Climate Change Impacts on Dams Projects on Transboundary River Basins. The Case of Mesta/Nestos River Basin, Greece

SKOULIKARIS Charalampos – AUTH
hskoulik@civil.auth.gr
Monget Jean Marie – ENSMP
Ganoulis Jacques – AUTH

Aristotle University of Thessaloniki - AUTH
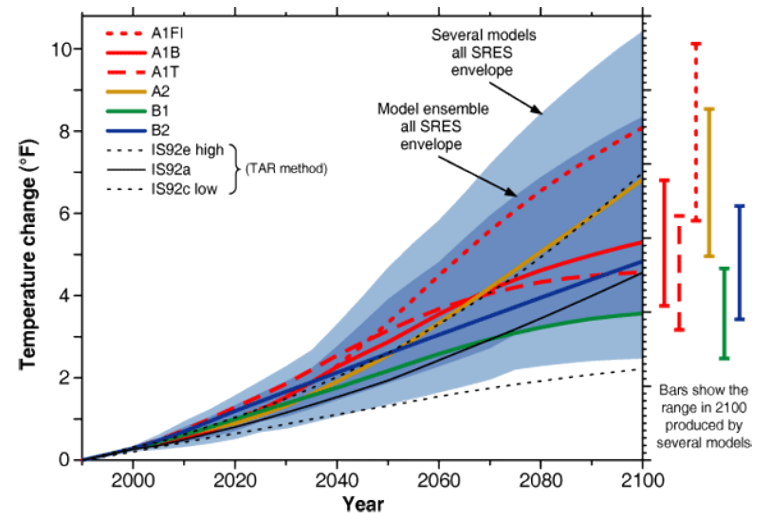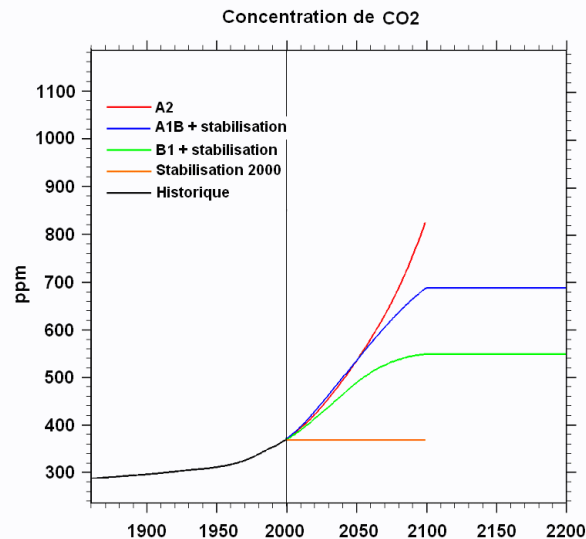
16, October 2008

Mines Paritech

The climate change scenarios

The IPCC scenarios

In 1996 the Intergovernmental Panel on Climate Change (IPCC) created a report, the « **Special Report on Emission Scenarios » (SRES)**. It describes the possible climate change scenarios: « stabilisation 2000 », B1, B2, A1, A2 and their variants.

**The temperature augmentation (1.4 to 5.8°C) is related to:**

a) the diminution of precipitation
b) the increase in evapotransiration

Climate Change: A local reality ?

