Smart Control of the Climate Resilience in European Coastal Cities

From Global to Local scale: Predicting the effects of climate change on coastal cities

2 Models for downscaling – step 1 : from global scale to basin and coastal scale

Hydrological model

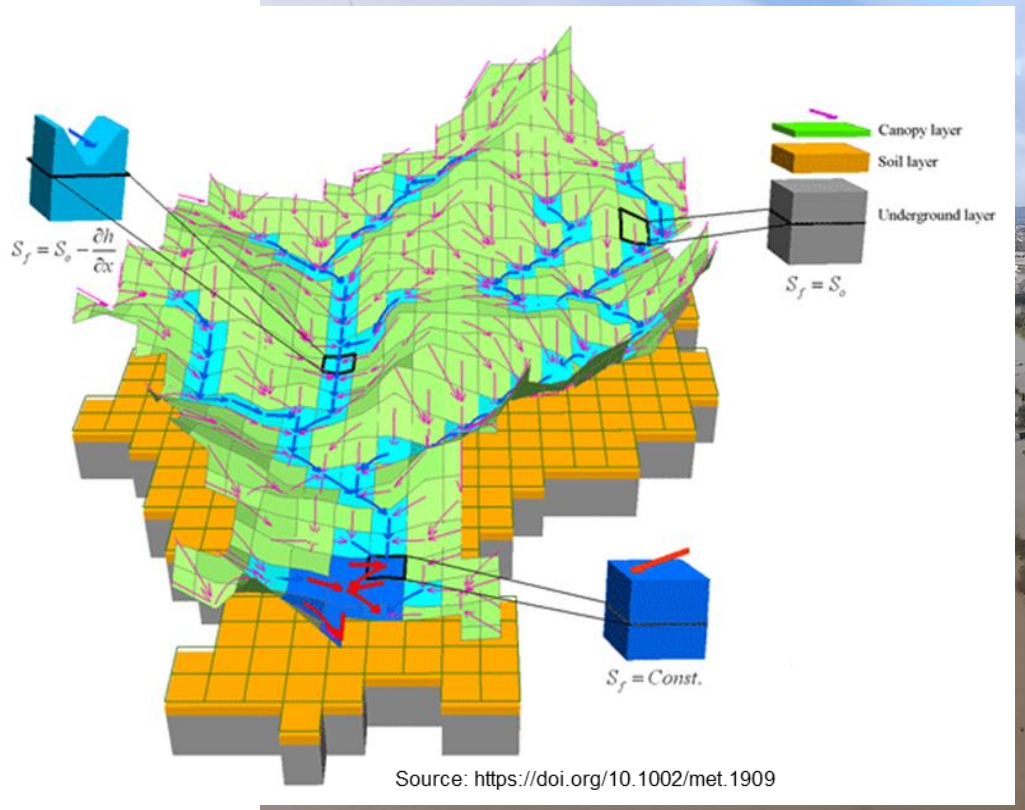
Thursday, 18 January 2024
11:00 a.m.- 12:00 p.m. (CET)

Francesca Caparrini, CNR
Massimo Perna, LaMMA Consortium
Giovanni Vitale, CNR ISMAR

