



PANTA RHEI DROUGHT IN THE ANTHROPOCENE STUDENT PROJECTS

By Anne Van Loon & members of the [“Drought and The Anthropocene” working group](#) *



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This is a list of student projects defined by the IAHS Panta Rhei “Drought in the Anthropocene” working group* to stimulate research and collaboration. These student projects can be based at any of the institutes below or at your home institute with remote supervision by the supervisory team. The students will be supervised cooperatively, student exchanges between participating institutes are encouraged. The projects are grouped in themes: Reconstruction, Vulnerability & risk, Socio-hydrology, Water quality, Attribution of drought to climate & human drivers, Large-scale analyses.

Reconstruction of historic drought

Project: Drought impacts for the major historical droughts in central Europe

Supervisors: Mathilde Erfurt & Veit Blauhut (Uni of Freiburg, DE), Jean-Philippe Vidal (IRSTEA, FR), Simon Parry (CEH, UK)

The purpose of this project is to characterize and quantify drought episodes since the 15th century in Central Europe by analysing historical documentary data. Most studies in the field of climatology have focused on instrumental data to reconstruct meteorological droughts. Very little is known about drought episodes where no instrumental data is available. The purpose of this project is 1) to quantify and characterize drought episodes (e.g. 1540, 1893, 1921 and 1947) in Central Europe by using documentary data (e.g. collected in the collaborative research environment tambora.org), precipitation and temperature records or even information on water levels (if available) and 2) build a narrative of the drought impacts for the major droughts.

Looking for: MSc / BSc student, interest in meteorological drought, drought impact

Contact: mathilde.erfurt@geographie.uni-freiburg.de



Water quality & drought

Project: Catchment Scale Impact of Drought on Water Quality in the UK

Supervisors: Danny Croghan & Anne Van Loon (Uni of Birmingham, UK), Gemma Coxon (Bristol Uni, UK), Bethel Ugochukwu Ukazu (Uni of Nigeria), Jan Greiwe & Jost Hellwig & Veit Blauhut (Uni of Freiburg, DE), Michael Kraft (Heidelberg Uni, DE)

For the UK a database with 94 measured water quality variables is available that provides an excellent starting point for analysing the impact of drought on water quality, in near-natural to heavily human-influenced catchments. Some initial analyses have been done and a student can take these further by focusing mainly on water temperature. Water Temperature acts as a controlling variable over a wide range of abiotic and biotic water quality parameters. Despite this, the impacts of drought on water temperature are not well studied. This project will focus on identifying trends in water temperature response to drought conditions based on catchment characteristics (e.g. land use, geology, meteorological conditions) in order to identify broad trends in water temperature response to drought, and latterly to identify influential catchment characteristics on the water temperature – drought relationship. The project will utilise a dataset comprising of 51 Water Temperature sites paired with Flow Gauges within the UK, with records ranging from 3-18 years, from 1989-2016.

Looking for: MSc (or BSc) – Experience with R, Data Analysis skills, GIS maybe useful but not necessary

Contact: a.f.vanloon@bham.ac.uk

Drought vulnerability & risk

Project: Comparative analysis of risk

Supervisors: Veit Blauhut (Uni of Freiburg, DE), Gustavo Naumann (JRC, IT), Marthe Wens (VU Amsterdam, NL)

The basic idea is to have comparative studies within Europe (or even outside). Several MSc students from different countries will follow the same guidelines. The major focus of the project is to generate drought risk maps on the basis of linking drought impacts, drought hazard indices and vulnerability information. Actually, a variety of different approaches to do this are at the market, for different scales, foci, and all based on different data. The basis of these studies will be data that is actually available on a pan-European scale. Therefore impact information will have to be investigated at national level, considering: agricultural yields, forestry, hydropower production and public water supply an ecology. Various sources of information will have to be used e.g. impact reports, yield statistics from national governments, dendrochronological information, energy production rates. Hazard information will be provided by the European Drought Observatory and include the entire range their products. Vulnerability information will be based on an updated version of the sample used in Blauhut et al. 2016. On the basis if these data, the projects are intended to elaborate adequate methods to identify drought risk, sector specific drought risk approaches and discuss the pro and cons of currently applied methods.

