reg_multi_plot` *Plots the daily environmental impact of flow regulation for multiple years*

Description

Plots the daily environmental impact of flow regulation for multiple years

Usage

```
impact_reg_multi_plot(Row, Column, sp_years, River_name, First_year, Last_year,
  Year_impact)
```

Arguments

`Row`	Number of rows in the figure to compare multiple years in separated graphs (e.g.: Row = 2)
`Column`	Number of columns in the figure to compare multiple years in separated graphs (e.g.: Column = 5)
`sp_years`	A vector specifying the years to be plotted (e.g.: sp_years = c(1965,1966,1967,1968,1969,2006,2007,2008
`River_name`	Name of the river written as character (e.g.: River_name = "Esla")
`First_year`	First year to consider in the analysis starting on October 1st (e.g.: First_year = 1964)
`Last_year`	First year to consider in the analysis finishing on September 30th (e.g.: Last_year = 2011)
`Year_impact`	Year when the human impact started (the construction of a dam) (e.g.: Year_impact = 1988)

Value

Plots the daily environmental impact of flow regulation for multiple years.

Examples

```
data(flowdata)
impact_reg_multi_plot(Row = 1,Column = 2,
sp_years = c(1965,2010),
River_name = "Esla", First_year=1964, Last_year=2011,
Year_impact=1988)
```

impact_reg_plot *Plots the daily environmental impact of flow regulation (high- and low-flow impact)*

Description

Plots the daily environmental impact of flow regulation (high- and low-flow impact)

Usage

```
impact_reg_plot(River_name, First_year, Last_year, Year_evaluated, Year_impact)
```

Arguments

River_name	Name of the river written as character (e.g.: River_name = "Esla")
First_year	First year to consider in the analysis starting on October 1st (e.g.: First_year = 1964)
Last_year	First year to consider in the analysis finishing on September 30th (e.g.: Last_year = 2011)
Year_evaluated	Year when the environmental impact is evaluated (e.g.: Year_evaluated = 2010)
Year_impact	Year when the human impact started (the construction of a dam) (e.g.: Year_impact = 1988)

Value

Plots the daily environmental impact of flow regulation (high- and low-flow impact).

Examples

```
data(flowdata)
impact_reg_plot(River_name = "Esla", First_year=1964,
Last_year=2011, Year_evaluated=2010, Year_impact=1988)
```

summary_flow *Provides a summary of flow data during the pre-impact period*

Description

Provides a summary of flow data during the pre-impact period

Usage

```
summary_flow(First_year, Last_year, Year_impact)
```

Arguments

First_year	First year to consider in the analysis starting on October 1st (e.g.: First_year = 1964)
Last_year	First year to consider in the analysis finishing on September 30th (e.g.: Last_year = 2011)
Year_impact	Year when the human impact started (the construction of a dam) (e.g.: Year_impact = 1988)

Value

Provides a dataframe on a daily basis of mean, min, p10, p25, median, p75, p90 and max values during the pre-impact period.

Examples

```
data(flowdata)
summary_flow(First_year=1964, Last_year=2011, Year_impact=1988)
```

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