

# EGU short course

## Using R in Hydrology

Introduction  
11 April 2018



# Using R in Hydrology

This course is run by the Young Hydrological Society (<https://younghs.com/>), along with a range of other ECS courses:



Interactive discussion  
Short course / Workshop  
Education

PICO session  
EGU Networking  
Social

*Join us!*

	Mon 9/4	Tue 10/4	Wed 11/4	Thu 12/4	Fri 13/4
08:30 - 10:00			Innovation in Geoscience, Hydrology and Engineering Education (Orals) Room -2.85   EOS16HS1.14		How to write a paper in Hydrology Room -2.16   SC3.6HS12.2 Giuliano Di Baldassarre, Hannah Clarke, Claren Harman, Margaret Shanksfield
10:30 - 12:00		Rhyme your research Room -2.16   SC2.4 Science poetry workshop by Sam Illingworth	Using R in Hydrology Room -2.16   SC1.19HS12.4 With guest lecturers!		
12:15 - 13:15		Meet the expert in Hydrology: hydrological science and practice Room -2.91   SC3.16HS12.1 Jutta Thieleke del Pozo (EC JRC), Johannes Cullmann (WMO)		EGU Early Career Scientists' Forum Room N2   PONT	
13:30 - 15:00	Hydroinformatics for Hydrology: extreme value modelling Room -2.85   SC1.20HS12.3 Hugo Winter (EDF Energy)		Innovation in Geoscience, Hydrology and Engineering Education (Posters) Hall X1   EOS16HS1.14		Future of (hydrological) publishing PICO Spot A   HS1.16 Dorothea Tetzlaff (solicited contribution)
15:30 - 17:00					
17:30 - 19:00					
19:00 - ...			HYDRODRINKS Legendary drink deals with fellow young hydrologists. We will be at Gasteinhaus Hanny this year. Follow @YoungHydrology for details!		EGU SCIENCE POETRY SLAM Recite your science poem during the convener's party. Entrance included! Register with @samillingworth before Tue, 4 PM

Interested in what we do?

*Get in touch!*

youngHS.com

@YoungHydrology



younghydrologicsociety@gmail.com

groups/YoungHydrologicSociety

## How should I follow this short course?

The material for the course is located on the YHS GitHub page [https://github.com/hydrosoc/rhydro\\_EGU18](https://github.com/hydrosoc/rhydro_EGU18) – you can download it and follow along now, or later after the course.

We will be using data from the Centre for Ecology and Hydrology:

- National River Flow Archive (NRFA)
- The Climate, Hydrology and Ecology research Support System (CHESS) - a 1km gridded meteorological and land state dataset for Great Britain.
- Gridded Estimates of Areal Rainfall (CEH-GEAR).

## Packages to install if you wish to follow along

You will need the following packages installed for this session (we will explain the use of each package...)

```
install.packages(c("rnrfa", "lfstat", "osmdata", "tidyverse",  
  "sf", "leaflet", "ncdf4", "lubridate", "ggplot2",  
  "raster", "rgdal", "airGRteaching", "airGR"))
```

## Layout of the session

The running order of the short course follows a typical hydrological analysis workflow:

1. [Accessing hydrological data using web APIs](#) (a demo of the `rnrf` package)- Claudia Vitolo
2. [Extracting netCDF climate data for hydrological analyses](#) (reading and visualising gridded data) - Louise Slater
3. [Processing, modelling and visualising hydrological data in R](#) (tidyverse; piping, mapping and nesting) - Alexander Hurley
4. [Hydrological modelling and teaching modelling](#) (`airGR` and `airGRteaching`) - Guillaume Thirel
5. [Typical hydrological tasks in R](#) (List columns, Leaflet and Coordinate Transformation, Open Street Maps) - Tobias Gauster

## Objectives of the course

- To introduce and illustrate the power of R in hydrology
- To give a general feeling for hydrology-oriented R coding
- To discuss hydrological R uses/updates in a friendly environment

