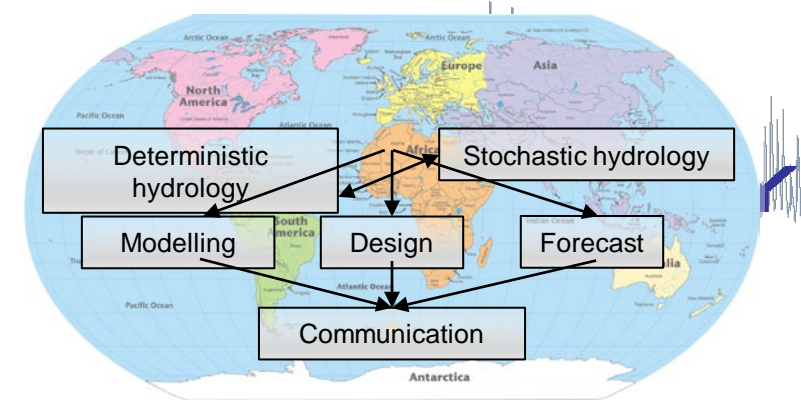# Hydrologic Design: Solutions and Communications

Joint proposal of the ICSH officers

→ A succesful water planning and the economy based on it depends on being able to make reliable predictions of the water related variables.
→ Prediction of hydrological variables is important operationally (because we do not have measures in the future or/and in ungauged catchments) and scientifically to understand the hydrological processes
→ We aim:
  → 1- to improve our **understanding**, **characterization, quantification and reduction of uncertainty i**n hydrology embranzing the different methods
  → 2- to move forward towards a more **reliable predictions by advancing and innovating in the combination of the knowledge from deterministic models, probabilistic models and AI methods**. As well as by looking at the predictions problem from the different angles.
→ What **information** to use for each of the target prediction is key. Indeed, nowadays there is a huge amount of available data but it is not clear what data is needed, how this can be combined, what is the minimum description length and so on.
  → We will incluce local knowledge and citizen science
  → We will use methods of forensic hydrology, historical hydrology and palaeohydrology (various records from the field can also say much on how large the historical or current, i.e., non-captured by measurement, flood was and what its extent was)
  → We will Involve stakeholders into the whole process of data aquisition/processing/modelling/concluding
→ Potential identified goals include but are not limited to get reliable predictions of the quantiles of the flow duration curves, extrems (ie the heavy tails of the streamflow and rainfall distributions), the full time series of a target variable to capture the dynamics (eg a hydrograaph), the characterization of the storms (eg position of convective storms), and so on
→ Due to the HELPING decade nature, we will focus in the **stakeholders necessities and how they need the methodological developments to be communicated**. We will work in an oriented way to provide useful methods to the society.
  → An example might be to identify what are the necesities of water agencies with respect one aspect, standardice the way to accomplish such necessity and work as a team with that goal by using a toy case as proof of concept and then different case studies.
  → We will seek and define the ways to present the challenges (eg comunicación of uncertainty or predictions) to the stakeholders in form of papers with the formats that is more informative for them
→ Open perspectives for co-operation with othe WGs in the design broad subject of the design/projection of hydrological phenomena
→ **Deliverables**: we aim to produce the deliverables from the methodological developments in form **of scientific publications in top journals** and dedicated Conferences and sessions and maybe workshops and summer schoold, (eg. STAHY, EGU) Depending on the state of the work during the decade we might also apply for funding.

Frías, M. D., Iturbide, M., Manzanas, R., Bedia, J., Fernández, J., Herrera, S., Cofiño, A. S., and Gutiérrez, J. M.: An R package to visualize and communicate uncertainty in seasonal climate prediction, Environmental Modelling & Software, 99, 101–110, https://doi.org/10.1016/j.envsoft.2017.09.008, 2018.
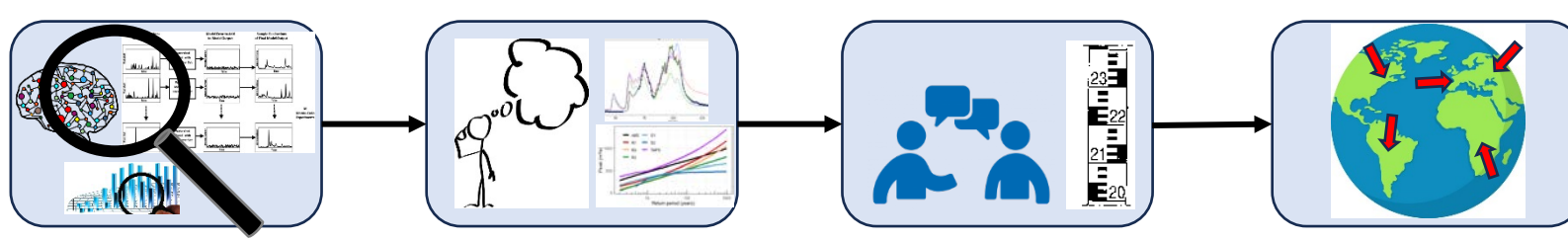
Planned first steps:

1. Review of existing models and methodologies that couple deterministic and stochastic approaches
   - Stochastic watershed models
   - Physics-informed machine-learning approaches
   - Type-based flood statistics
   - Diagnostic metrics

2. Development of new models
   - Including of historical flood events and their geneses in flood statistics

   …

3. Improve the communications with stakeholders
   - create a survey on the challenges of estimating design floods (complex methods, scarce data, …)
   - create small workshops for stakeholders
   - create dissemination methods (based on traditional and modern ways)

4. Collect case studies for which the models can be applied

WG „Hydrologic Design: Solutions and Communication" – Theme 1