A probable decrease of the precipitations:
The monitoring of annual rainfall from 1934 to 1995 at peak Mussala (Rila Mountains), indicate a decreasing trend.
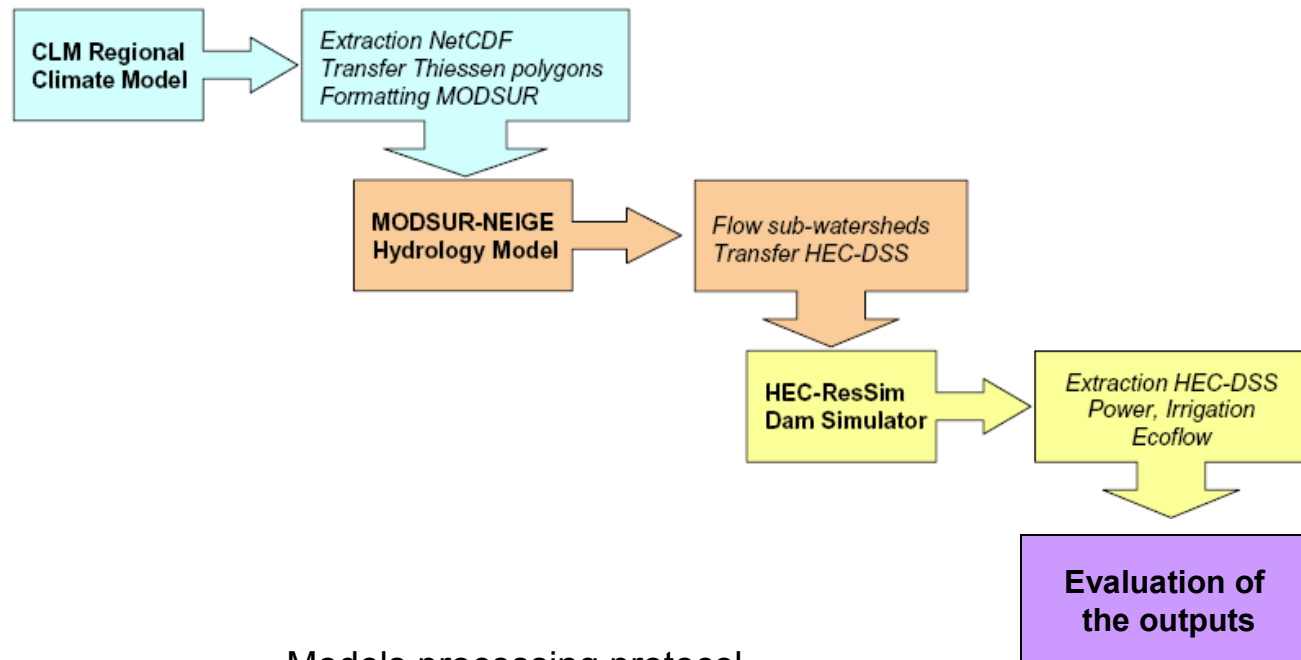
Climate change?

Annual mean rainfall (1934-1995) at Peak Mussala
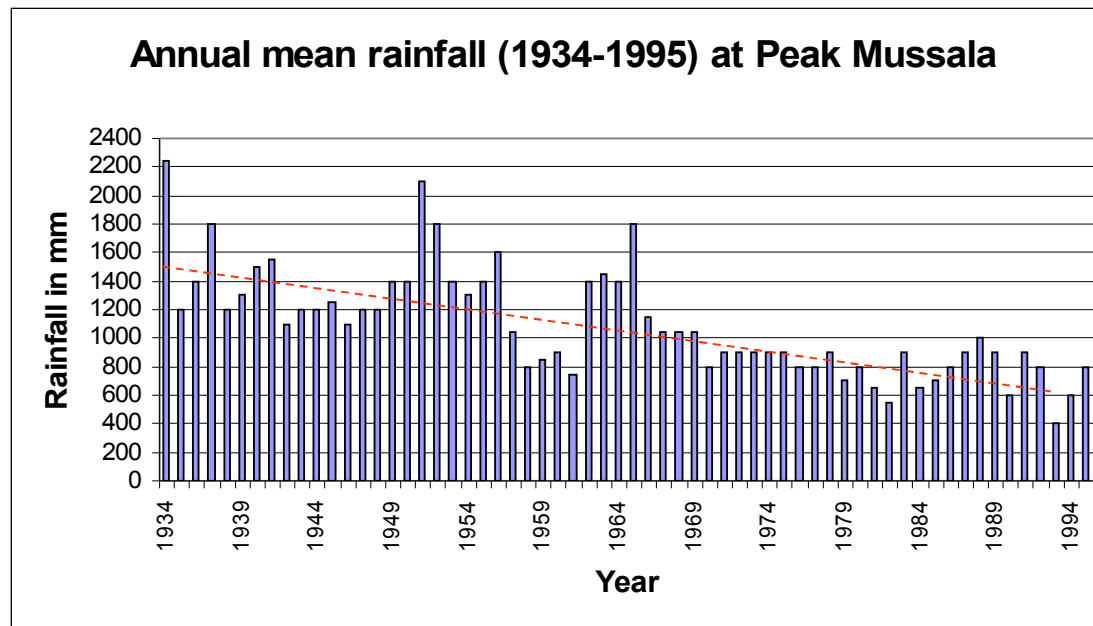
Objectives of our project

