

Climate change and Water Resources Management (part2)

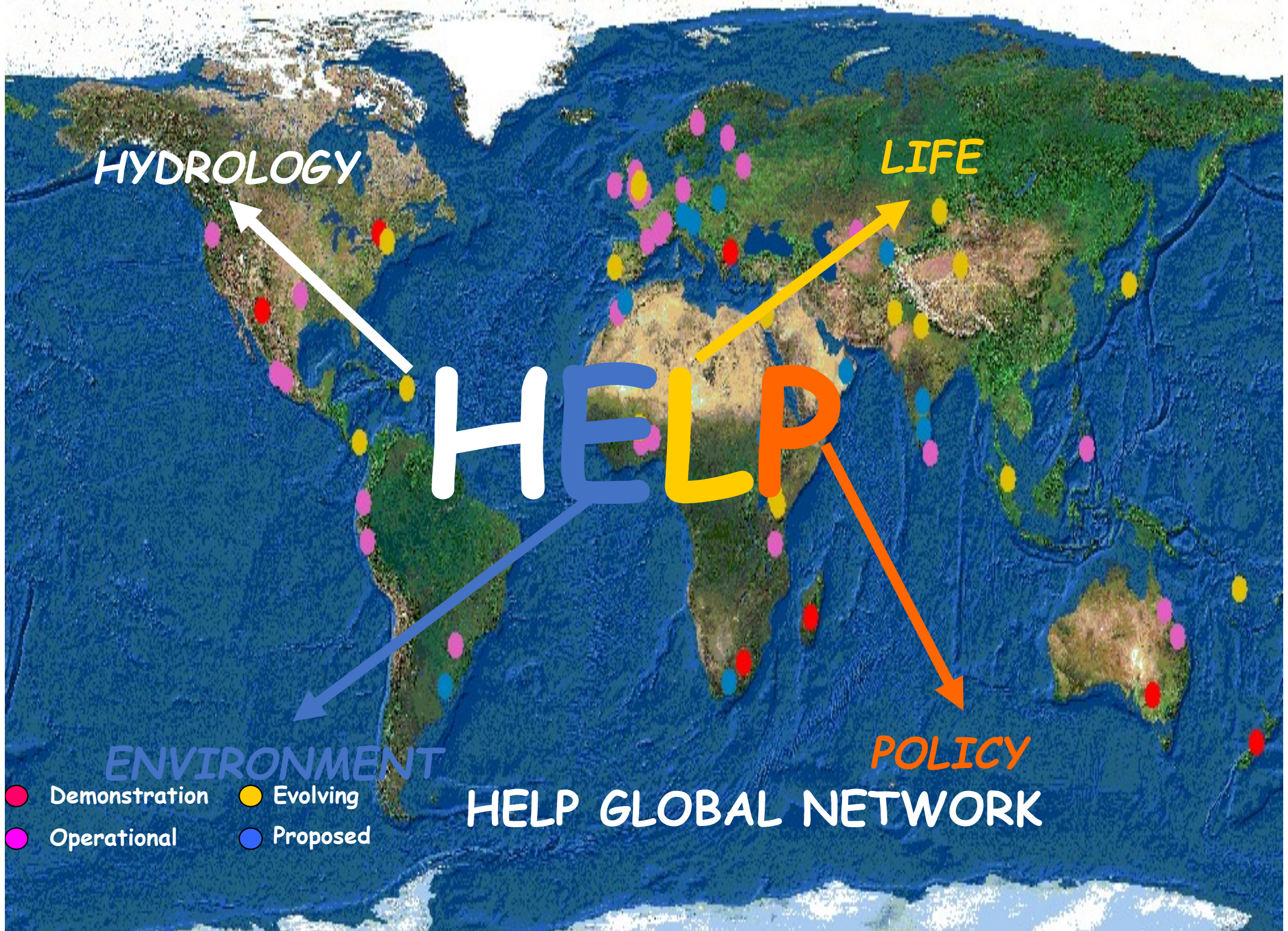
Hydrologic simulations under climate change.

By

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hskoulik@civil.auth.gr

April 2022



HYDROLOGY

LIFE

HELP

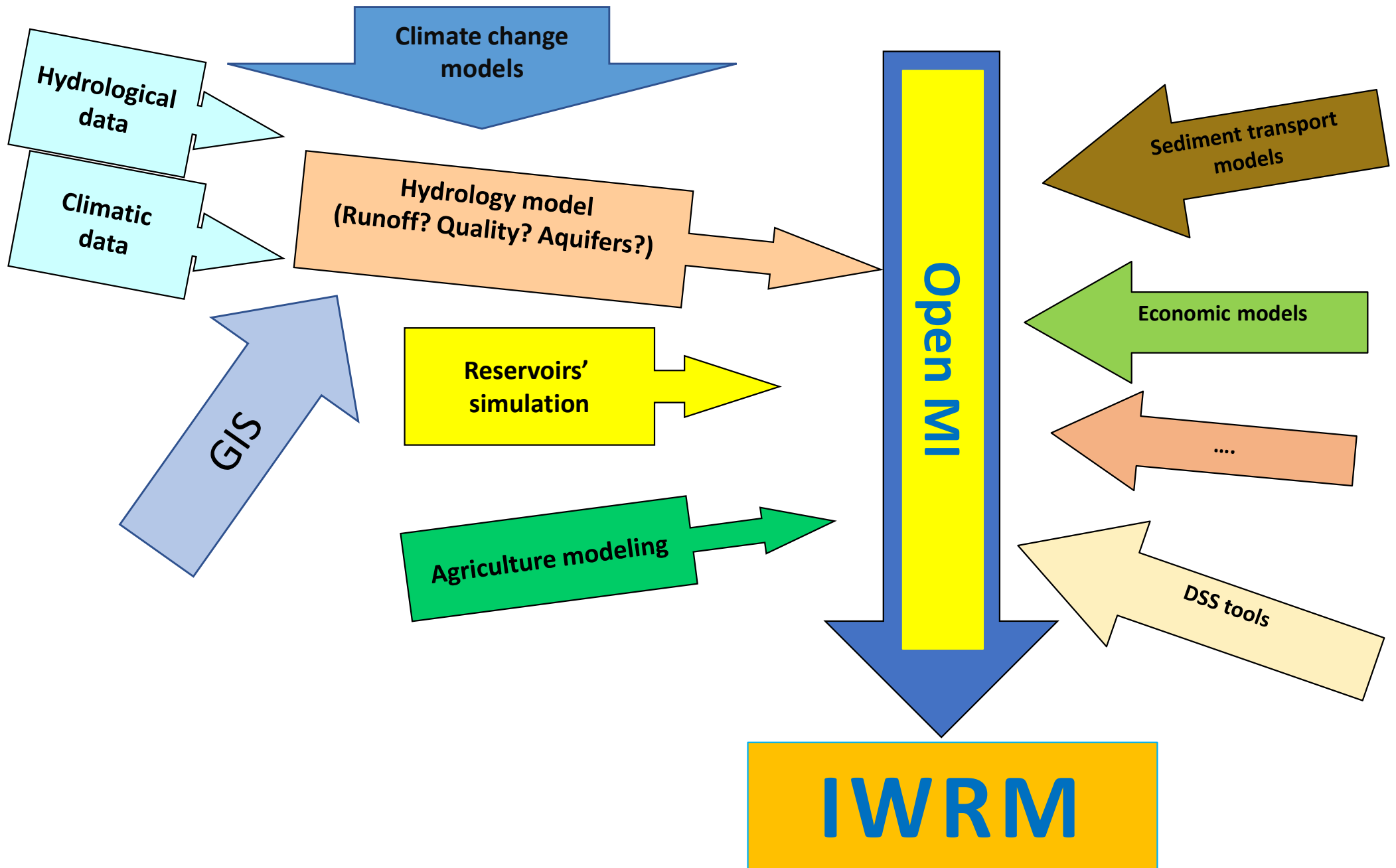
ENVIRONMENT

POLICY

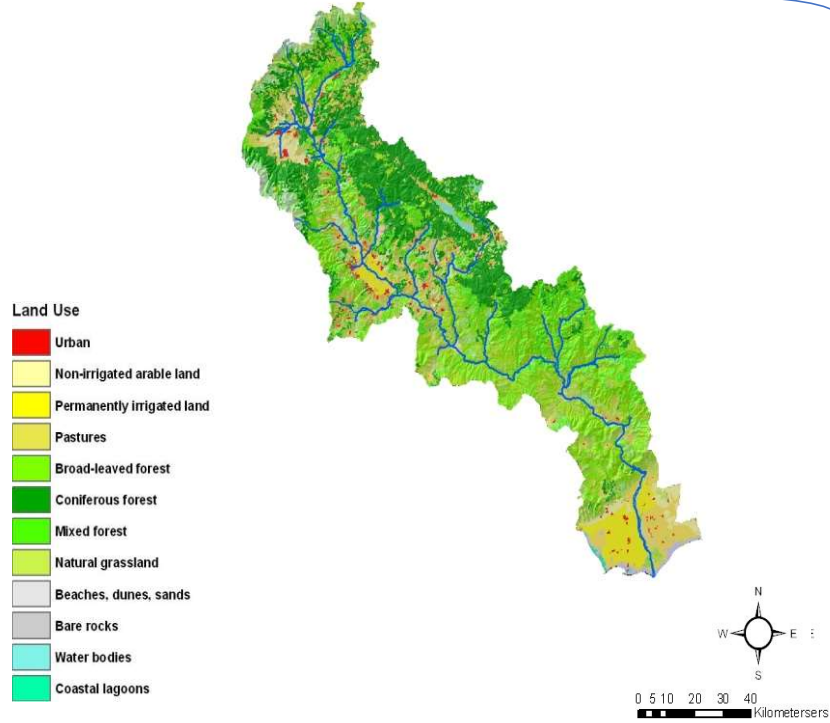
HELP GLOBAL NETWORK

- Demonstration
- Evolving
- Operational
- Proposed

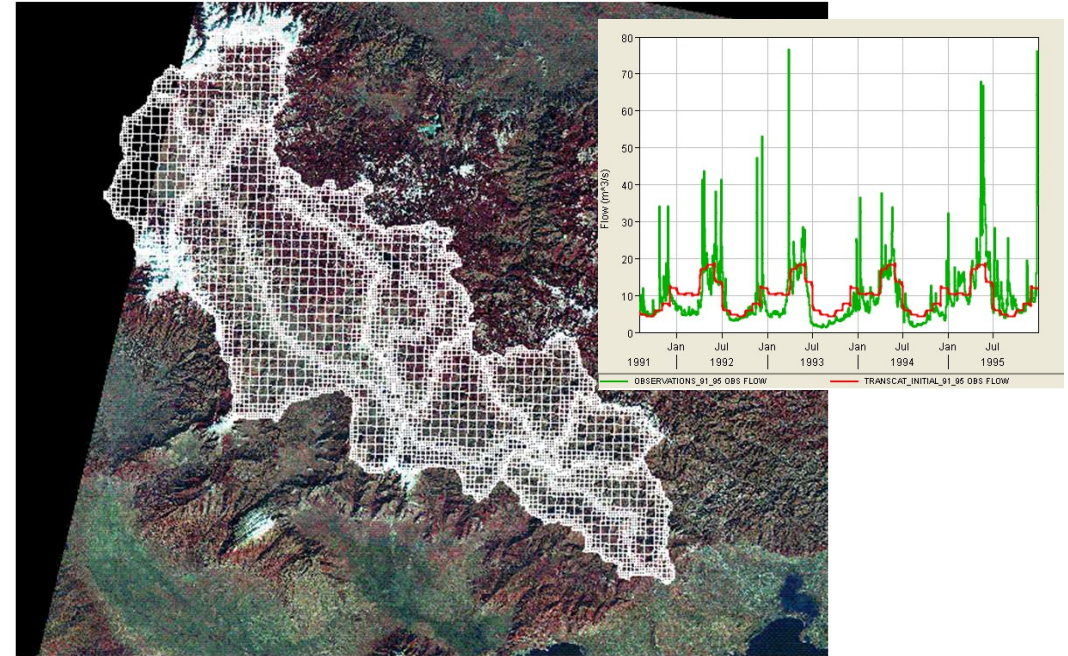
Modeling Coupling for the Integrated Water Resources Management



