Hydropower dams impacts and relation to climate change

- general basics and a selected case study from Albania -

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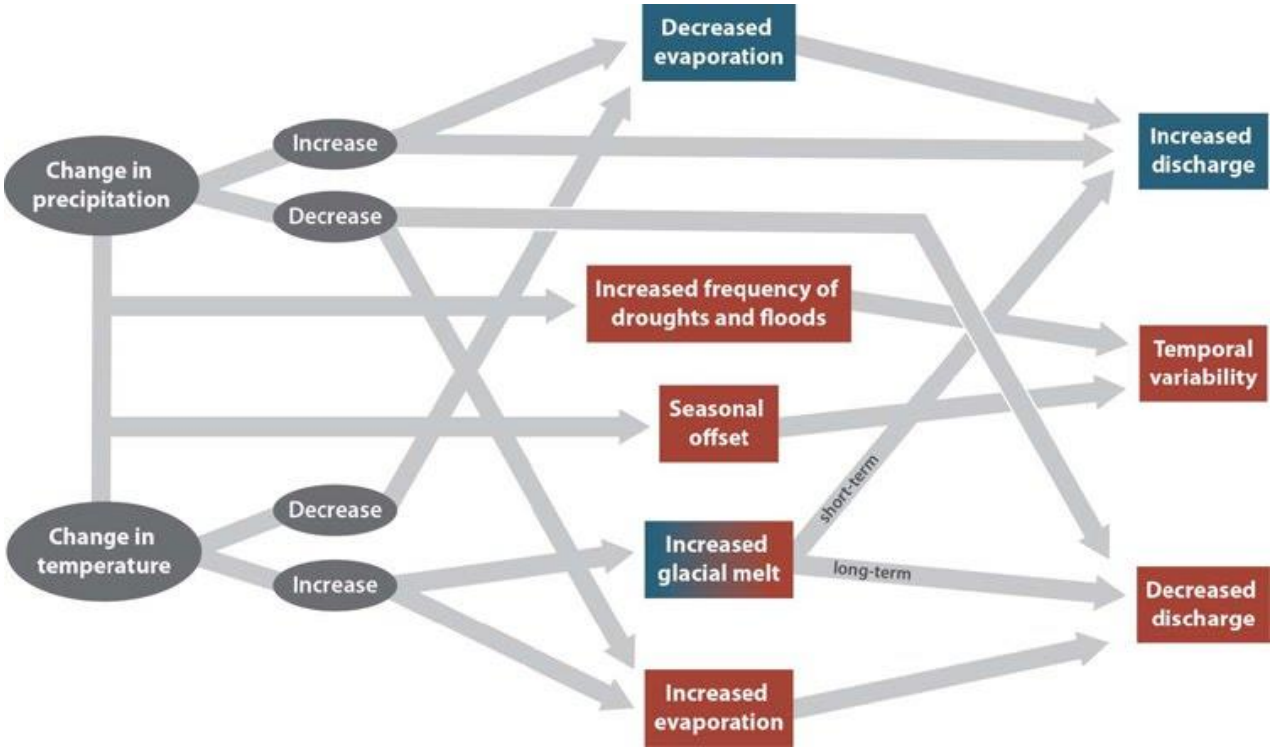
General basics