Contact: veit.blauhut@hydrology.uni-freiburg.de

Project: Seasonal drought impact forecasting

Supervisors: Henny van Lanen & Sony Sutanto (Wageningen Uni, NL), Jurgen Voigt (JRC, IT), Niko Wanders (Utrecht Uni, NL), Veit Blauhut (Uni of Freiburg, DE), Marthe Wens (VU Amsterdam, NL), Lena Tallaksen (Uni of Oslo, NO), Simon Parry (CEH, UK)

The student will work on the translation of the forecasted drought hazard into drought impacts in the EU. As a first step, Standardized Drought Indices, such as SPI and SPEI will be used to analyse the forecasted drought events. Logistic regression is used to connect the Standardized Drought Indices to the impacts that have been collated via the European Drought Impact Inventory (EDII). Data are obtained from: (i) the of a LISFLOOD water balance model simulations using ECMWF-SEAS weather forecasts, and the Copernicus EdGe project (multi-weather forecasts, multi-hydrological models). In the next phase, the forecasted impacts (based on reforecasts of the hazard) will be compared with reported impacts from a major pan-European drought event (e.g. 2003, 2015).

Contact: henny.vanlanen@wur.nl

Project: How to translate risk to policy makers?

Supervisors: Veit Blauhut (Uni of Freiburg, DE), Doris Wendt (Uni of Birmingham, UK), Pieter van Oel (Wageningen Uni, NL)

Policy makers at all governmental levels are empowered to drive political changes with regard to drought management. Thus, raising their awareness for drought risk is the major aim of current drought risk analysis. Past experience have shown that the interfacing between science and policy making is lacking, which is either due to a lack of interest or a lack of understanding. Both issues will have to be solved by the “science” side. Thus, the aim of the study is to develop and test ways to attract policy maker’s interest and understanding. Based on different risk analyses, this project is intended to develop and test new ways to display drought risk and its components (hazard, vulnerability, impacts). Different approaches will have to be developed and tested on a broader audience via online questionnaire. The results will have to be discussed with regard to different stakeholders (initial stakeholder analysis at the beginning of the thesis) and levels of action. The final outcome should be guidance of “how to sell drought risk science to stakeholders”

Contact: veit.blauhut@hydrology.uni-freiburg.de



Attribution of drought to climate & human drivers

Project: Finding hotspots of climate-induced & human-induced drought

Supervisors: Anne Van Loon & Sally Rangelcroft (Uni of Birmingham, UK), Erik Tijdeman (Uni of Freiburg, DE), Buruk Kitachew Wossenyeleh (Uni of Leuven, BE), Bethel Ugochukwu Ukazu (Uni of Nigeria), Beatriz Quesada Montano (Uppsala Uni, Sweden), Niko Wanders (Utrecht Uni, NL), Pieter van Oel (Wageningen Uni, NL), Jean-Philippe Vidal (IRSTEA, FR), Lena Tallaksen (Uni of Oslo, NO), Joschka Thurner (Cologne Uni of Applied Sciences, DE)

Hydrological drought (drought in river flow and/or groundwater) is driven by climate variability (lack of rainfall) and human activities (water abstraction). This project will explore freely available global datasets to find hotspots of these different drivers. Four different types of datasets will be put together, i) large-sample datasets of observed hydrological variables (e.g. precipitation, discharge), ii) global satellite data on hydro-climatological and socio-economic variables, iii) large-scale hydrological model data, iv) and large-scale socio-economic datasets on human influences on the water system (e.g. irrigation, land use change). The aims of this project is to find areas where these datasets agree on the drivers of hydrological drought.