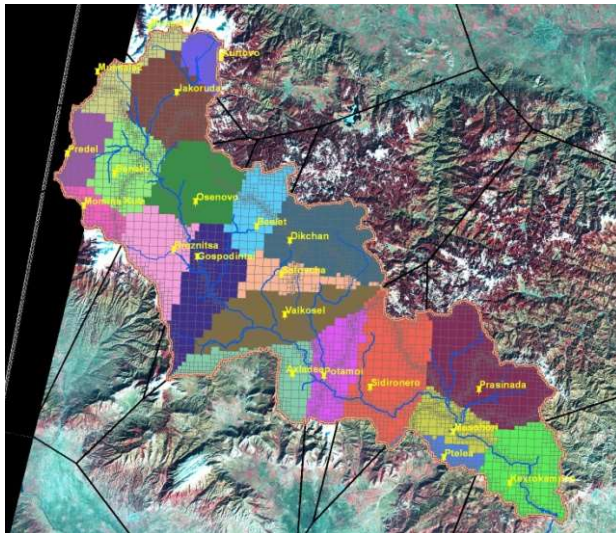
Geographic Information Systems - GIS



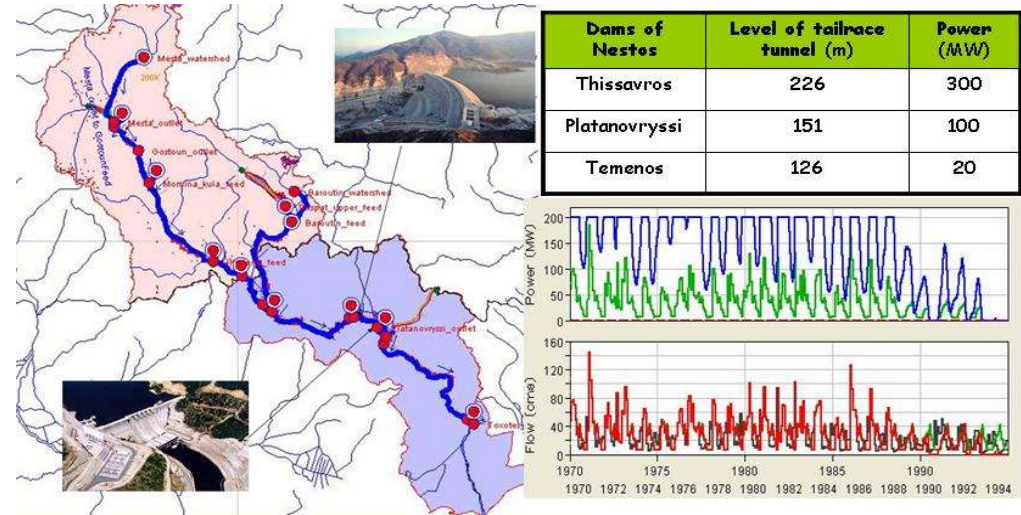
Hydrologic modelling



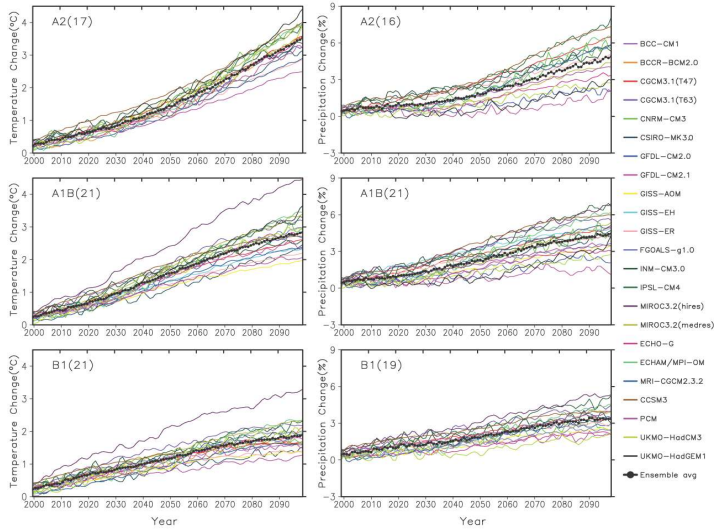
Meteorological data



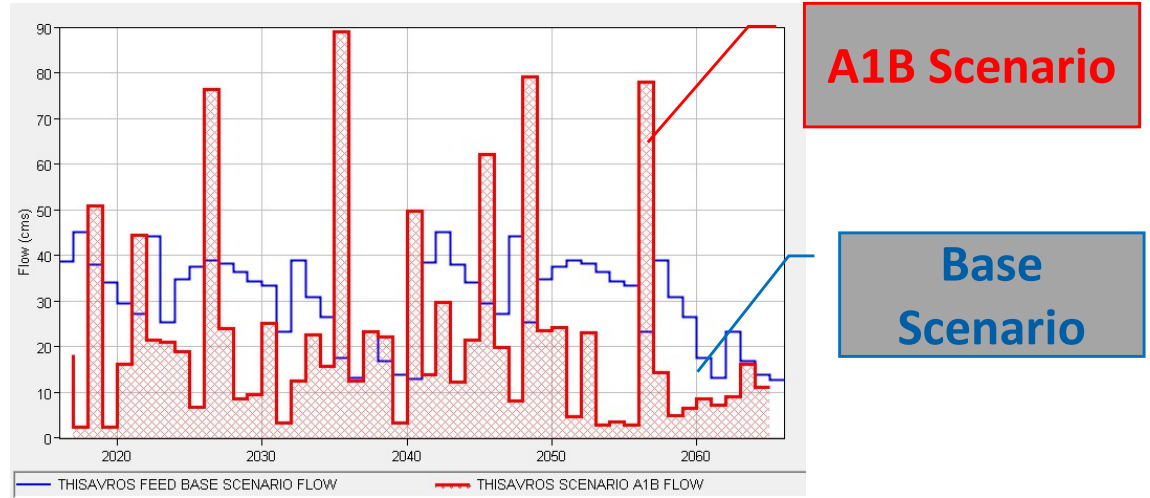
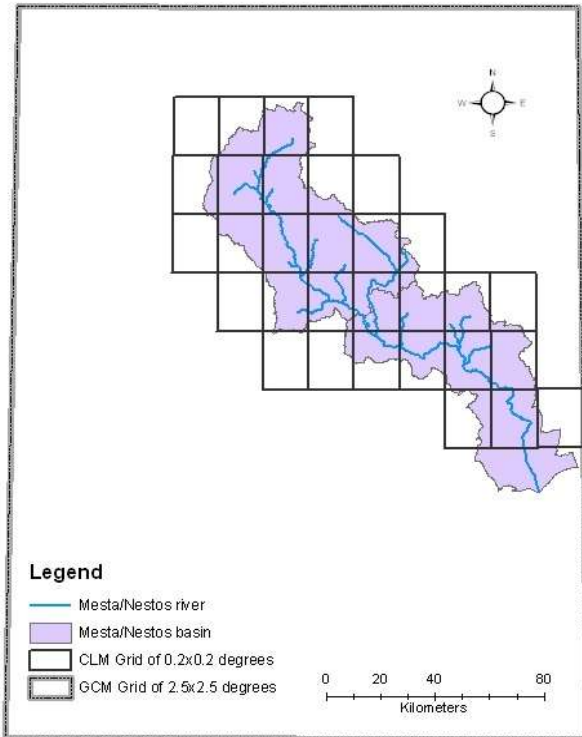
Reservoir simulation



