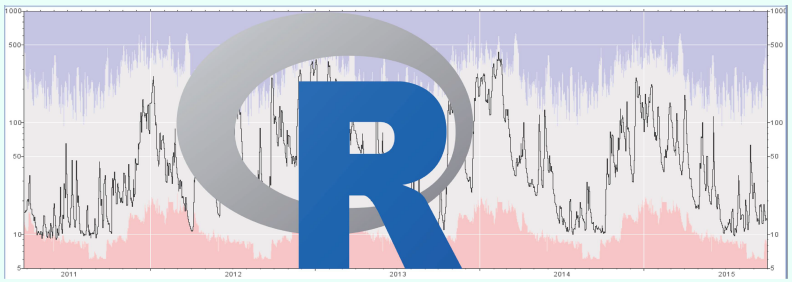
EGU short course
Using R in Hydrology

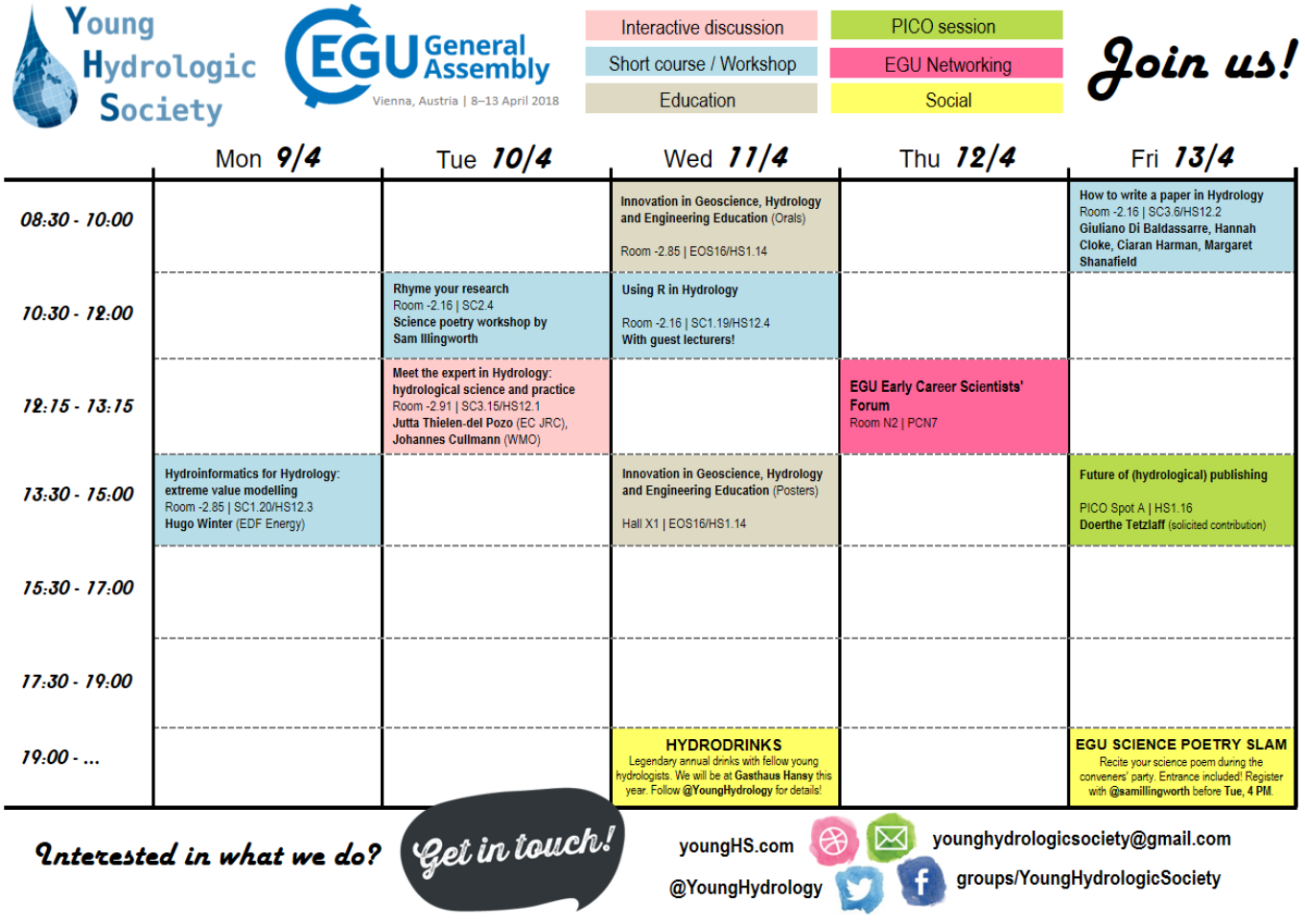
Introduction
11 April 2018

Young Hydrologic Society



Using R in Hydrology

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



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

Packages for accessing national hydrometric archives