To examine the climate change impacts on existing and future dams on the Mesta/Nestos River basin.
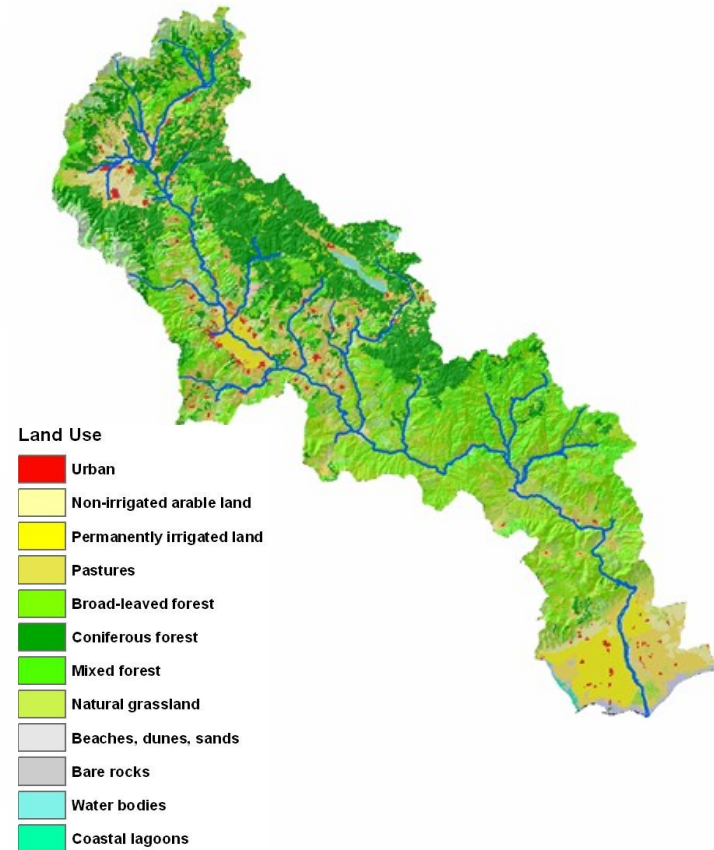
A cascade of mathematical models were used:

- **Climate model:** *CLM*
- **Hydrological model:** *MODSUR-NEIGE*
- **Dams-Reservoir model:** *ResSim*

Models processing protocol

The Mesta/Nestos River basin

Sub-Danubian Transboundary River & Lake Basins in the Balkans

Land Use

- Urban
- Non-irrigated arable land
- Permanently irrigated land
- Pastures
- Broad-leaved forest
- Coniferous forest
- Mixed forest
- Natural grassland
- Beaches, dunes, sands
- Bare rocks
- Water bodies
- Coastal lagoons

The Regional Climate Model CLM

For the needs of our work, we used the latest results of Regional Climate Model **CLM of Max Plank Institute, Germany**. They are available on line in the World Data Center for Climate, Hamburg (CERA).
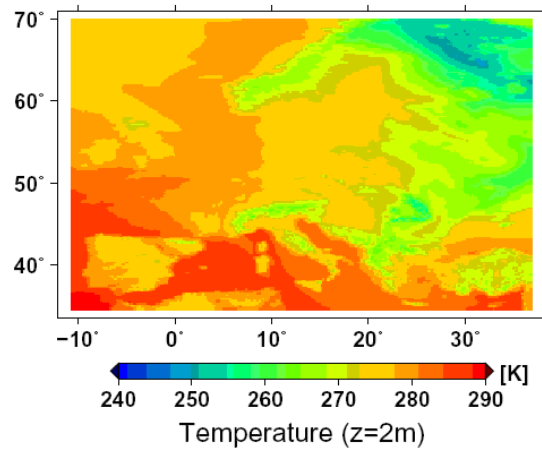
It produces data of temperature, precipitation and evapotranspiration as monthly mean values on a grid of 20 km (square cells).
The data series correspond to the **IPCC-SRES B1 and A1B scenario** for the period 2000-2100