Climate change models



Downscaling techniques

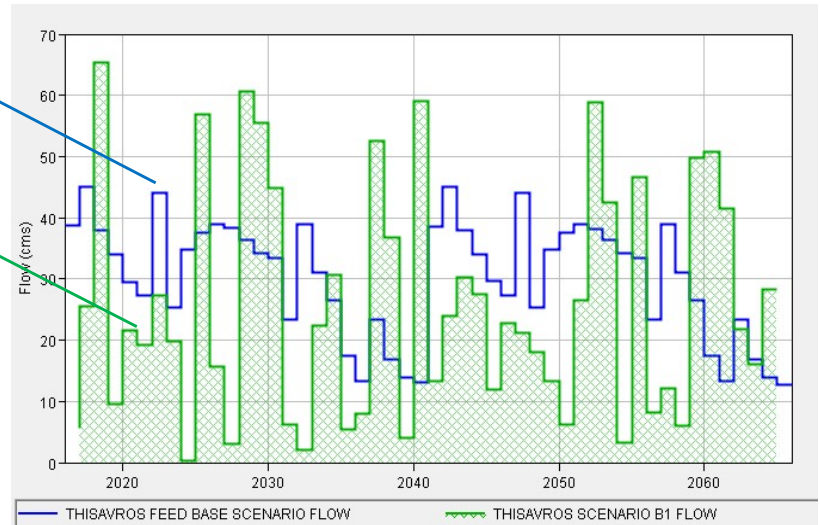


A1B Scenario

Base Scenario

Base Scenario

B1 Scenario



	Base	A1B	B1
Mean flow (m ³ /day)	30.15	22.20	25.90

Case study: Mesta/Nestos River Basin



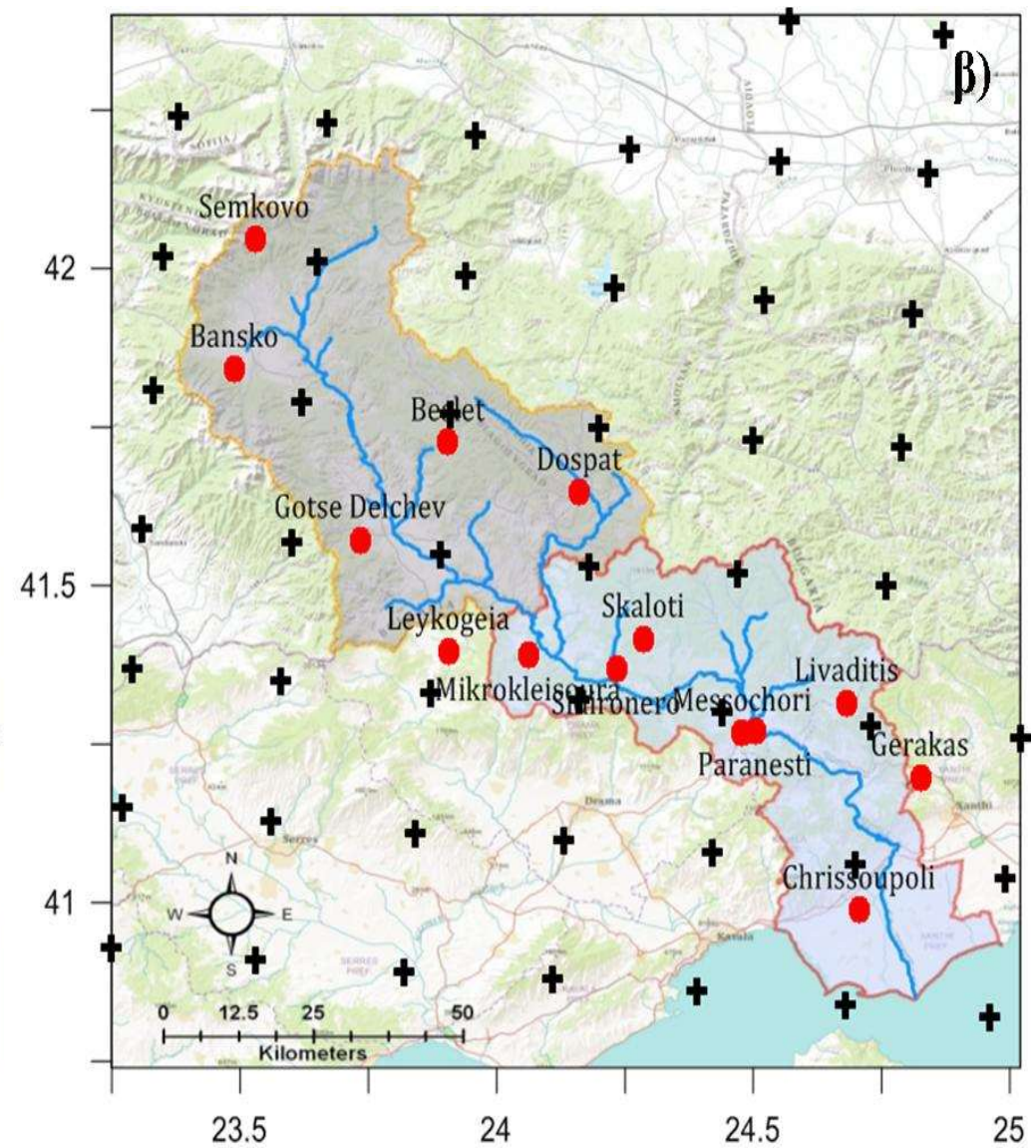
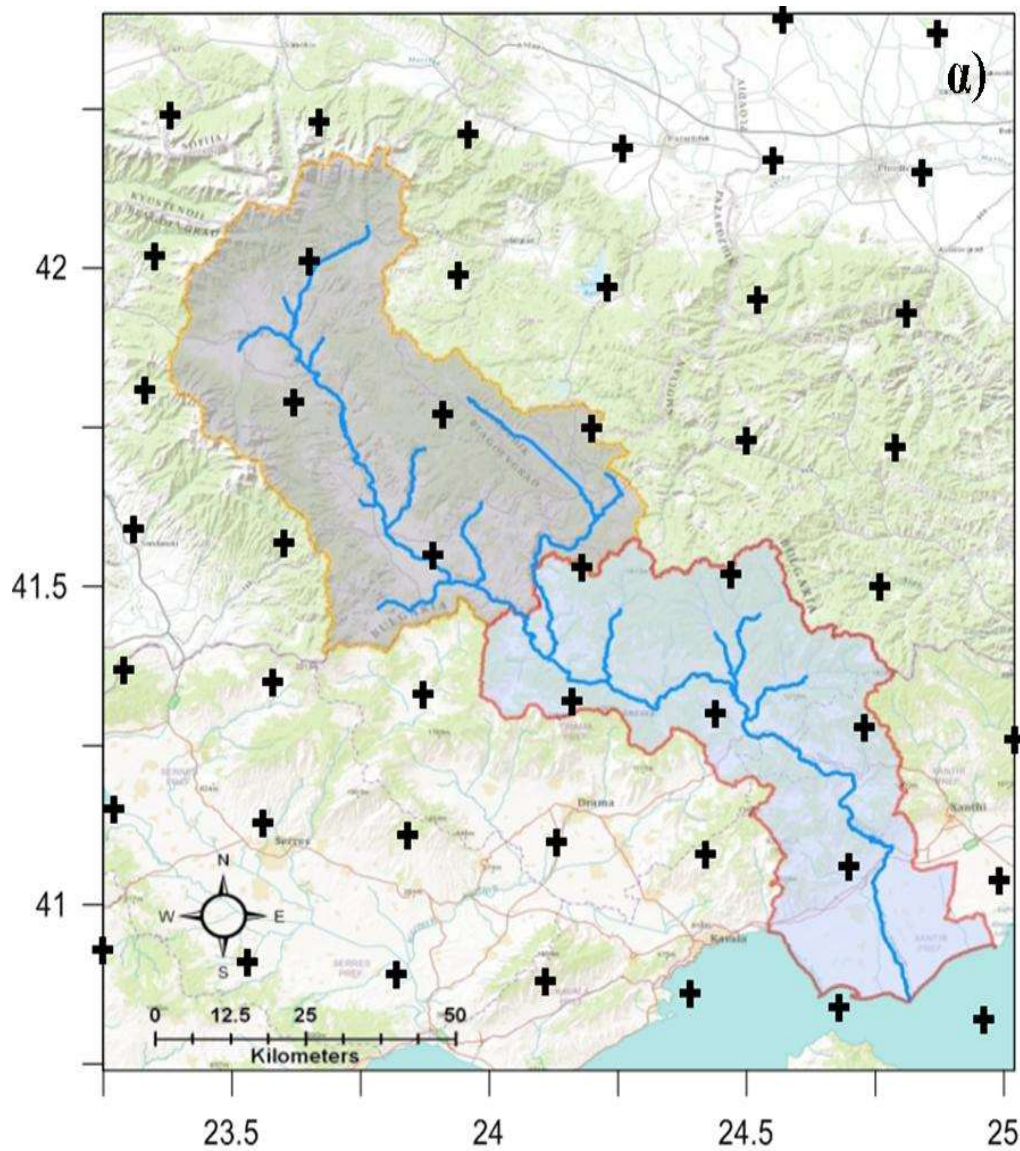
Surface: 6,218 Km²

Length: 255 Km

Climate change RCMs

MODEL	Climate Institute	ABREVIATION	GCM	EMISSION SCENARIO
RCA3	Community Climate Change Consortium for Ireland	C4IRCA3	ECHAM5	A2 (- >2050)
RACMO2	Royal Netherlands Meteorological Institute	KNMI-RACMO2	ECHAM5-r3	A1B (- >2100)
RegCM3	International Centre for Theoretical Physics	ICTP-RegCM3	ECHAM5-r3	A1B (- >2100)
REMO	Max Planck Institute for Meteorology	MPI-M-REMO	ECHAM5-r3	A1B (- >2100)
CLM	Max Planck Institute for Meteorology	RCM-CLM	ECHAM5	B1 (- > 2100)

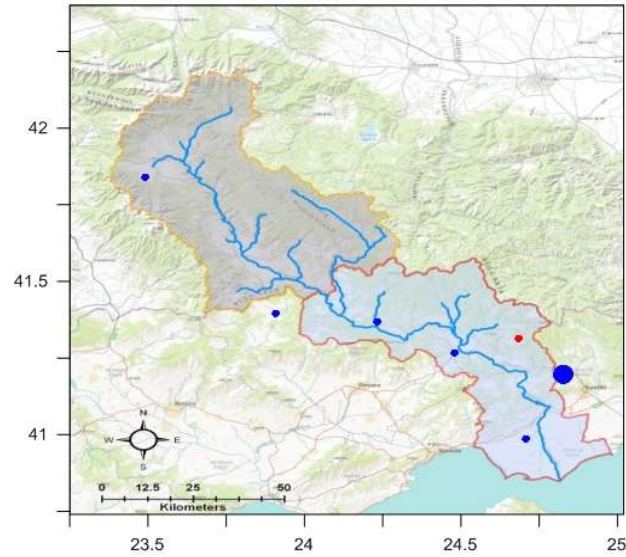
Climate change potential impacts to HPP



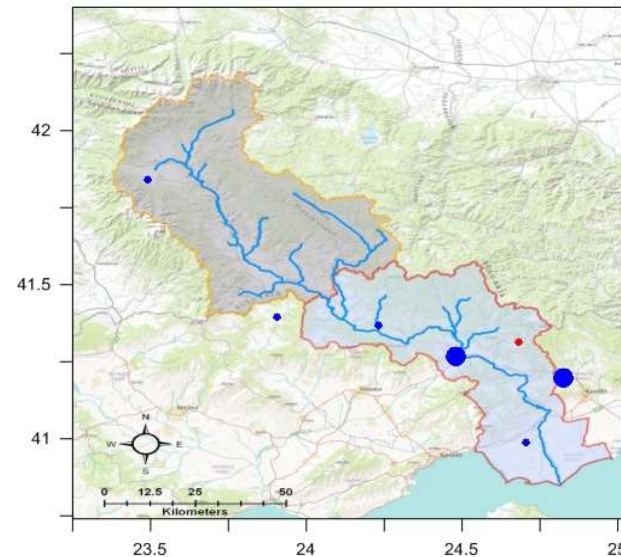
Hindcast: Temperature

Annual Temperature Differences

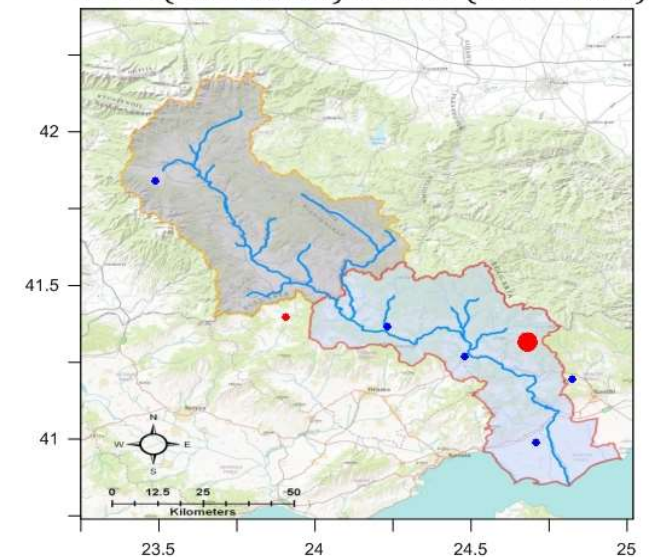
C4I (1981-2000)-Station (1981-2000)



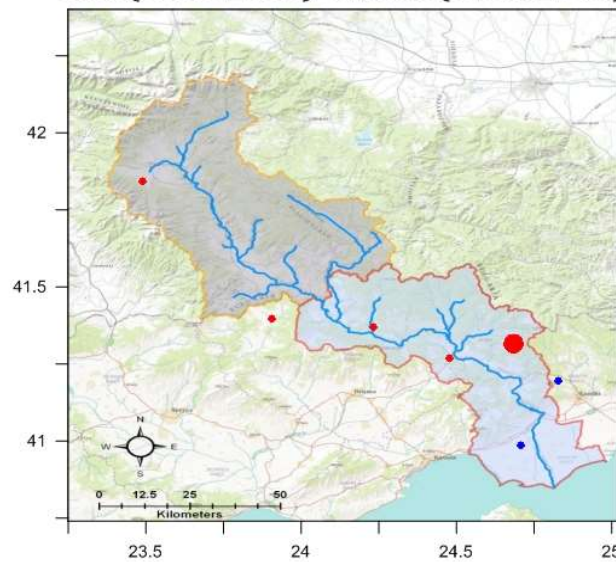
ICTP (1981-2000)-Station (1981-2000)