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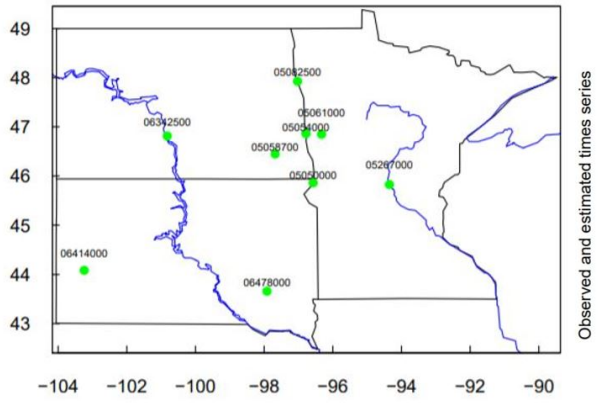
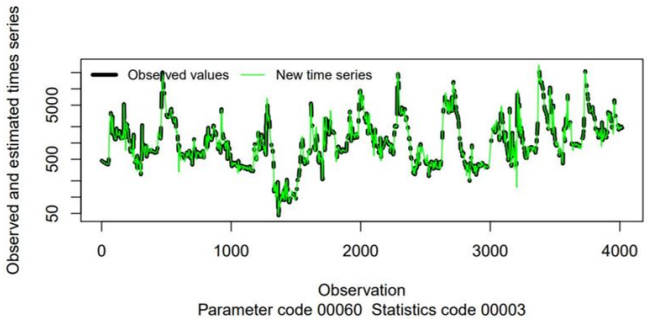
National hydrometric archives

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.

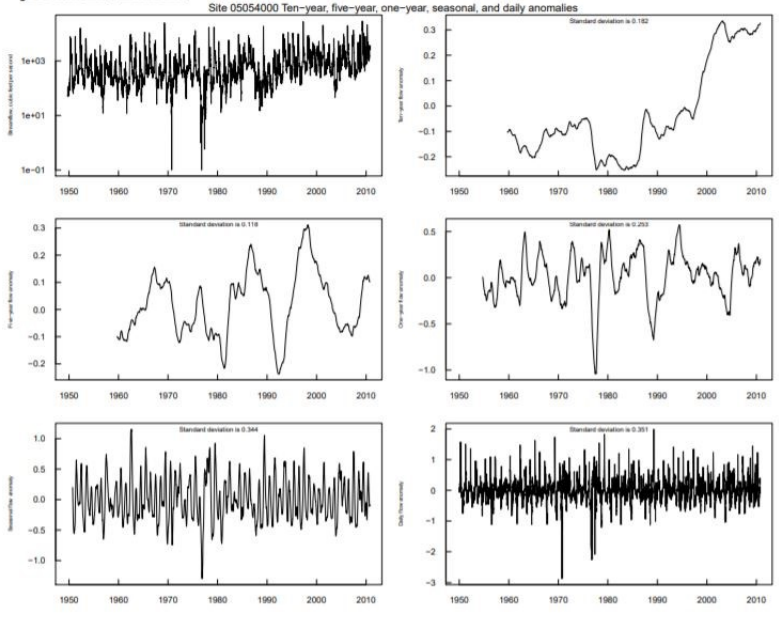
Example - `waterdata` package






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

> plotAnoms(anomsLT)
```



We hope you enjoy our short course!