Flow chart of climate change impacts on hydropower production potential

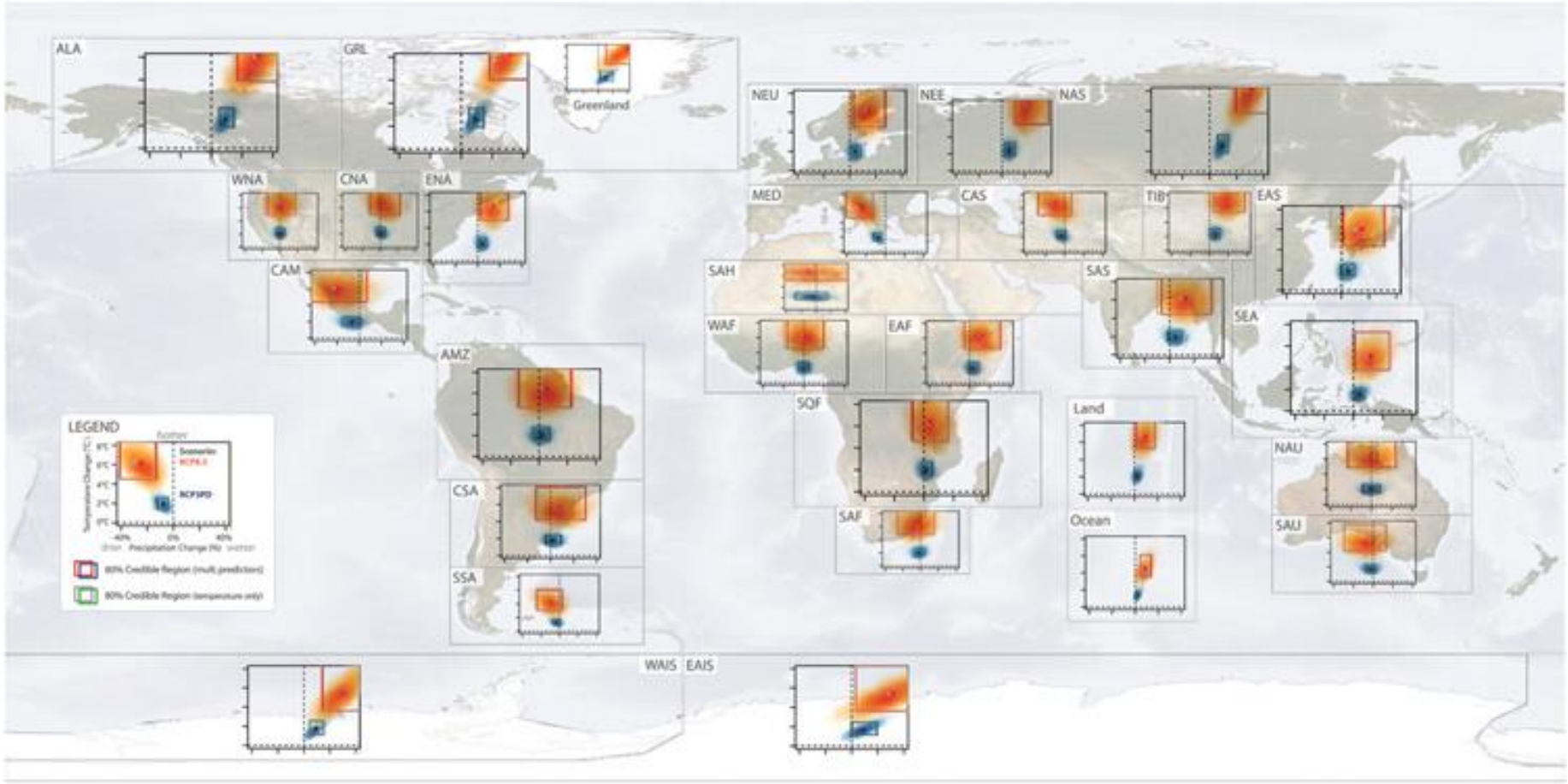


Blackshear *et al.* (2011)

neglecting impacts of sediment dynamics!

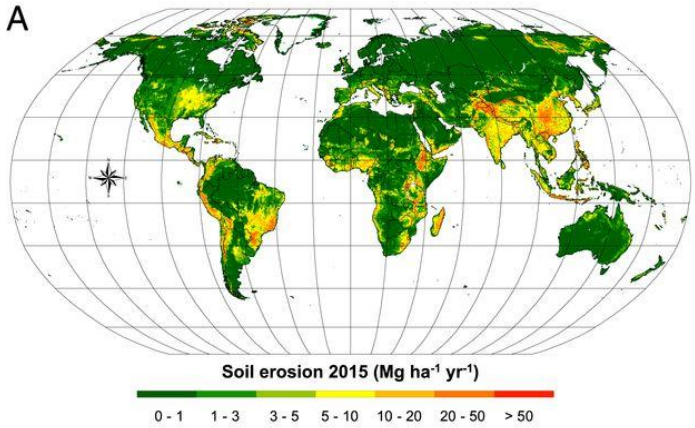
General basics

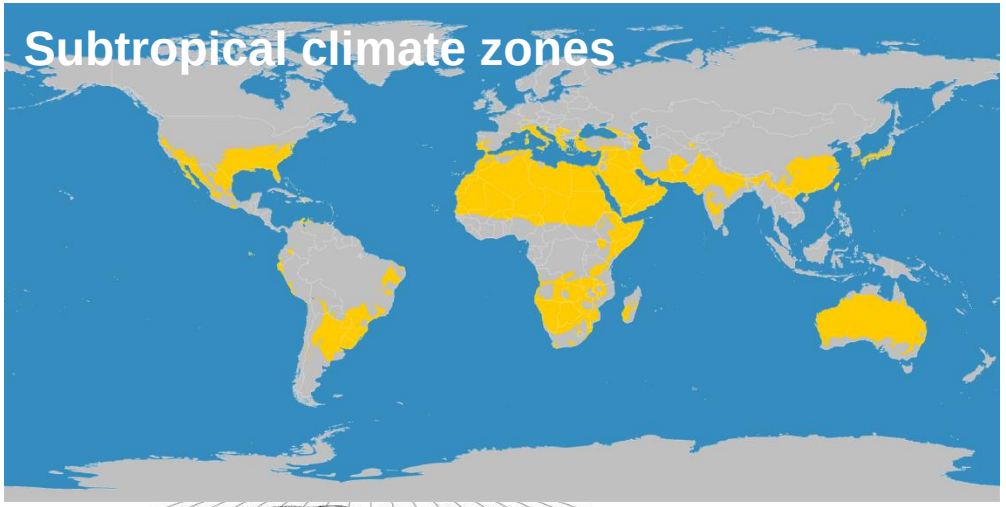
Correlation between regional warming and precipitation changes