# Recent hydrological packages - see CRAN

Date	Package	Title
03-2018	<a href="#">hydrolinks</a>	Hydrologic Network Linking Data and Tools
03-2018	<a href="#">berryFunctions</a>	Function Collection Related to Plotting and Hydrology
03-2018	<a href="#">airGRteaching</a>	Teaching Hydrological Modelling with the GR Rainfall-Runoff Models ('Shiny' Interface Included)
03-2018	<a href="#">hydroscoper</a>	Interface to the Greek National Data Bank for Hydrometeorological Information
03-2018	<a href="#">foreSIGHT</a>	Systems Insights from Generation of Hydroclimatic Timeseries
02-2018	<a href="#">tidyhydcat</a>	Extract and Tidy Canadian 'Hydrometric' Data
02-2018	<a href="#">SoilHyP</a>	Soil Hydraulic Properties
02-2018	<a href="#">topmodel</a>	Implementation of the Hydrological Model TOPMODEL in R
01-2018	<a href="#">dynatopmodel</a>	Implementation of the Dynamic TOPMODEL Hydrological Model
01-2018	<a href="#">LPM</a>	Linear Parametric Models Applied to Hydrological Series
11-2017	<a href="#">airGR</a>	Suite of GR Hydrological Models for Precipitation-Runoff Modelling
10-2017	<a href="#">dbhydroR</a>	'DBHYDRO' Hydrologic and Water Quality Data
10-2017	<a href="#">zFactor</a>	Calculate the Compressibility Factor 'z' for Hydrocarbon Gases
09-2017	<a href="#">dataRetrieval</a>	Retrieval Functions for USGS and EPA Hydrologic and Water Quality Data
08-2017	<a href="#">Ecohydmod</a>	Ecohydrological Modelling
08-2017	<a href="#">hydroGOF</a>	Goodness-of-Fit Functions for Comparison of Simulated and Observed Hydrological Time Series
08-2017	<a href="#">HydroTSM</a>	Time Series Management, Analysis and Interpolation for Hydrological Modelling
07-2017	<a href="#">RHMS</a>	Hydrologic Modelling System for R Users
07-2017	<a href="#">wqi</a>	Exploring Water Quality Monitoring Data
04-2017	<a href="#">waterData</a>	Retrieval, Analysis, and Anomaly Calculation of Daily Hydrologic Time Series Data
03-2017	<a href="#">hyfo</a>	Hydrology and Climate Forecasting
03-2017	<a href="#">hydrogeo</a>	Groundwater Data Presentation and Interpretation
03-2017	<a href="#">fitcvc</a>	Fit Hydraulic Vulnerability Curves
01-2017	<a href="#">hail</a>	Read HYDRA Rainfall Data
12-2016	<a href="#">mrfa</a>	UK National River Flow Archive Data from R
11-2016	<a href="#">hydrostats</a>	Hydrologic Indices for Daily Time Series Data
09-2016	<a href="#">TUWmodel</a>	Lumped Hydrological Model for Education Purposes
07-2016	<a href="#">geotopbricks</a>	An R Plug-in for the Distributed Hydrological Model GEOFop
03-2016	<a href="#">RQbsDat</a>	Data Management for Hydrology and Beyond Using the Observations Data Model
03-2016	<a href="#">getMet</a>	Get Meteorological Data for Hydrologic Models

# Packages for accessing national hydrometric archives

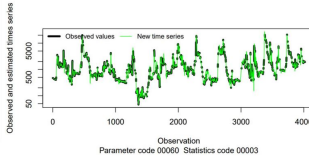
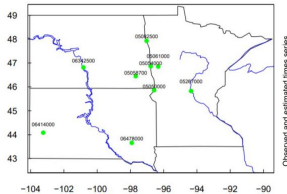
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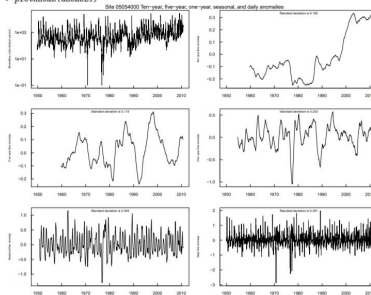
## National hydrometric archives

1. `rnrfa` ([UK](#)) - Utility functions to retrieve data from the UK National River Flow Archive. The package contains R wrappers to the UK NRFA data temporary-API.
2. `tidyhydat` ([Canada](#)) - Provides functions to extract historical and real-time national 'hydrometric' data from Water Survey of Canada data sources and then applies tidy data principles.
3. `hydroscoper` ([Greece](#)) - R interface to the Greek National Data Bank for Hydrological and Meteorological Information.
4. `dataRetrieval` ([USA](#)) - Collection of functions to help retrieve U.S. Geological Survey (USGS) and U.S. Environmental Protection Agency (EPA) water quality and hydrology data from web services.
5. `waterdata` ([USA](#)) - Imports USGS daily hydrologic data from USGS web services, plots the data, addresses some common data problems, and calculates and plots anomalies.

# Example - waterdata package



```
> q05054000LT <- cleanUp(q05054000LT, tank = "fix")
> anomsLT <- compAnom(q05054000LT, which = 4)
> plotAnoms(anomsLT)
```



We hope you enjoy our short course!