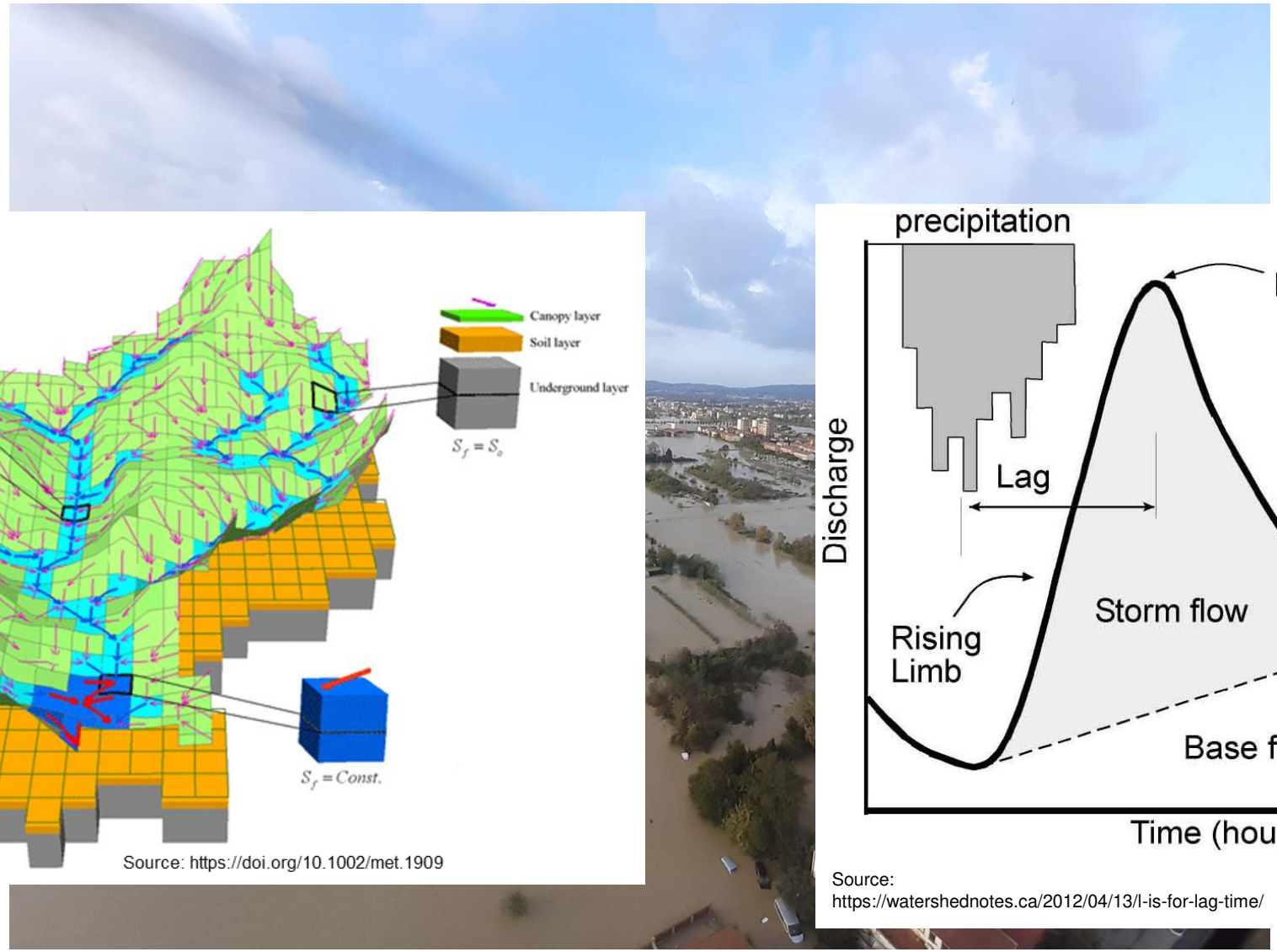
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101007142

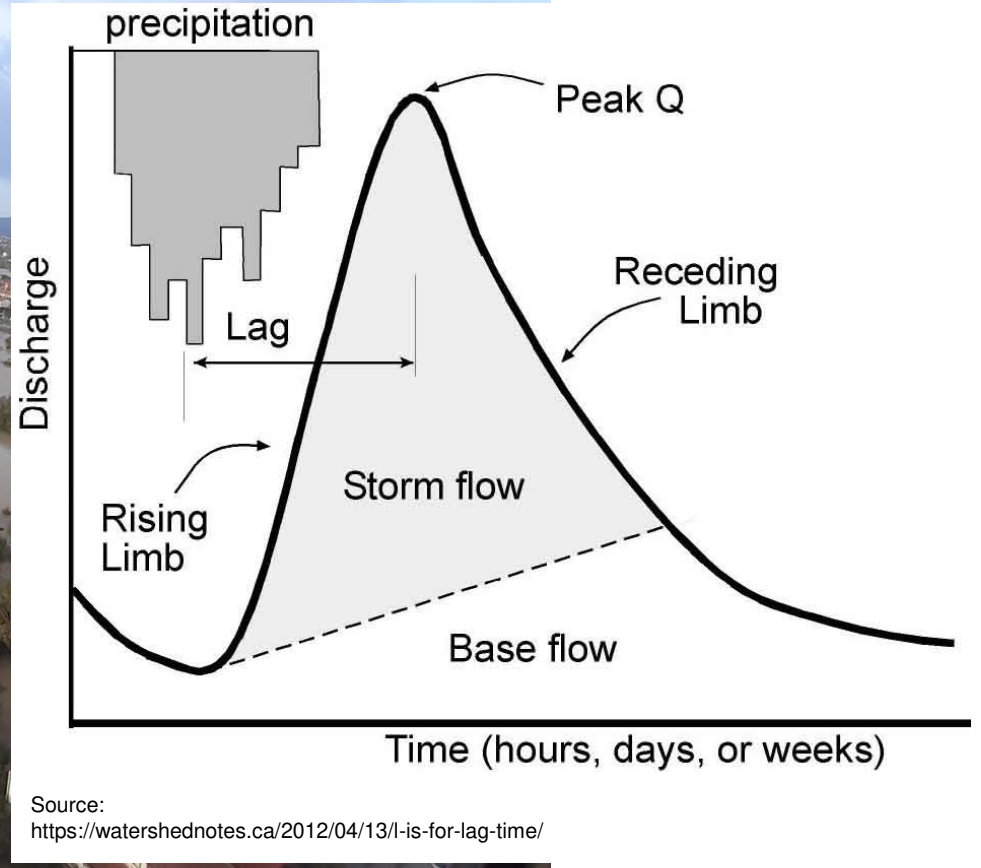
2 Models for downscaling – step 1 : from global scale to basin and coastal scale