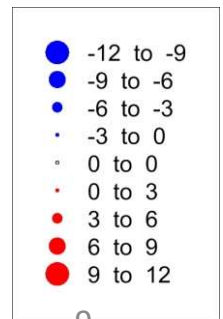
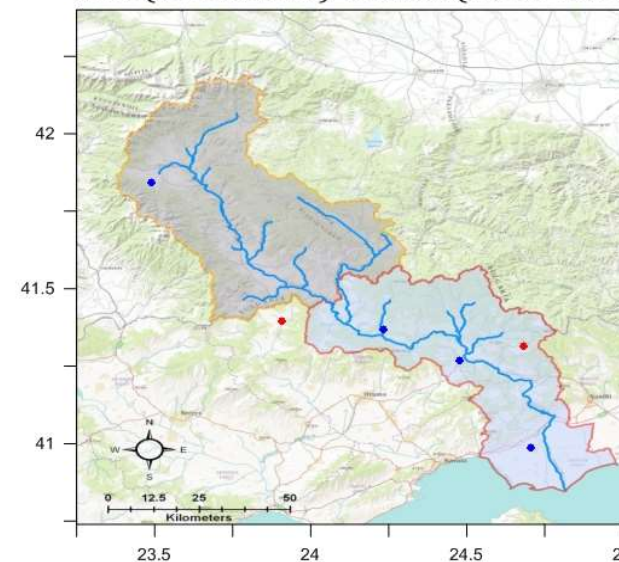
KNMI (1981-2000)-Station (1981-2000)



MPI (1981-2000)-Station (1981-2000)



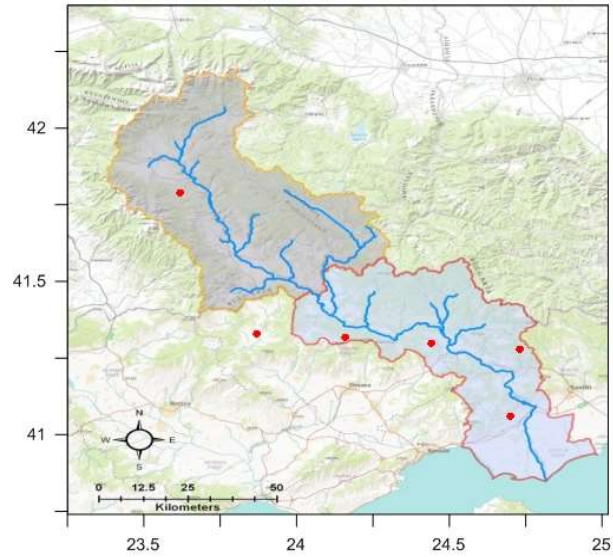
CLM (1981-2000)-Station (1981-2000)



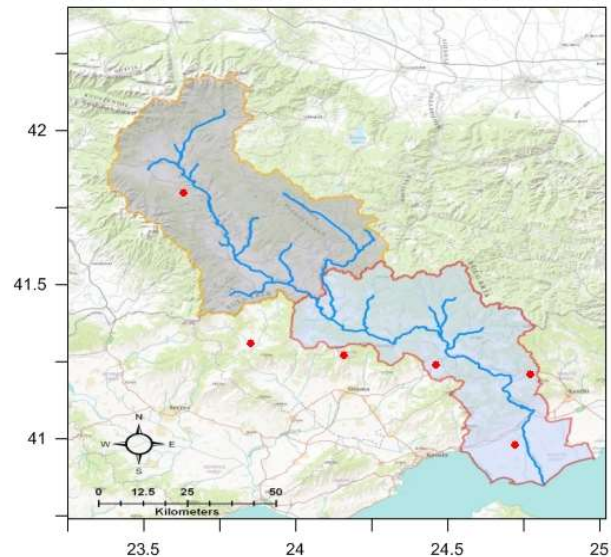
Temperature differences (1)

Annual Temperature Differences

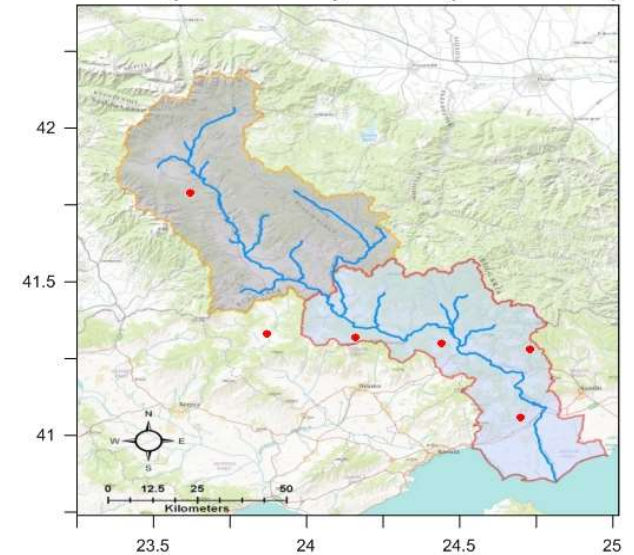
C4I (2031-2050)-C4I (1981-2000)



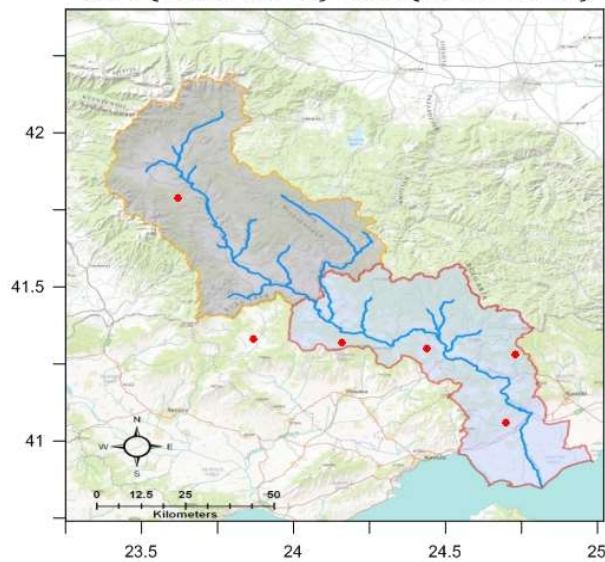
ICTP (2031-2050)-ICTP (1981-2000)



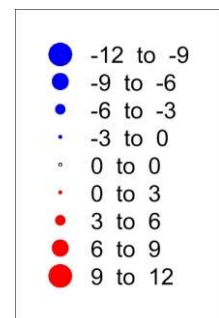
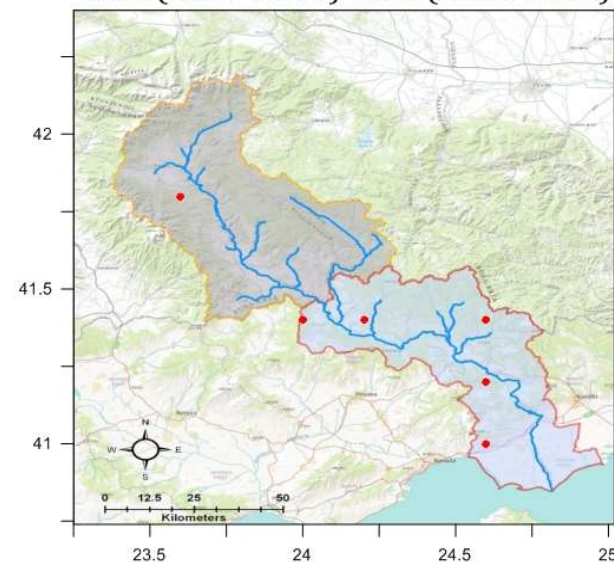
KNMI (2031-2050)-KNMI (1981-2000)



MPI (2031-2050)-MPI (1981-2000)

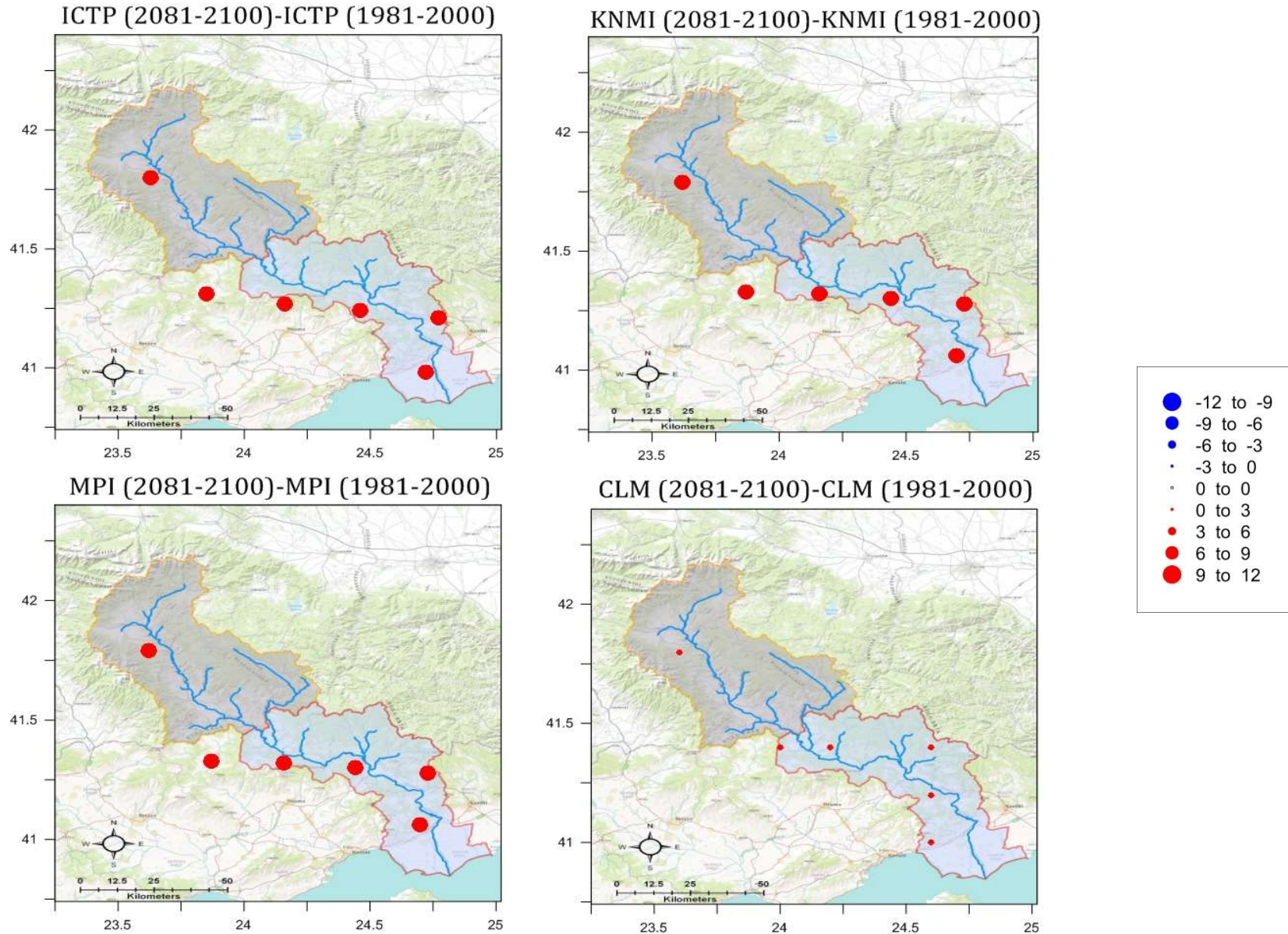


CLM (2031-2050)-CLM (1981-2000)