Looking for: MSc student, good mapping skills, interest in drought & large-scale analysis

Contact: a.f.vanloon@bham.ac.uk

Project: The benefits of human aggravation of hydrological drought

Supervisors: Anne Van Loon (Uni of Birmingham, UK), Veit Blauhut (Uni of Freiburg, DE), Bethel Ugochukwu Ukazu (Uni of Nigeria)

Water abstraction for human use has benefits to society and the economy, but also makes hydrological droughts worse, with consequent negative effects on society, economy and/or the environment. These negative effects might occur later in time or elsewhere in space, or they influence another sector in society or only damage the environment. This project will analyse the trade-off between the costs and benefits of aggravating hydrological droughts focusing on a specific case study. The spatial, temporal and sectoral aspects of this trade-off will be analysed in a framework that will lead to an improved understanding of the effects of water management choices.

Looking for: BSc / MSc student, background: geography, economics, hydrology

Contact: a.f.vanloon@bham.ac.uk

Large-scale analysis of drought

Project: Bridging the gap: comparing Large Scale Models with case studies

Supervisors: Anne Van Loon (Uni of Birmingham, UK), Niko Wanders (Utrecht Uni, NL), Gemma Coxon (Bristol Uni, UK), Henny van Lanen (Wageningen Uni, NL), Lena Tallaksen (Oslo Uni, NO), Erik Tijdeman (Uni of Freiburg, DE), Joschka Thurner (Cologne Uni of Applied Sciences, DE), Verena Maurer (Uni of Heidelberg, DE)

Research is being done to quantify the influence of human activities on hydrological drought by using observations in case studies spread around the world and by using large-scale hydrological models, but it is still hard to compare and reconcile these two approaches. This is essential so that what is found in local case studies can be upscaled to global scale and so that global models represent the situation on the ground. This project therefore aims to compare human influences on hydrological drought obtained with an observation-based approach and a model-based approach for selected case studies.

Looking for: MSc student, good (R) programming skills, interest in drought and data-crunching

Contact: a.f.vanloon@bham.ac.uk

Project: Observation-modelling framework on large scales

Supervisors: Anne Van Loon & Sally Rangelcroft (Uni of Birmingham, UK), Niko Wanders (Utrecht Uni, NL), Henny van Lanen (Wageningen Uni, NL)

Research is being done to quantify the influence of human activities on hydrological drought in case studies by using an observation-modelling framework that compares naturalised river discharge (modelled) with human-influenced river discharge (observed). If we could apply this methodology on a much larger scale by using large-scale hydrological models, we could quantify human influence on drought worldwide, which would highly benefit drought management. This project aims to test the observation-modelling framework to quantify human influences on hydrological drought on a global scale. It starts with exploring the use of large-scale hydrological models in well-studied and monitored large river basins like the river Rhine and will then use the Global Runoff Data Centre (GRDC) river discharge database to apply the methodology to human-influenced catchments around the world.

Looking for: MSc student, excellent (R) programming skills, interest in drought, global models and data-crunching

Contact: a.f.vanloon@bham.ac.uk

Project: Large-sample datasets of hydrology and socio-economics

Supervisors: Gemma Coxon (Uni of Bristol, UK), Henny van Lanen (Wageningen Uni, NL), Erik Tijdeman & Jost Hellwig (Uni of Freiburg, DE), Niko Wanders (Utrecht Uni, NL), Lena Tallaksen (Uni of Oslo, NO), Anne Van Loon & Doris Wendt (Uni of Birmingham, UK), Jean-Philippe Vidal (IRSTEA, FR), Simon Parry (CEH, UK), Verena Maurer (Uni of Heidelberg, DE)

Hydrologists have been developing and using catchment characteristics for decades to describe and classify catchments globally. To date these catchment characteristics have focused on natural, physical properties of the catchment such as elevation, area, soil type, mean annual precipitation, geology etc., however, relatively little research has been focused on indicators of human activity such as water abstractions/discharges, reservoirs, water transfers etc. This project will focus on using global datasets to develop indicators of human activity for catchments in the UK and evaluating them against local/national datasets to investigate their accuracy.