Hydrological model



Source: https://doi.org/10.1002/met.1909





Source: https://watershednotes.ca/2012/04/13/l-is-for-lag-time/

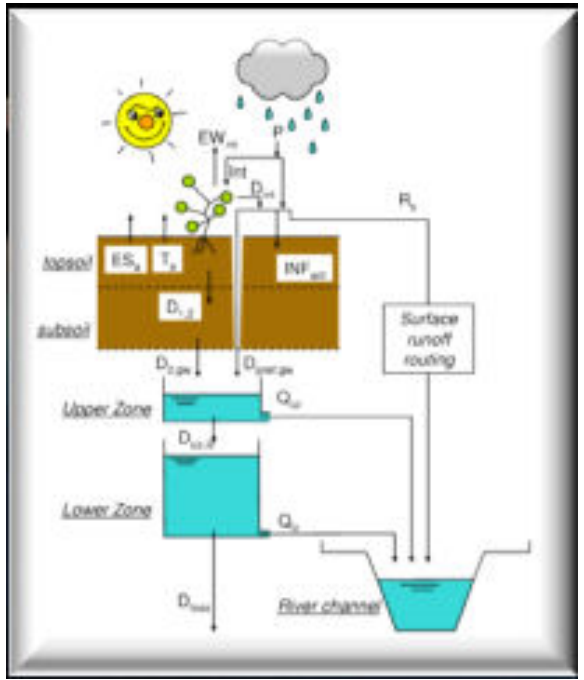
Floods in Tuscany, Italy, early November 2023. Photo: Government of Tuscany

2 Models for downscaling – step 1 : from global scale to basin and coastal scale

Hydrological model

JRC TECHNICAL REPORTS

LISFLOOD
Distributed Water Balance and Flood Simulation Model



Revised User Manual

Peter Burek, Johan van der Knijff, Ad de Roo

2013

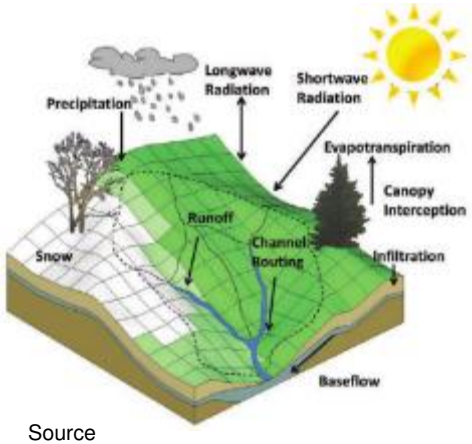
ec-jrc/**lisflood-code**

Lisflood OS - LISFLOOD

The LISFLOOD model is a hydrological rainfall-runoff model that is capable of simulating the hydrological processes that occur in a catchment.
LISFLOOD has been developed by the floods group of the Natural Hazards Project of the Joint Research Centre (JRC) of the European Commission. The specific development objective was to produce a tool that can be used in large and trans-national catchments for a variety of applications, including:

