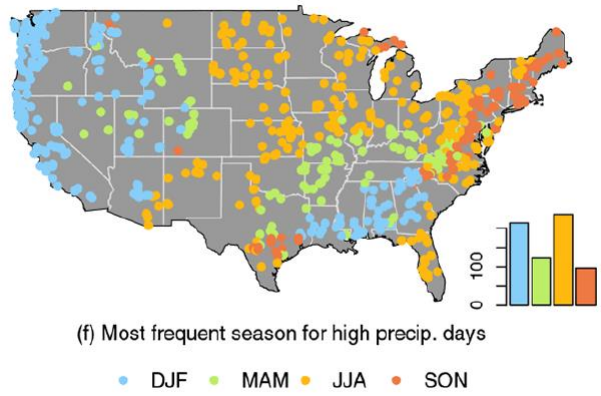
Characterizing floods in US catchments using large-sample data

Motivation:

In natural catchments, floods can be induced by different processes such as extreme rainfalls, rapid snowmelts, or rain-on-snow events[1]. These different types of floods exhibit various behaviours, observed as the flood development over time, and have a different likelihood of occurrence depending on catchment properties[2]. This feature has been recently incorporated into flood-type classification developed for Swiss catchments[2]. This classification uses properties of observed past flood events to determine dominant flood processes. It can be also applied to trace long-term changes in catchments such as resulting from climate change[3]. It remains, however, unclear whether the same flood classification scheme could be adapted to different geographic or climatic regions than the original area of its development.

Content of this Master thesis:

The aim of this thesis is thus to adopt the flood classification scheme developed for Swiss catchments to US conditions using a subset of CAMELS database – a rich dataset of 671 US catchments[4]. Specifically, classes of flood-types and their characteristic signatures should be verified and if needed, re-designed to meet US conditions. This thesis aims at covering the following research questions:



CAMELS cachements, source: Addor et al. 2017.

- Is the flood-tree scheme developed for Swiss catchments applicable to other geographic regions such as US catchments?
- How can the previously proposed scheme be modified to characterize flood conditions in US catchments better?
- Which types of floods dominate in US catchments?
- How (and if) these types have changed over observation years?

Supervisor: Dr. Anna Senoner

Faculty member: Prof. Dr. Jan Seibert

Key references:

[1]Merz, R. and G. Blöschl (2003) A process typology of regional floods, Water Resour. Res., 39(12), 1340, doi:10.1029/2002WR001952.

[2]Sikorska, A.E., D. Viviroli, and J. Seibert (2015) Flood-type classification in mountainous catchments using crisp and fuzzy decision trees, Water Resour. Res., 51, doi:10.1002/2015WR017326.

[3]Sikorska-Senoner, A.E., Seibert, J. (2020) Flood-type trend analysis for alpine catchments, Hydrological Sciences Journal, doi: 10.1080/02626667.2020.1749761.

[4]Addor, N., Newman, A. J., Mizukami, N., and Clark, M. P. (2017) The CAMELS data set: catchment attributes and meteorology for large-sample studies, Hydrol. Earth Syst. Sci., 21, 5293–5313, https://doi.org/10.5194/hess-21-5293-2017.