Temperature differences (2)

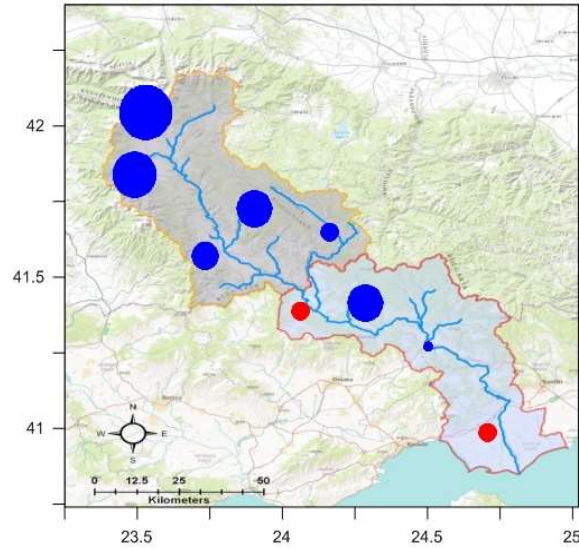
Annual Temperature Differences



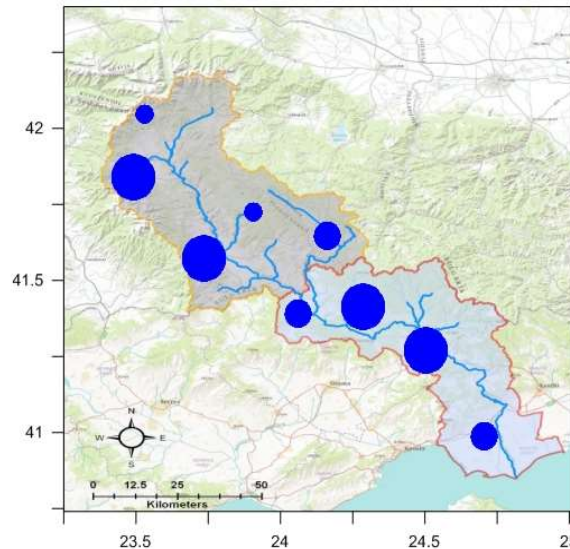
Hindcast: Precipitation

Annual Precipitation Differences

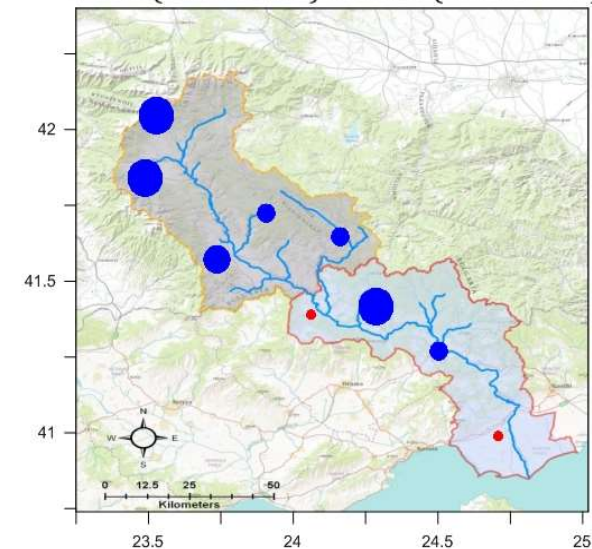
C4I (1970-1989)-Station (1970-1989)



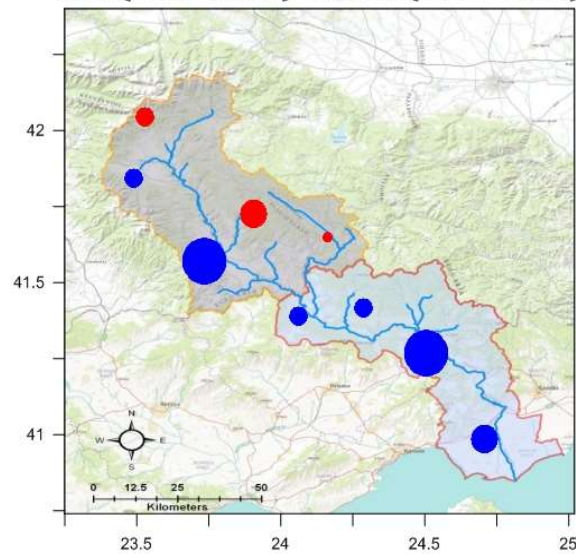
ICTP (1970-1989)-Station (1970-1989)



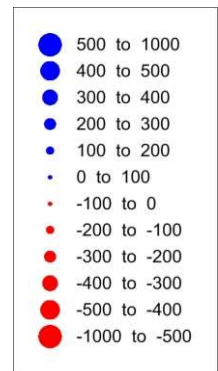
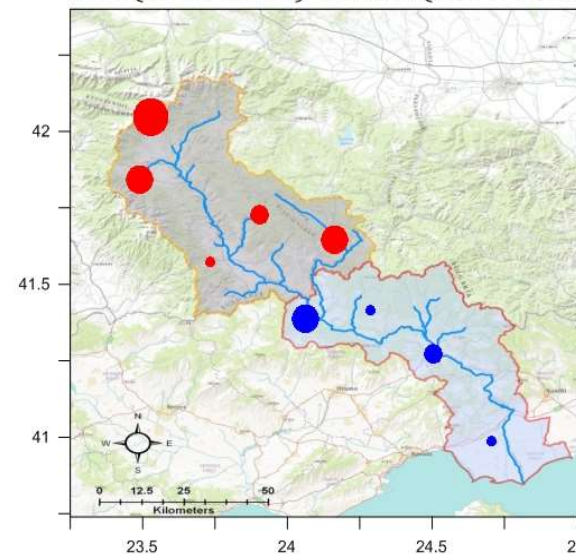
KNMI (1970-1989)-Station (1970-1989)



MPI (1970-1989)-Station (1970-1989)



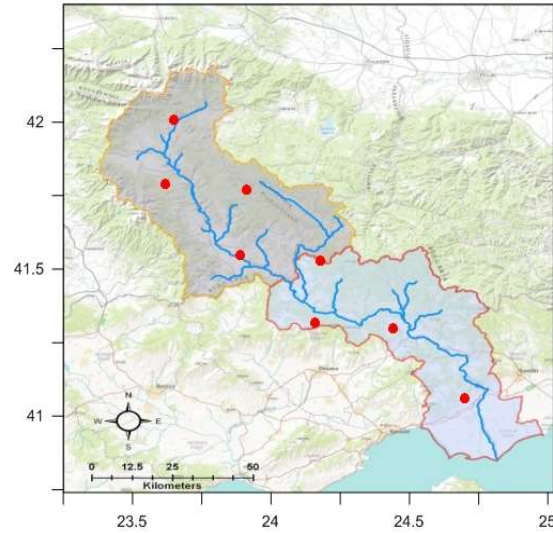
CLM (1970-1989)-Station (1970-1989)



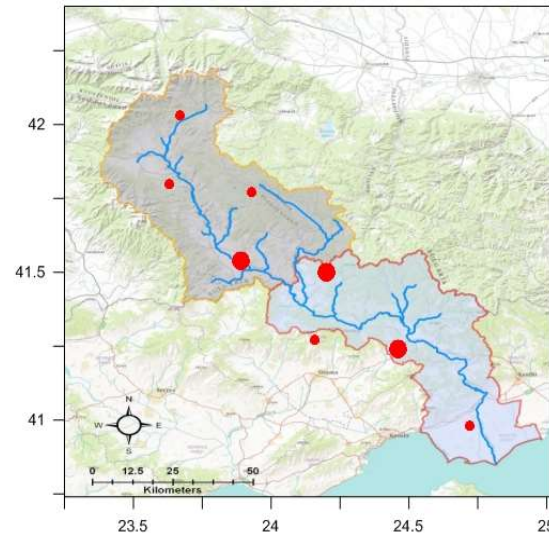
Precipitation differences (1)

Annual Precipitation Differences

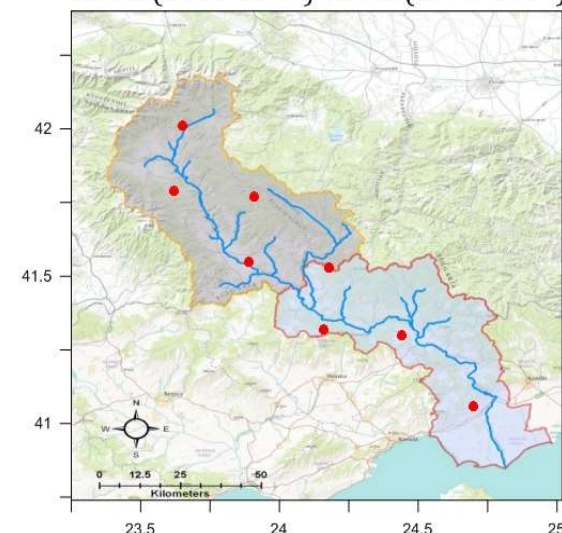
C4I (2030-2049)-C4I (1970-1989)



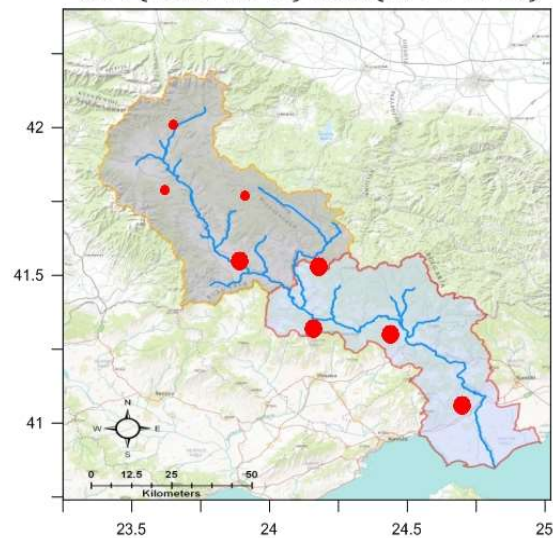
ICTP (2030-2049)-ICTP (1970-1989)