- Flood forecasting
- Assessing the effects of river regulation measures
- Assessing the effects of land-use change
- Assessing the effects of climate change

Hydrological and Hydraulic Models



Source
https://doi.org/10.1175/BAMS-D-12-00212.1

Input datasets

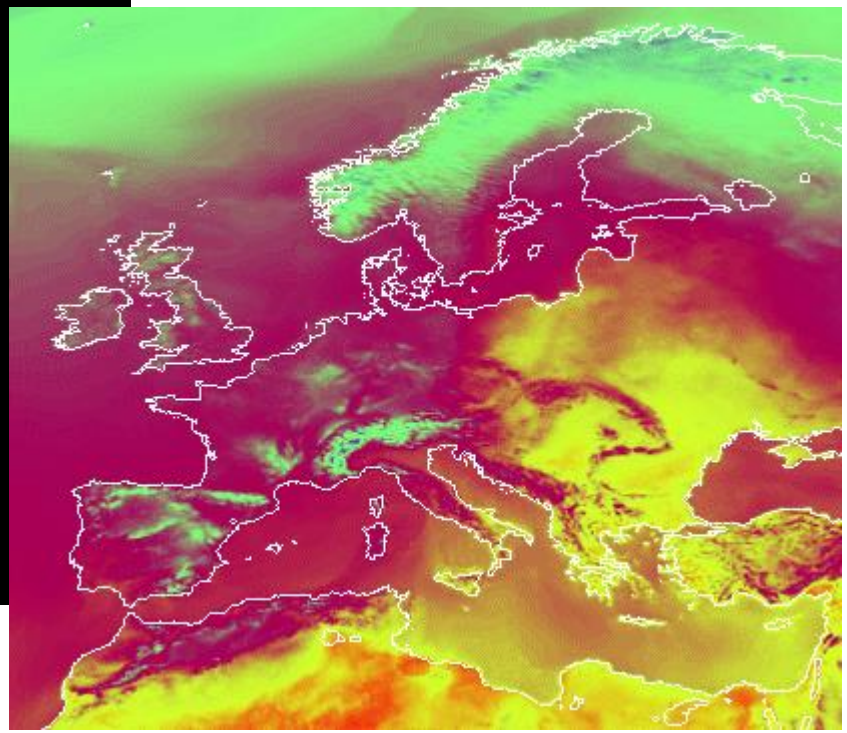
- **meteorological forcings:** These maps provide time series of values for each pixel of the computational domain The meteorological forcings provide the values of precipitation, temperature and reference values of evaporation from different terrains.

- **static maps:** These maps provide information of morphological, physical, soil, and land use properties for each pixel of the computational domain.

Meteorological forcing

total precipitation (mm/hour)

average daily temperature at 2m (°K)

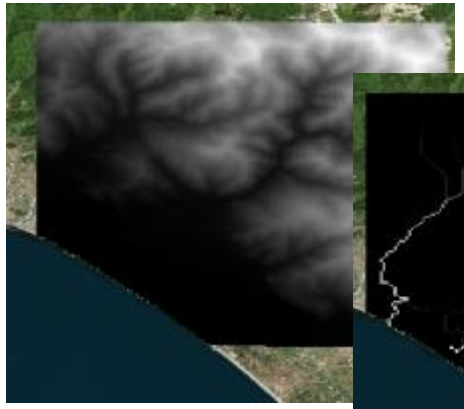


reference value of evaporation (mm/day)

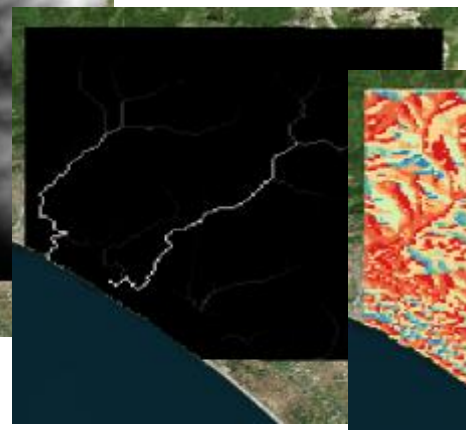
Input datasets

static maps:

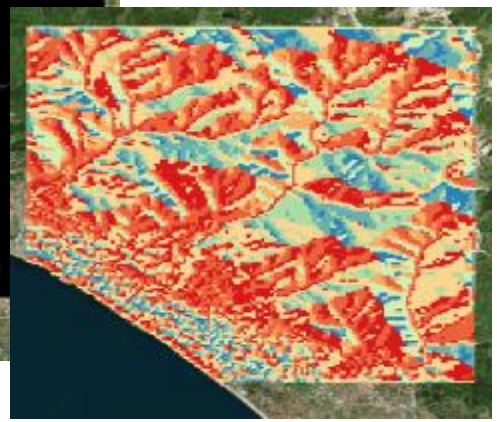
Dem



Flow accumulation



Local Drain Direction



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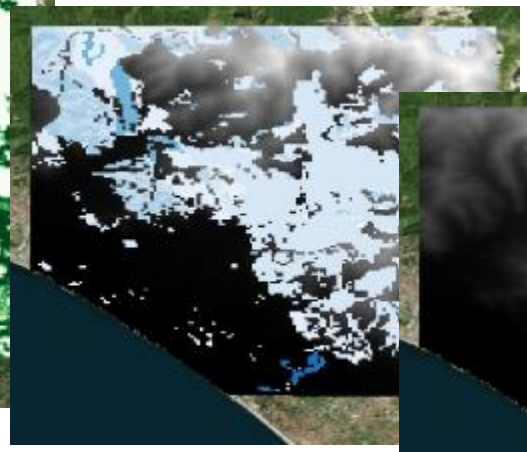
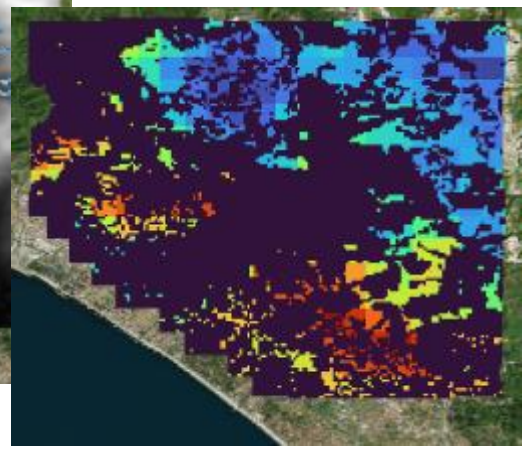
Fraction of Forest

Ksat forest



Stream Slope

Leaf Area Index



Preprocessing input data for LISFLOOD hydrological model with R

Massimo Perna, Francesca Caparrini & Giovanni Vitale

January, 2024

1 Introduction

LISFLOOD is a model that simulates the full water cycle from rainfall to water in rivers, lakes and groundwater. The model simulates, in large areas such as river basins, continents or the entire globe, the combined effects of weather and climate changes, land use, socio-economic changes on water demand, as well as policy measures for water savings or flood control. The model is used for water and climate studies, as well as flood and drought forecasting. Informations here

In this document a workflow of input data setup in R is presented.

The following picture show the workflfow of th LISFLOOD model; for any information about the model see References