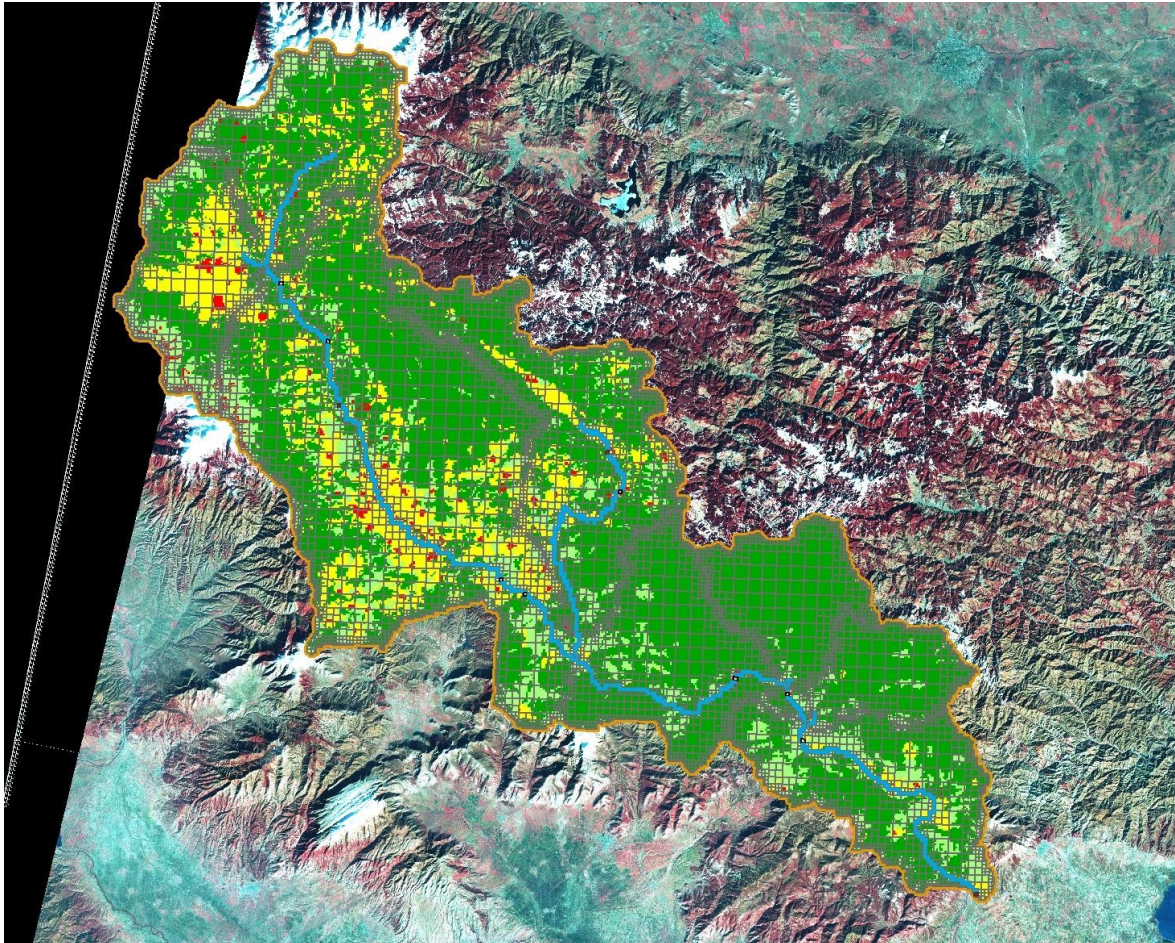## Scale reduction with CLM
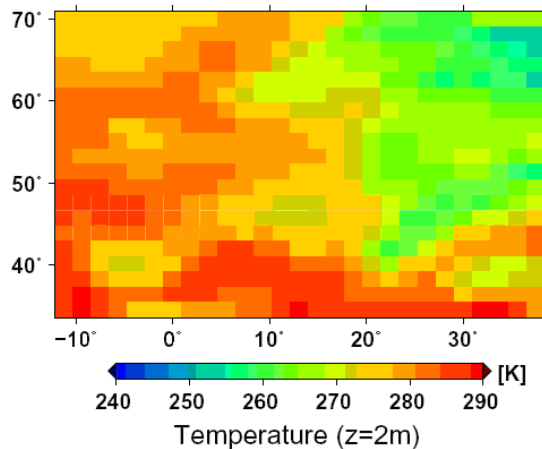
a) Results of GCM ECHAM5/MPIOM