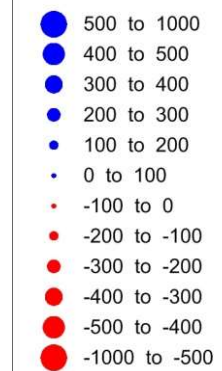
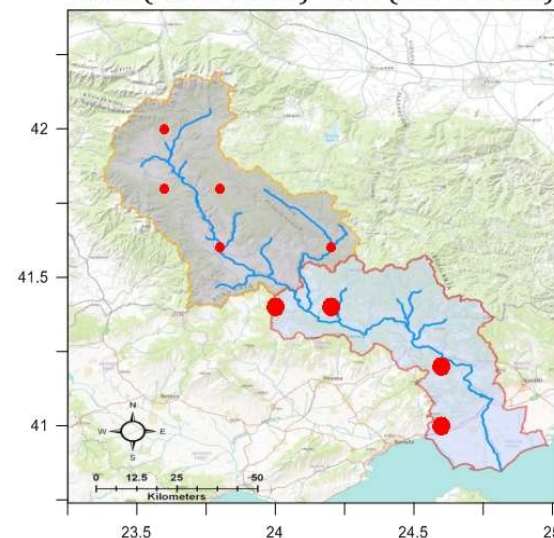
KNMI (2030-2049)-KNMI (1970-1989)



MPI (2030-2049)-MPI (1970-1989)



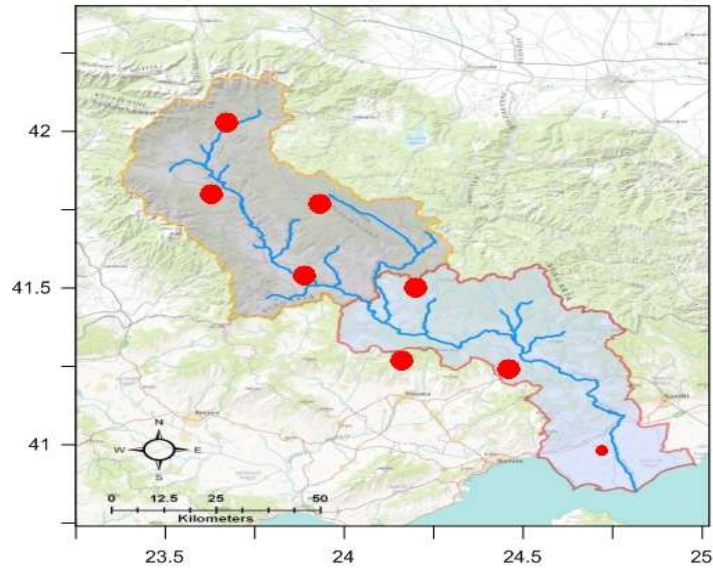
CLM (2030-2049)-CLM (1970-1989)



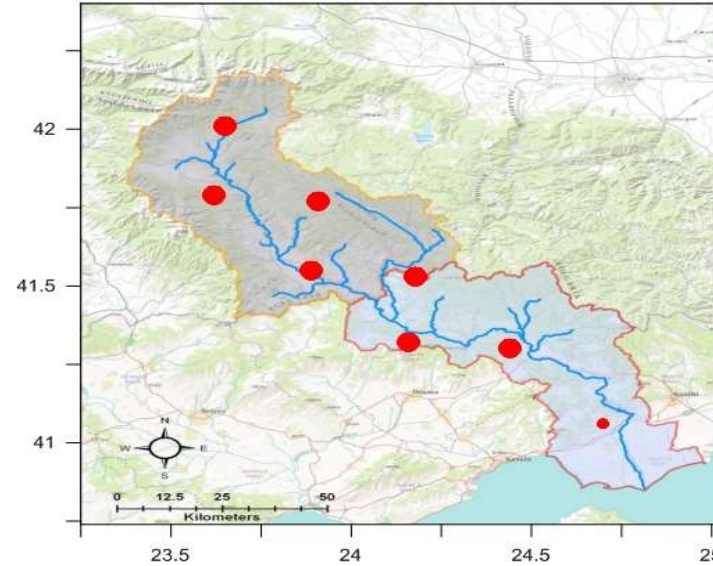
Precipitation differences (2)

Annual Precipitation Differences

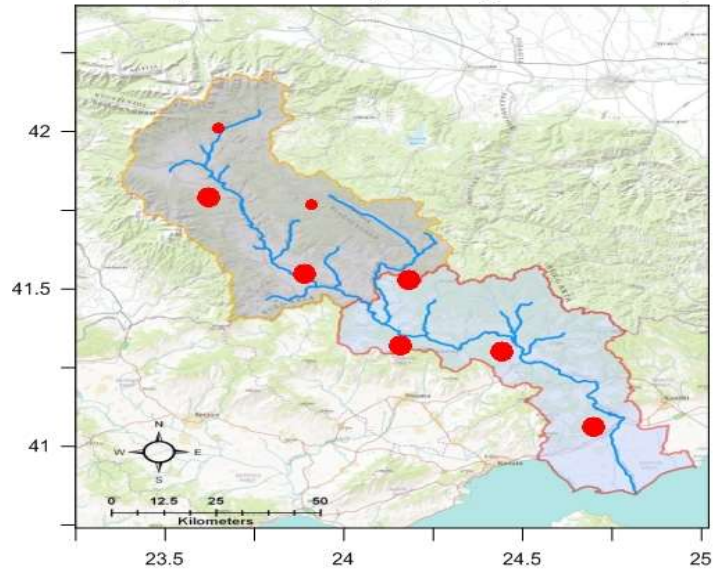
ICTP (2080-2099)-ICTP (1970-1989)



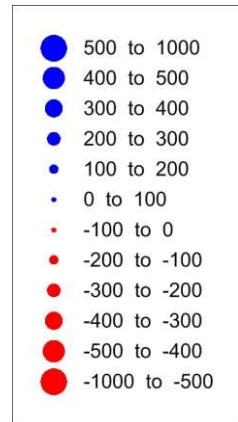
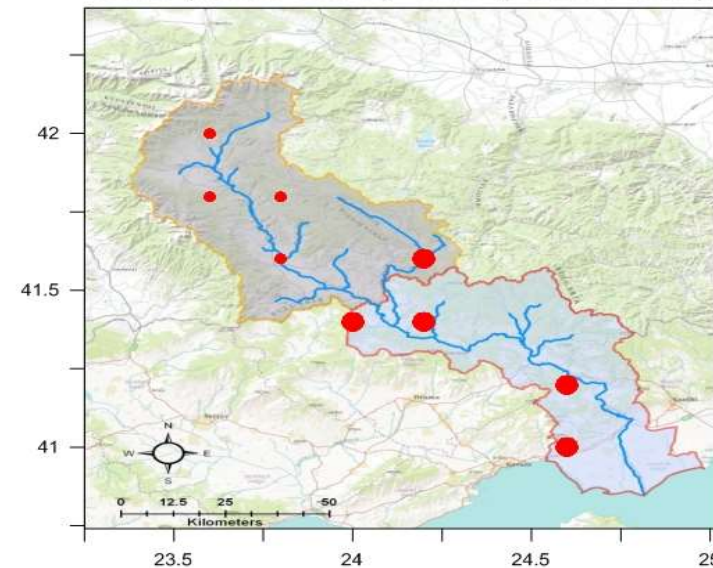
KNMI (2080-2099)-KNMI (1970-1989)



MPI (2080-2099)-MPI (1970-1989)



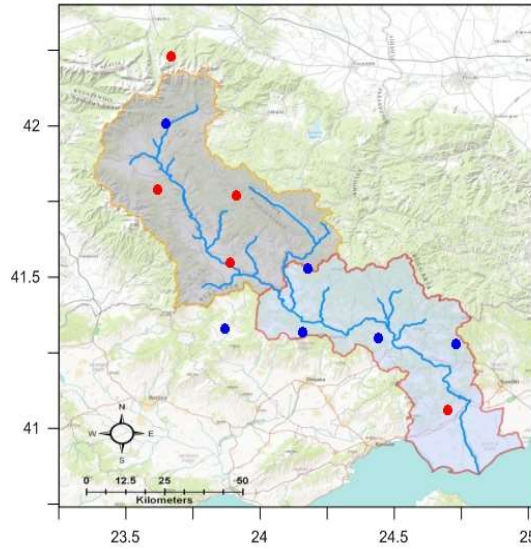
CLM (2080-2099)-CLM (1970-1989)



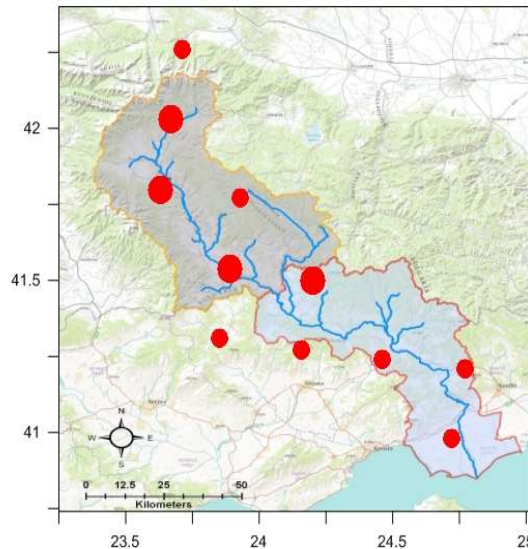
Evapotranspiration variations

Annual Evapotranspiration Differences

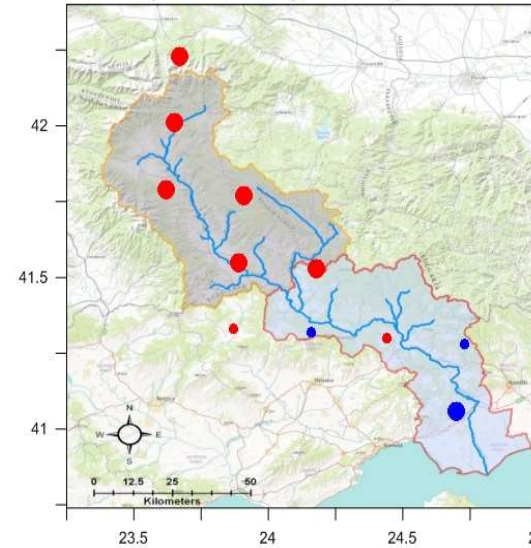
C4I (2021-2050)-C4I (1971-2000)



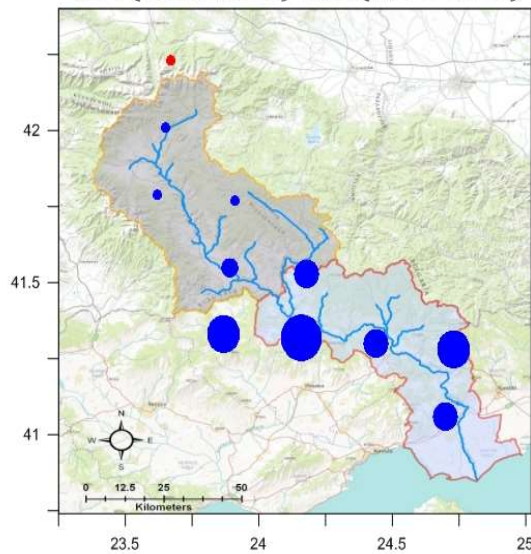
ICTP (2021-2050)-ICTP (1971-2000)