Looking for: MSc Student, good GIS and data analysis skills

Contact: Gemma.Coxon@bristol.ac.uk

Project: Apply four approaches for comparing natural and human-influenced hydrological time series to same catchment

Supervisors: Gemma Coxon (Uni of Bristol, UK), Sally Rangelcroft & Anne Van Loon (Uni of Birmingham, UK)

Many different methods can be used to quantify the human impact on drought including paired catchment analysis, upstream-downstream approach and hydrological modelling. This project will apply four different methods to a single case study to assess the methodological uncertainties of quantifying the human impact on drought. The project aims to (1) quantify the impacts of human activity on different drought characteristics using four different methodologies, (2) assess the differences in human impact between the four methods and finally, (3) provide guidance on the suitability of different methods.

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Socio-hydrology of drought

Project: Threshold of dryness triggering people’s response

Supervisors: Pieter van Oel (Wageningen Uni, NL), Giuliano di Baldassarre (Uppsala Uni, Sweden)

The spatial distributions of water resources development and water use change during periods of drought and also following periods of drought. This project explores how patterns of water supply (reservoirs) and use (irrigation) have evolved since the ‘green revolution’ (since late 1960s) in two large river basins (Nile, Indus). The student will conduct a spatially-explicit quantitative analysis of water-related activities, using the downstreamness concept. The student will determine the following: i) the downstreamness of reservoirs (GRanD database, ASTERGDEM), ii) the downstreamness of ET (focus on irrigated area, seasonal/permanent crops) based on WaPOR and other remote-sensing data-products, possibly supplemented with: i) the downstreamness of population (population census data on lowest administrative level), ii) the downstreamness of biomass (NDVI).

Looking for: MSc student – background geosciences (Hydrology, GIS, Remote sensing)

Contact: pieter.vanoel@wur.nl

Project: Literature review on upstream-downstream influences

Supervisors: Marthe Wens (VU Amsterdam, NL), Anne Van Loon (Uni of Birmingham, UK), Beatriz Quesada Montano (Uppsala Uni, Sweden), Pieter van Oel & Henny van Lanen (Wageningen Uni, NL)

While ideally, water resources management should move water from an area in surplus to an area in deficit; often, human interventions induce an unequal distribution of upstream- downstream water resources. Can we quantify this observation in economic terms? The proposed research would use scientific literature (journal articles and research reports) to create a broad image on the upstream-downstream discrepancies of drought adaptation infrastructure. By collecting detailed information on local costs and benefits of drought adaptation measures and on the downstream impact of such infrastructures, a first attempt to go towards a higher level – regional or global – scale cost-benefit analysis of drought adaptation strategies can be made.

Looking for: MSc / BSc student – background geosciences (Hydrology, Geography, Geo-engineering)

Contact: marthe.wens@vu.nl

Project: How drought is communicated in social media

Supervisors: Anne Van Loon (Uni of Birmingham, UK), Veit Blauhut (Uni of Freiburg, DE), Henny van Lanen (Wageningen Uni, NL)

Drought impact inventories have been using published information (scientific papers, reports and newspaper articles) to collect drought impact information and more classical drought vulnerability studies have used social science methods such as interviews. But nowadays social media provide a wealth of information that has not been explored for drought research. This project will explore the options to extract information on drought vulnerability and impacts from social media and investigate the links with other sources of information.

Looking for: BSc / MSc student, big data skills, interest in drought and data-crunching

Contact: a.f.vanloon@bham.ac.uk



Countries:

NL = the Netherlands
DE = Germany
UK = United Kingdom
FR = France
NO = Norway
IT = Italy
BE = Belgium

More information:

- web: iahs.info/Commissions--Working-Groups/Panta-Rhei/Working-Groups/Drought-in-the-Anthropocene/
- email: a.f.vanloon@bham.ac.uk

* What is the Panta Rhei “Drought and The Anthropocene” working group?

“Panta Rhei – Everything Flows” is the new scientific decade (2013–2022) of the International Association of Hydrological Sciences (IAHS) and is dedicated to research activities on change in hydrology and society. The “Drought and The Anthropocene” working group within the Panta Rhei initiative is devoted to the investigation and quantification of the interactions between drought and people. For more information see the website.