b) Results of RCM CLM

MODSUR-NEIGE hydrological modeling

The distributed model MODSUR-NESTOS

This model is based on the spatial discetisation of the surface domain which is represented by square cells of variable size (250 m).


- Network of stations
- Thiessen polygons
- CLC data

The great advantage:

Simulation of the flow at any "river cell", thus: *Thissavros*, *Platanovryssi*, Temenos (future project)

Hydro-electric modeling

The objective of the dam's simulation is to evaluate, the economic and operational feasibility in long term, of the existing dams in the Greek part of the basin.

The modeling procedure of the Nestos dams was realised with the program **HEC-ResSim (USACE).** This tool works in hourly step and optimises the flows by taking into account the constraints of the exploitation (power, discharge).
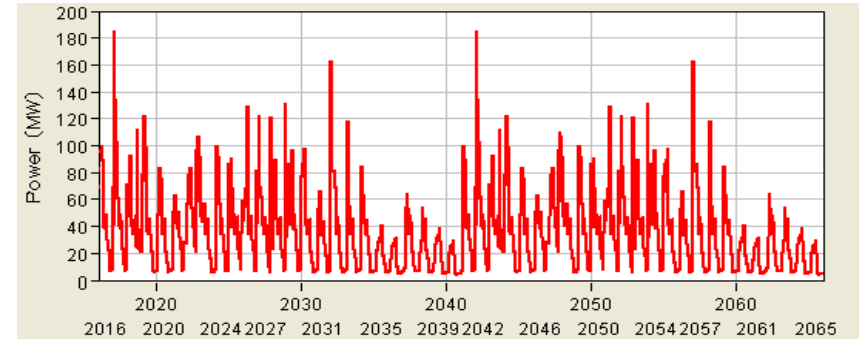

