Flood risk analysis for river confluences

Notebooks index

September 2022

1.Meteorological & Hydrological Evaluation (RQ1)

1. Meteorological
   - AcumAreas.ipynb:
     Calculate the accumulated area of each confluence according to the topology of the catchment and the area of each sub-basin
   - Confluences_ok2.csv
     Catchment configuration file
   - lmom.py
     This file contains the lmoments.f library created by:
     J. R. M. HOSKING
     IBM RESEARCH DIVISION
     T. J. WATSON RESEARCH CENTER
     YORKTOWN HEIGHTS
     NEW YORK 10598, U.S.A.
     AUGUST 1996
     The base Fortran code is copyright of the IBM Corporation, and the licensing information is shown in the file.
   - MET_AMseasons.ipynb
     Estimate the number of peaks per season and select the season with most of the peaks
   - MET00_TSplots.ipynb
     Meteorological and Hydrological Data exploration
   - MET01_TSfiles.ipynb
     Extract the time series from the compressed files and store them
   - MET02_AMfiles.ipynb
     Read each file and get the AM sets per file, combine them per confluence (50,000 peaks) per each set according to the condition (S1, S2, C), and store the data frames for later
   - MET03_AMmerge.ipynb
     Merge all the separate files of AM (25 files x 20 ensembles) to have 1 data frame of 50,000 peaks
     Add the seasonal average of the streams
     Save the new merged file"
   - MET04_AMmetrics
     Open the 50000 AM peak files
     Random selection according to N, pero set of AM
     Calculate the metrics per confluence (100 runs pero sample) and stores them according to the confluences
   - MET04_filter.ipynb
     Results filter: from 134 to 74 sub-basins
   - MetFunctions.py
     Probabilistic and extreme value functions
   - Topology.xlsx
     Topology configuration file
   - OtherFiles
     - Confluences_wareas.csv
     - Confluences_wnames.csv

- MET_AcumAreas.ipynb
  Add the area to the GeoDataFrames
- met_grade_NewDS.ipynb
  Exploring and creating the new time series that consider snow
- met_grade_Topology.ipynb
  Checking and adjusting the topology file
- Read_grade_NewDS.ipynb
  This notebook opens all the Grade files, separates them into 200year ensembles to make them easy to read, and saves them as a new DataSet file than can be read faster.

2. Hydrological
   - Confluences_ok2.csv
     Catchment configuration file
   - HID_AcumAreas.ipynb
     Add the area and CV to the results files
   - HID_AMseasons.ipynb
     Estimate the number of peaks per season and select the season with most of the peaks
   - HidFunctions.py
     Probabilistic and extreme value functions
   - HYD00_TSplots.ipynb
     Hydrological Data exploration
   - HYD01_TSfiles.ipynb
     Extract the time series and stores them
   - HYD01-03_AM.ipynb
     Get the AM sets
     Add the seasonal average of the streams
   - HYD04_AMmetrics.ipynb
     Open the 50000 AM peak files
     Random selection according to N, pero set of AM
     Calculate the metrics per confluence (100 runs pero sample) and stores them according to the confluences
   - lmom.py
     This file contains the lmoments.f library created by:
     J. R. M. HOSKING
     IBM RESEARCH DIVISION
     T. J. WATSON RESEARCH CENTER
     YORKTOWN HEIGHTS
     NEW YORK 10598, U.S.A.
     AUGUST 1996
     The base Fortran code is copyright of the IBM Corporation, and the licensing information is shown in the file.

3. Plots

- ConfluencePlot.ipynb
  Correlation per confluence according to:
  Catchment (Upstream to Downstream)
  Area (Smallest to largest)
  Mainstream (Upstream to Downstream)
- Data.ipynb
  Meteorological and Hydrological time series and Annual maxima sets
- InBetween.ipynb
  Differences between the AMSets --> compared to SET1
- lmom.py
  This file contains the lmoments.f library created by:
  J. R. M. HOSKING
  IBM RESEARCH DIVISION
  T. J. WATSON RESEARCH CENTER
  YORKTOWN HEIGHTS
  NEW YORK 10598, U.S.A.
  AUGUST 1996
  The base Fortran code is copyright of the IBM Corperation, and the licensing information is shown in the file.
- PotentialLocations.ipynb
  Spatial plots of the 7 potential locations
- ScatterPlot.ipynb
  Scatter plots:
  Correlation vs Area and size ratio
  Correlation & Standard deviation per N-size
- Seasons.ipynb
  Season with most of the peaks
- SpatialPlots.ipynb
  Spatial plots - Correlations and differences between the alternatives

2.Hydraulic Evaluation (RQ2)

1. Confluence68
   - C68.ipynb
     Exploration of the time series of Confluence 68:
     Annual maxima sets starting the block maxima the 1st of january
     Annual maxima sets starting the block maxima in the dry season
     Time series of the minimum and maximun peaks
   - C68_GRID.ipynb
     Determination of the grid of discharge combinations to be simulated
     Creation of the Time series files for the 25 hydraulic simulations
     Creation of the file to store the response function
   - C68_Histogram.ipynb
     Histograms of the annual maxima peak; determination of the new start of the block maxima according to the dry season

New files of the annual maxima sets (starting during the dry season)

- C68_peakHydrograps.ipynb
  Normalized Hydrographs for the Mainstream (Rhine) and Tributary stream (Main)
- C68_QT.ipynb
  Calculate the return period discharge (Qt) for each of the rivers
- C68_TimeDifference.ipynb
  Time difference between annual maxima peaks
  (and some nice graphs)

2. HydraulicsC68
   - HYD_evaluation.ipynb
     Hydraulic evaluation: Influence of both rivers in the flood patterns
   - HYD_Simulations.ipynb
     Functions to perform the hydraulic simulations
     The loop for the 25 simulations
     Calculate and store the response function
     Create the flood maps and the water depths

3. Response_functions
   - Res_Area.csv
     Grid of the response function in terms of inundated area
   - Res_Volume.csv
     Grid of the response function in terms of inundated area

3.Design Flood Event (RQ3)

1. MonteCarloSampling
   - HYDs_FitMarginal.ipynb
     Selection of the marginal distribution according to goodness-of-fit measures and the log plots for each of the annual maxima sets (using the full data sets)
   - HYDs_GOFT.ipynb
     Goodness-of-fit test: Semi-correlations
   - HYDs_MCruns.ipynb
     Response function and estimation of the benchmark
     Estimation of the design flood event: Copulas + Monte Carlo Sampling (+Bootstrapping experiment)
     Sensitivity analysis for the size of the data
     Sensitivity analysis for the selection of the marginal distribution
   - lmom.py
     This file contains the lmoments.f library created by:
     J. R. M. HOSKING
     IBM RESEARCH DIVISION
     T. J. WATSON RESEARCH CENTER
     YORKTOWN HEIGHTS

NEW YORK 10598, U.S.A.
AUGUST 1996
The base Fortran code is copyright of the IBM Corporation, and the licensing information is shown in the file.

2. Plots
   - HYDs_checkMarginals.ipynb
     Plots of the sensitivity analysis of the marginal distribution results
   - HYDs_fullDataresults.ipynb
     Plots:
     - The response function and the benchmark plots
     -Flooded area per return period T, according to the copula and sample size
     -CV per return period T, according to the copula and sample size