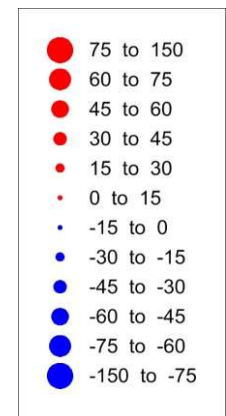
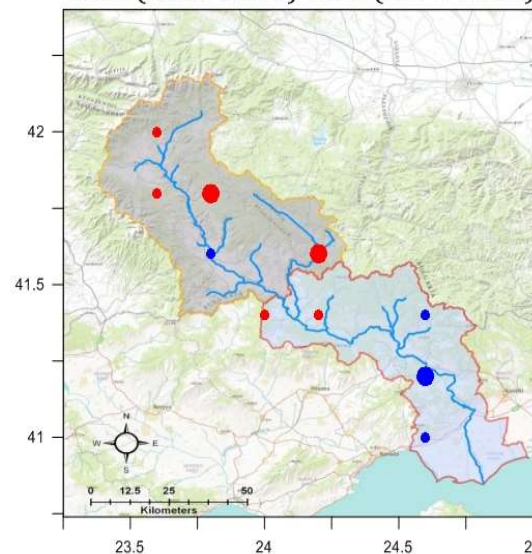
KNMI (2021-2050)-KNMI (1971-2000)



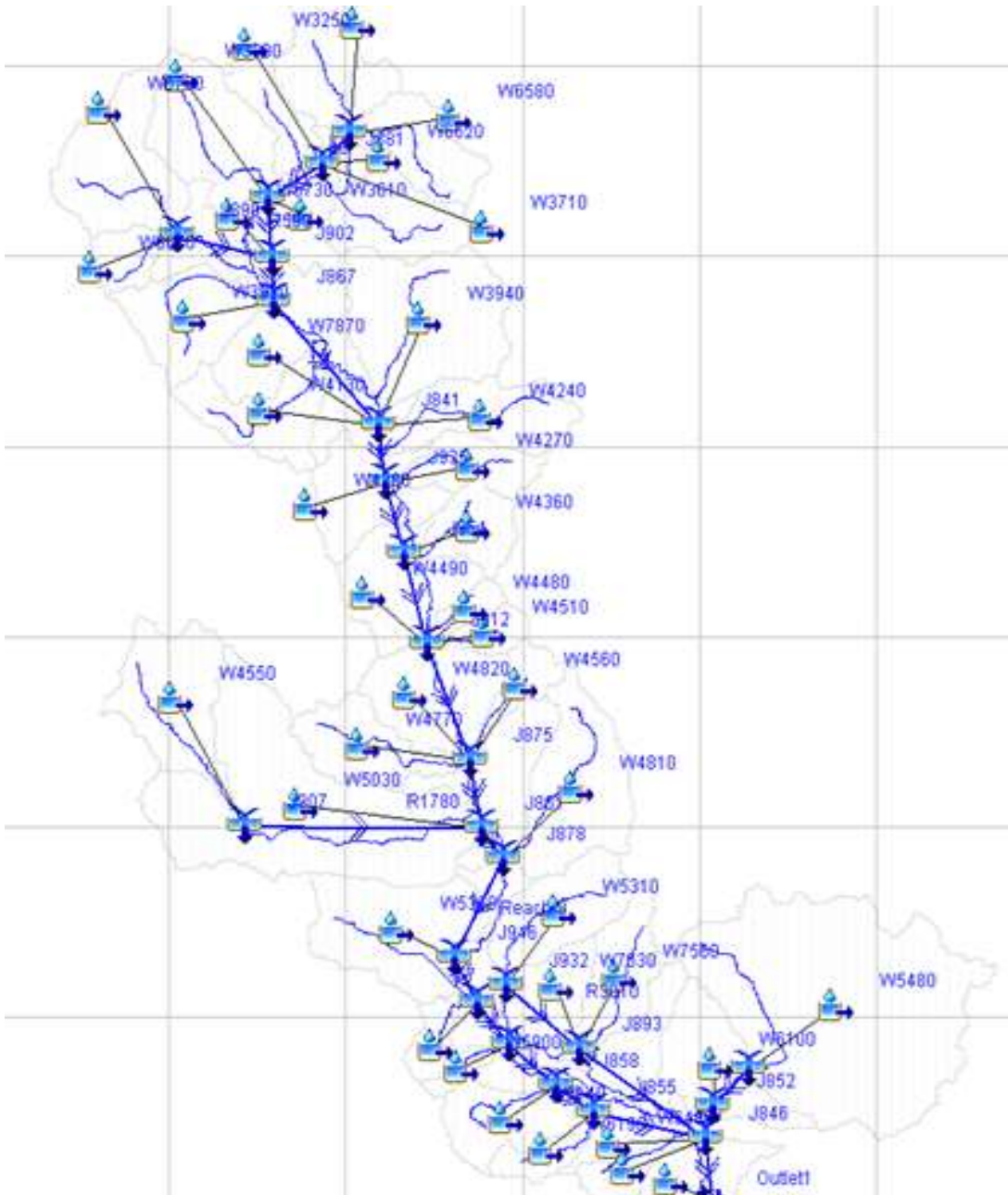
MPI (2021-2050)-MPI (1971-2000)



CLM (2021-2050)-CLM (1971-2000)



HEC-HMS: Application to the Struma basin



- **Transform method:**

- SCS Unit Hydrograph Model

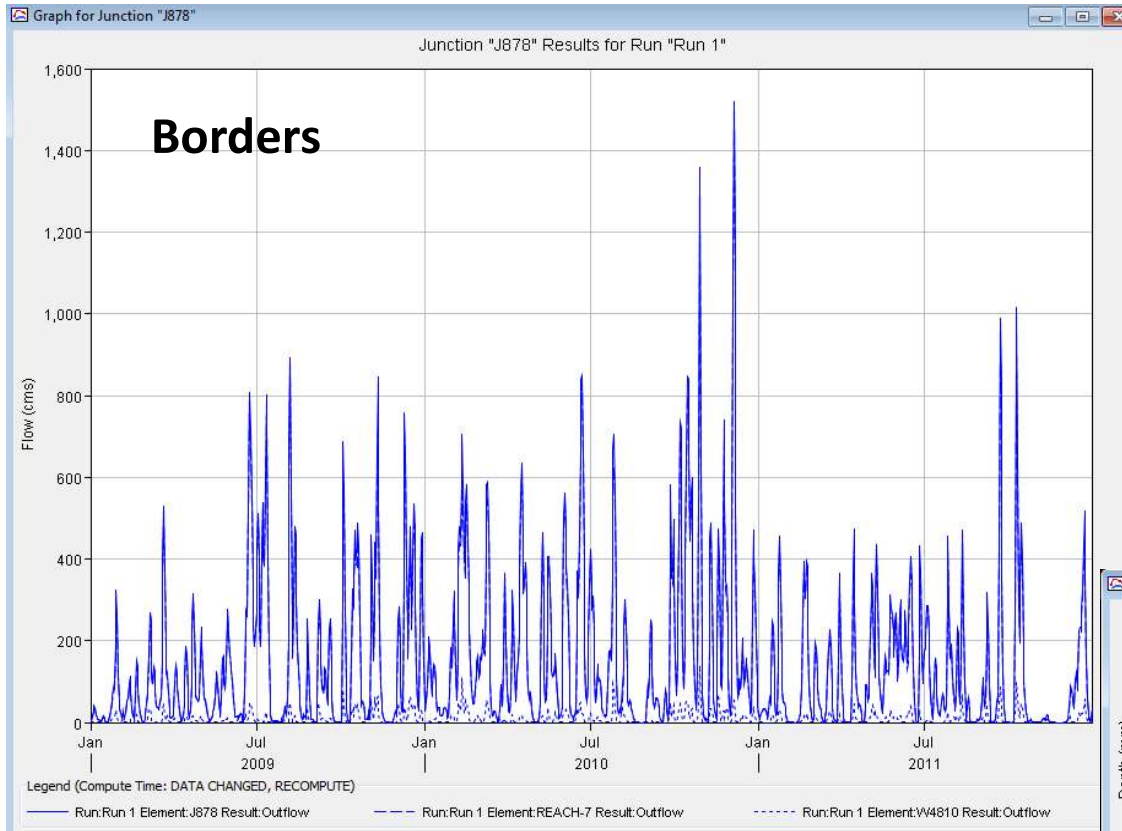
- Lag time: 60% of concentration time (Giandotti formula)