Thissavros

Platanovryssi

Toxotes
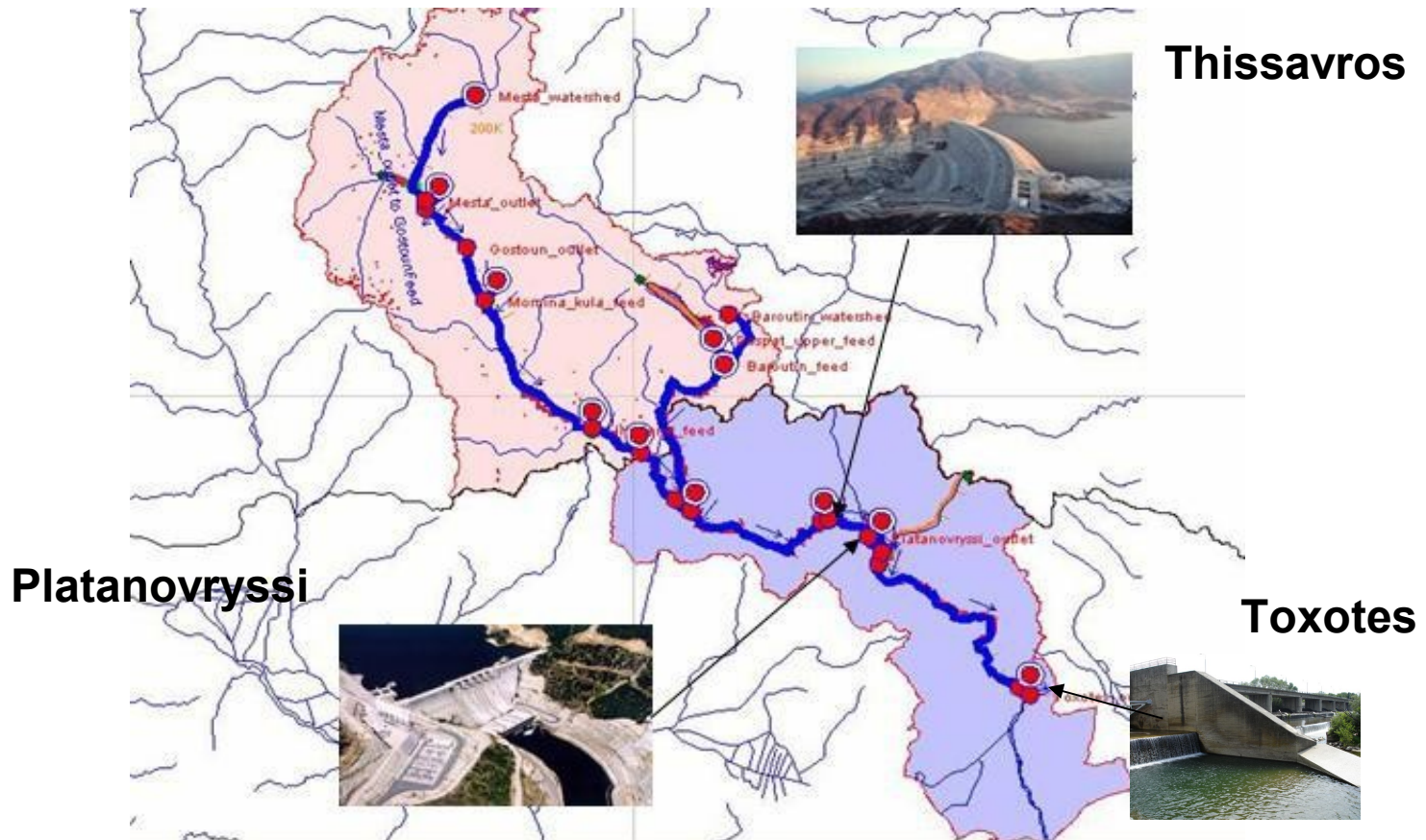
Results of dams simulation

Reference climate: Duplication of the past climate
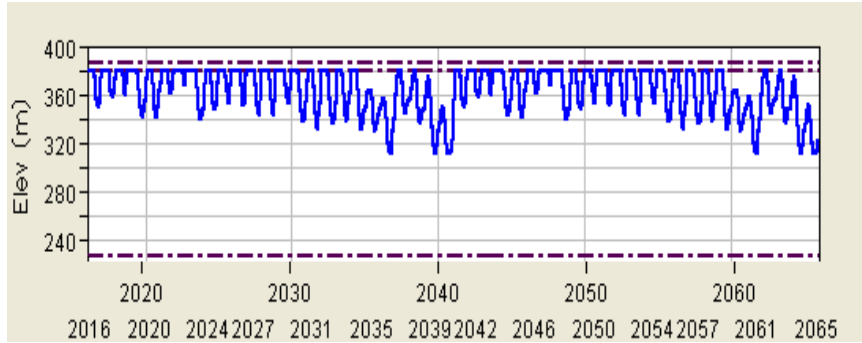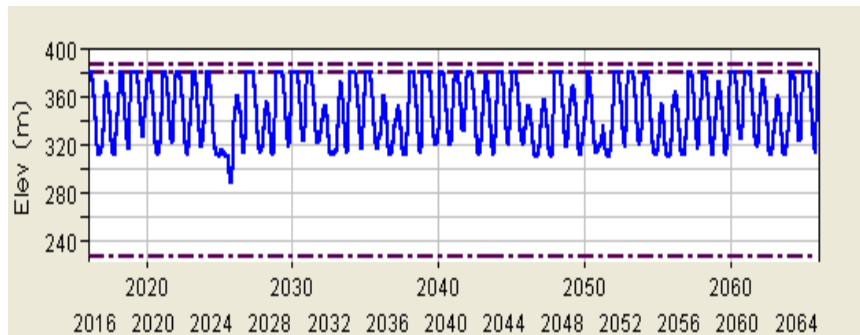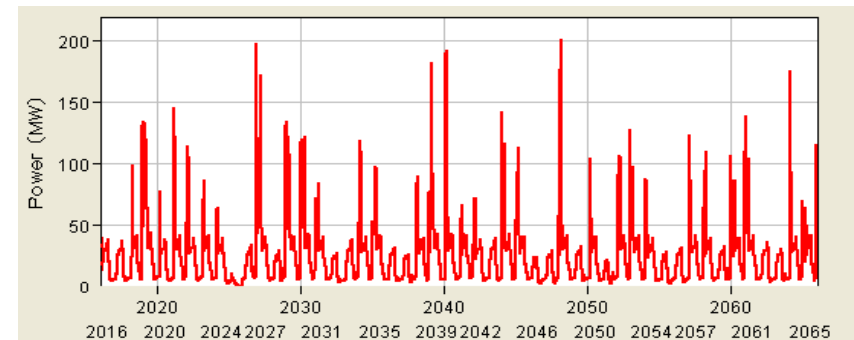