SCORE hydrological modelling

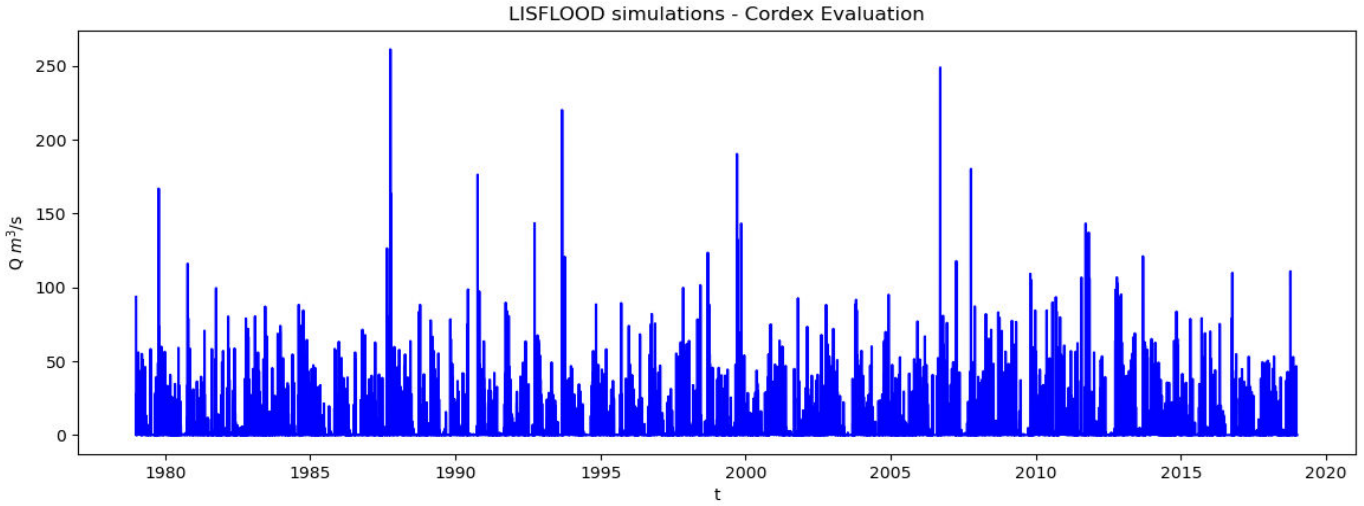
- **LISFLOOD model** setup for 3 coastal cities (Massa, Villanova and Orsoaldea)
  - 100 m spatial resolution

- Test/calibration run with **CORDEX evaluation** scenario (1979-2018, 1-hr time step)
- Run with **rcp45** and **rcp85** scenario (2006-2099, 1-hr time step)
- Preliminar statistical analysis and extreme events (design hydrographs for different Cordex scenarios, to be used in the hydraulic/2D flood simulations)

SCORE hydrological modelling

MASSA case study

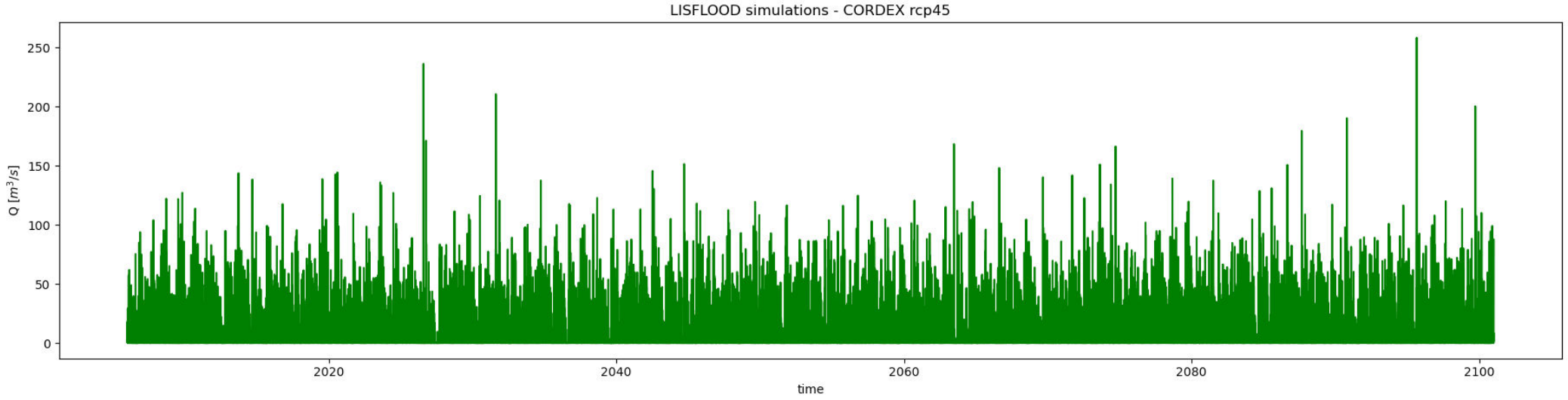
- Example of Massa test/calibration run with **CORDEX evaluation** scenario (1979-2018, 1-hr time step)



SCORE hydrological modelling

MASSA case study

- Example of Massa run with **CORDEX rcp45** scenario (2006-2099, 1-hr time step)



SCORE hydrological modelling

MASSA case study

- Example of Massa run with **CORDEX rcp85** scenario (2006-2099, 1-hr time step)