$$t_g = \frac{4\sqrt{A} + 1.5L}{0.8\sqrt{\Delta H}}$$

- **Loss Method :**

- SCS Curve Number method

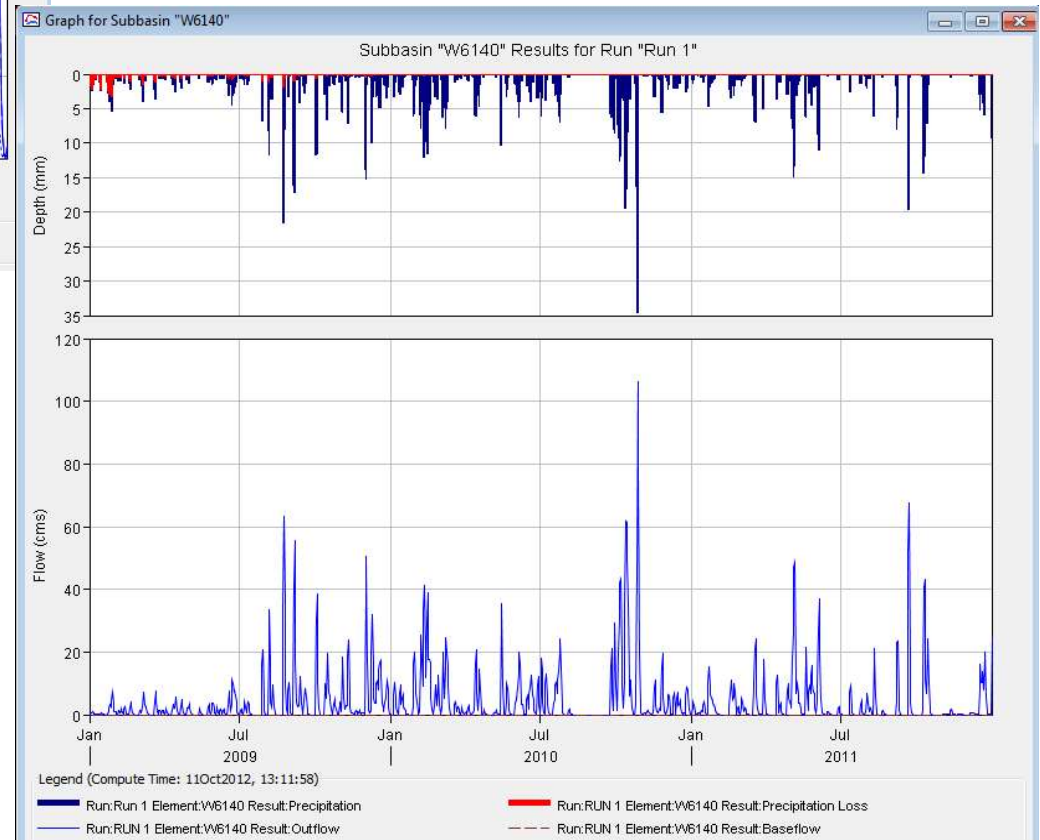
HEC-HMS: Results



Borders

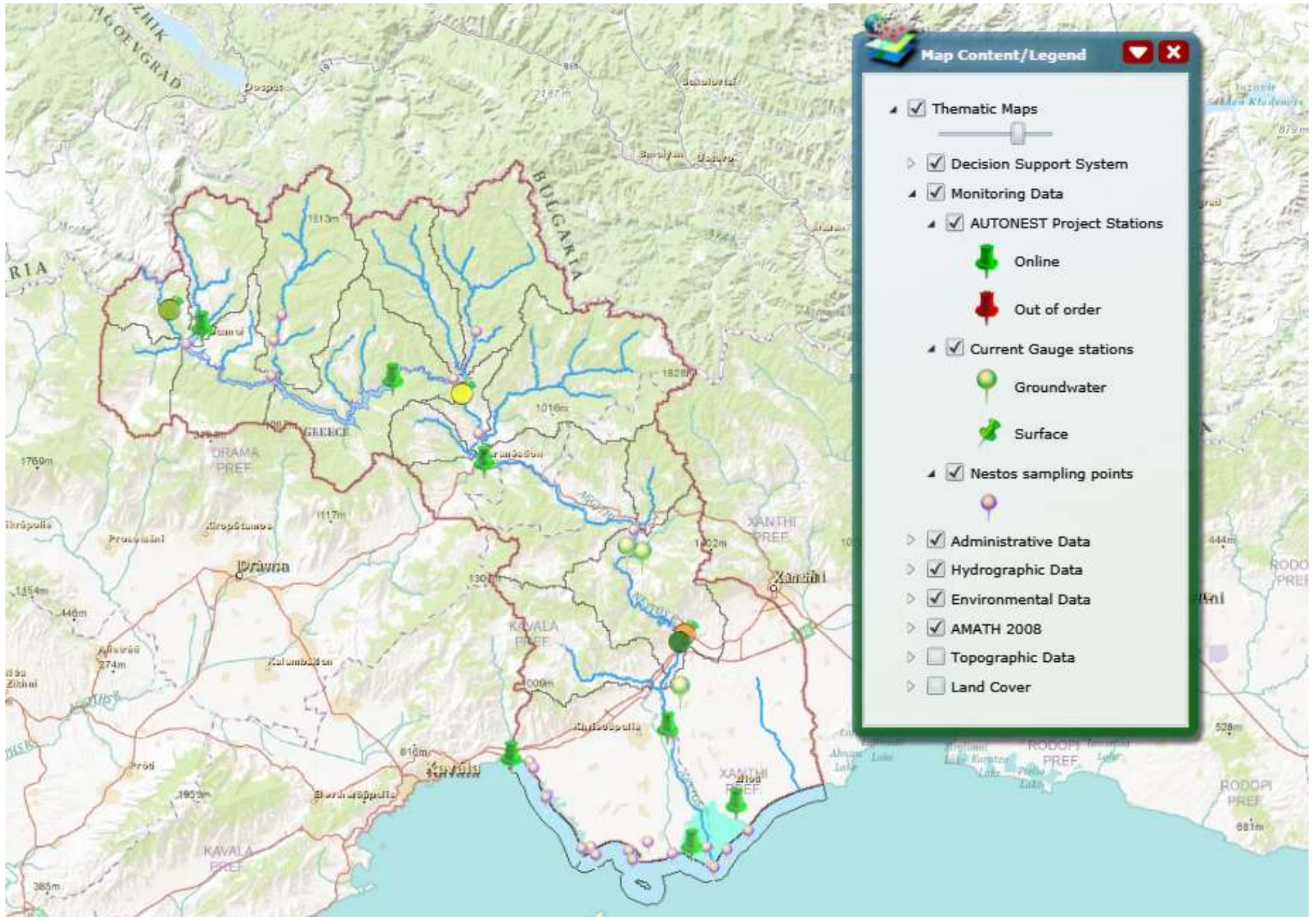
**Borders: Max Discharges 1550m³/s,
< 3,000m³/s (100y Return period)
Summer :Qmax = 800m³/s < 1800
m³/s**

Ξηροπόταμος

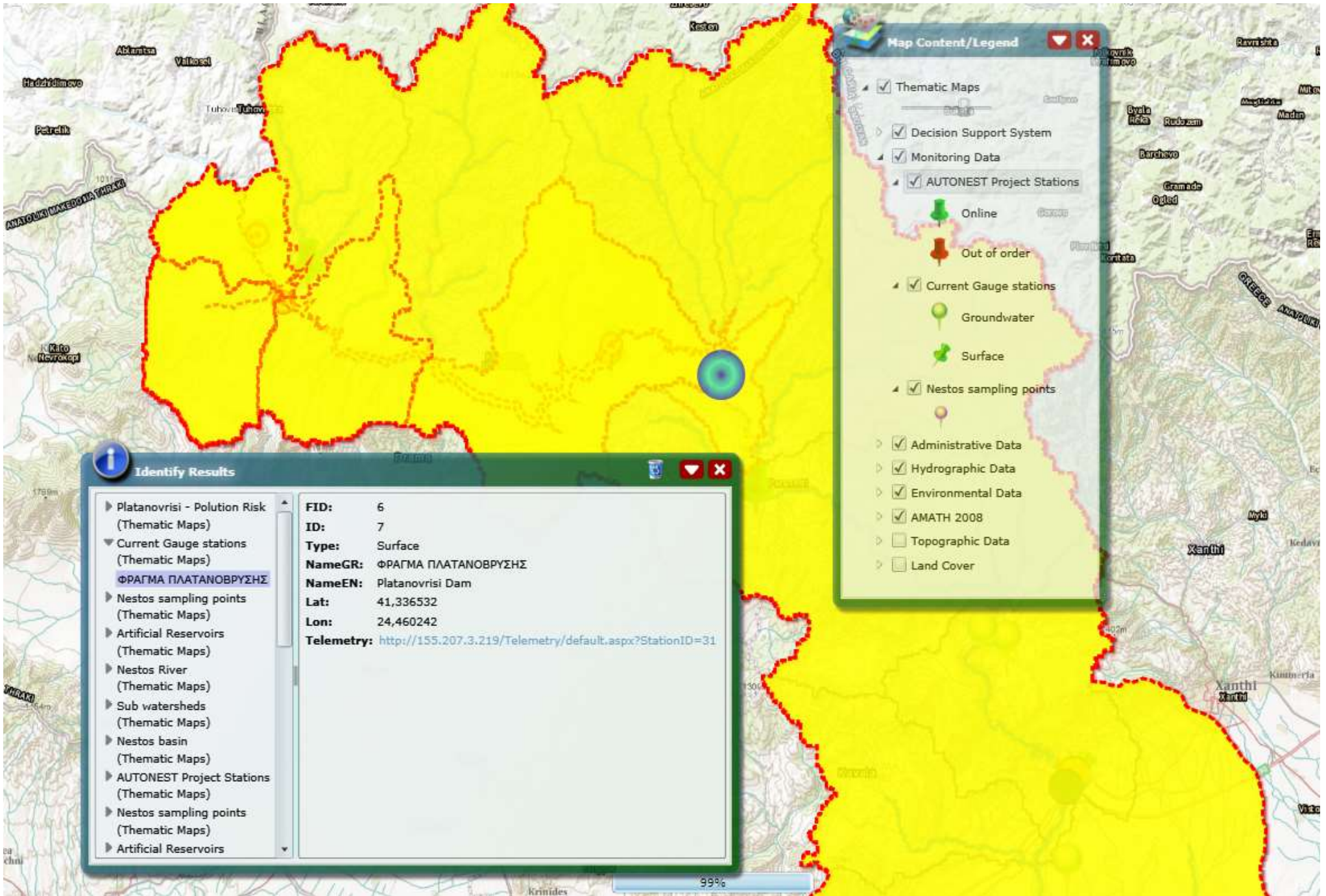


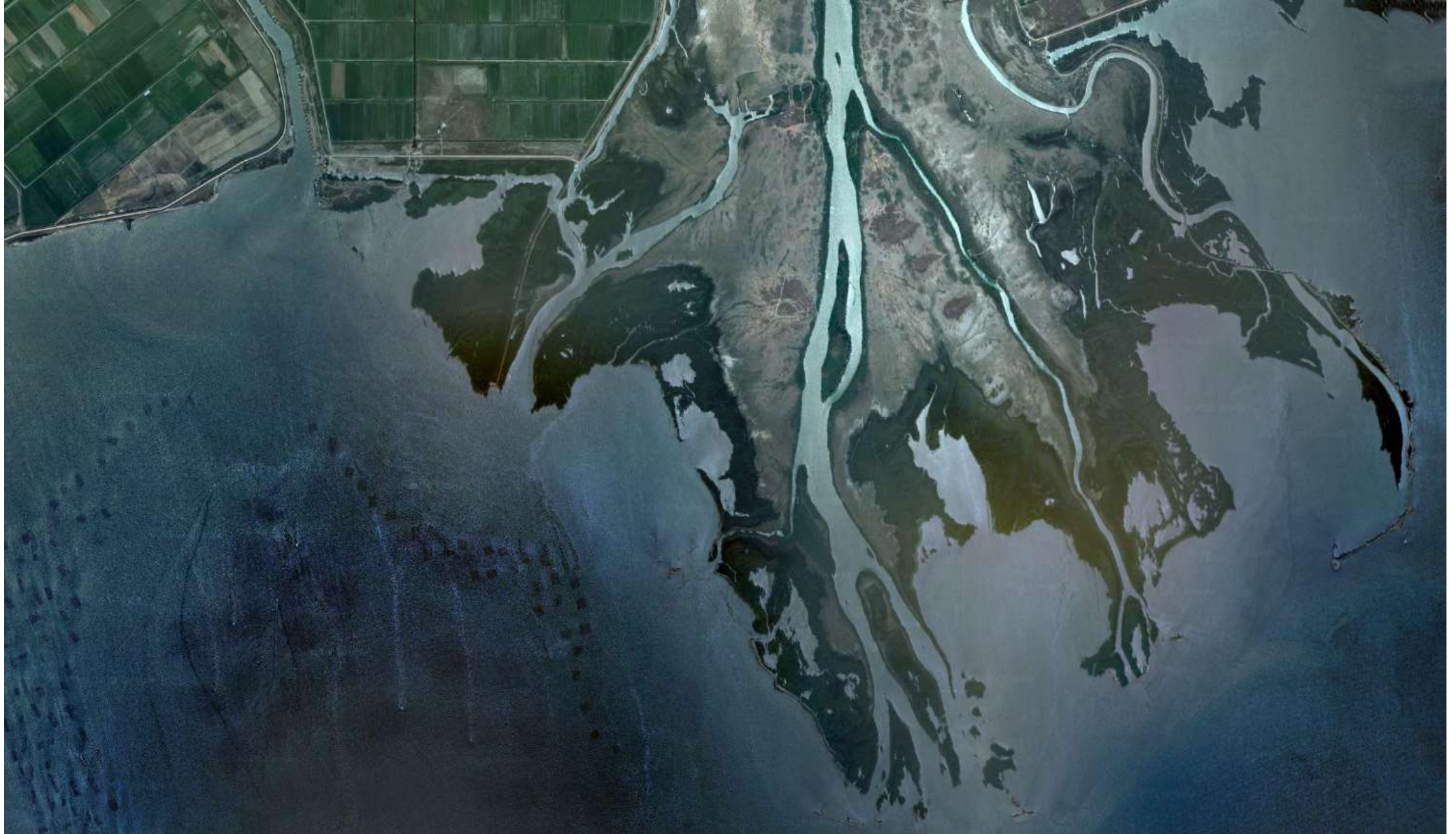
**Subbasin Xiropotamos: Max discharges
107m³/s < 183 m³/s (100y return period)**

WebIMS technologies



WebIMS technologies





Thank you for your attention!
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