a) Thissavros dam elevation

b) Thissavros dam produced power:
36,5 MW or 877,1 MWh
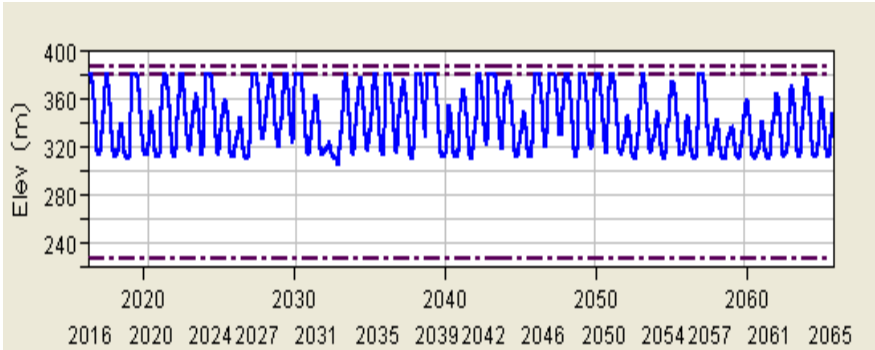
Climate change scenario IPCC-SRES B1
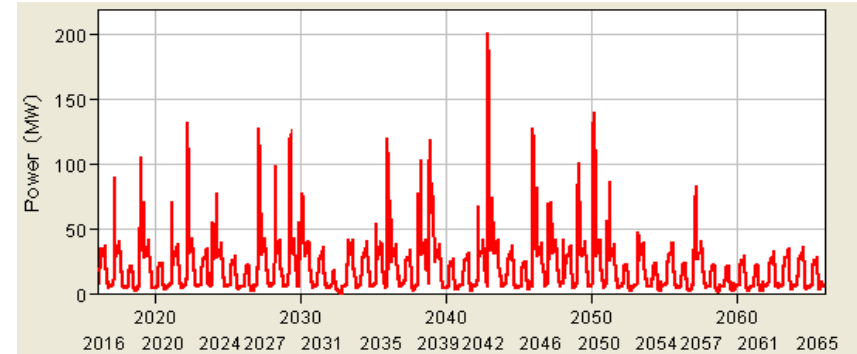

c) Thissavros dam elevation

d) Thissavros dam produced power:
24,6 MW or 590.7 MWh

Results of dams simulation

Climate change scenario IPCC-SRES A1B

e) Thissavros dam elevation

f) Thissavros dam produced power:
19,1 MW or 459,0 MWh

	Generated Power MW	Generated Energy MWh
"Reference" Climate Change scenario	36.5	877.1
CLM B1 Climate Change scenario	24.6	590.7
CLM A1B Climate Change scenario	19.1	459.0

Conclusion: A cascade of realistic simulations through computer based models

Thank you for your attention!