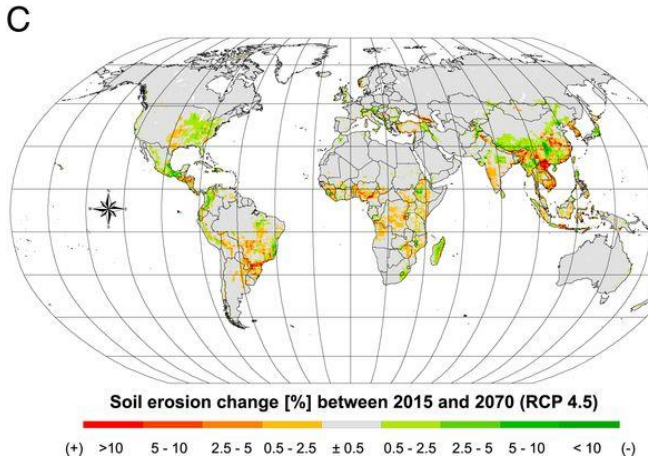


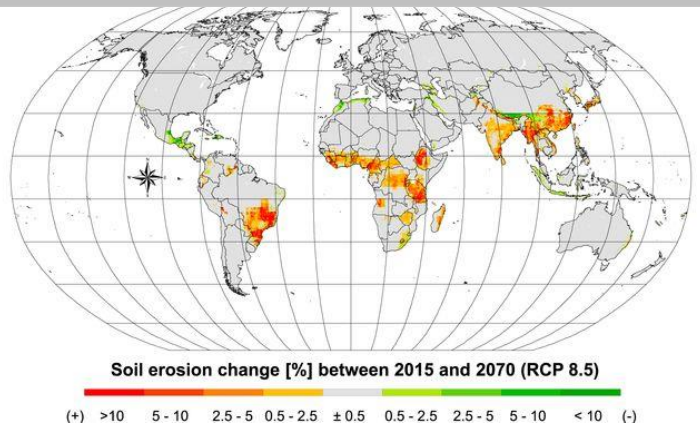
General basics

Land use and climate change impacts on global soil erosion by water (2015-2070)





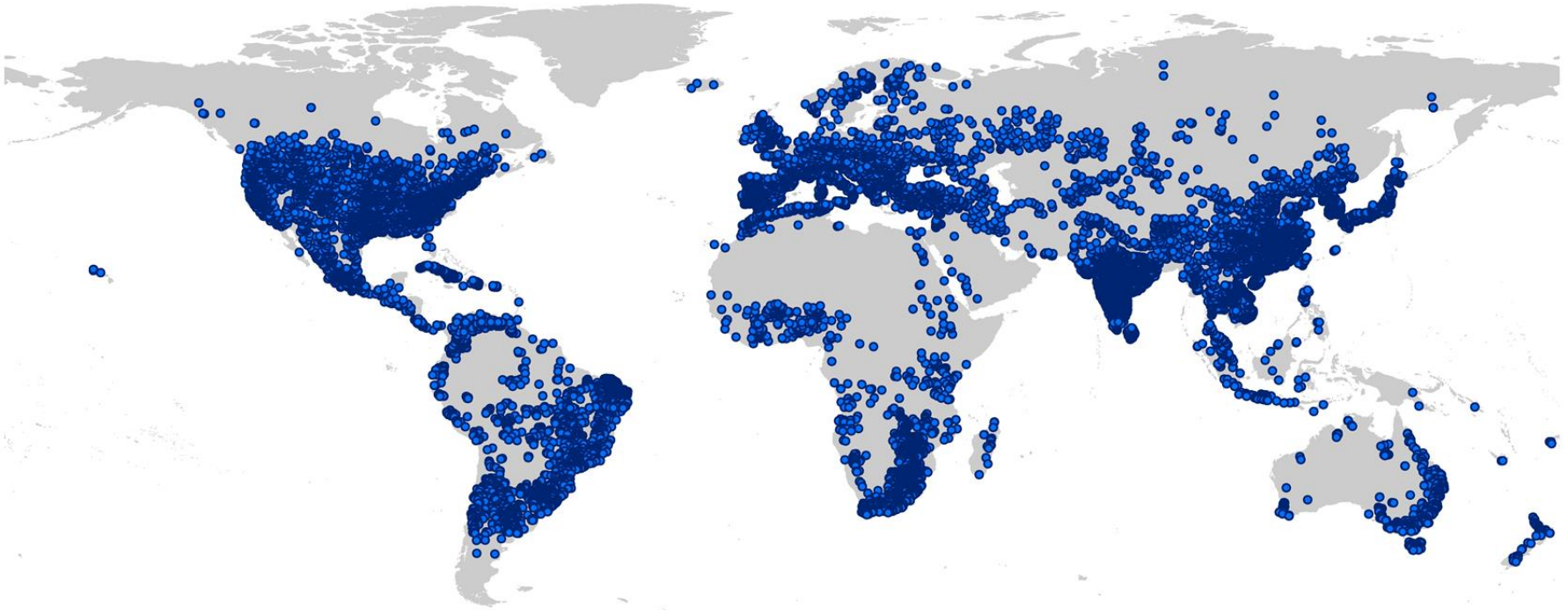




Borelli *et al.* (2020)

General basics

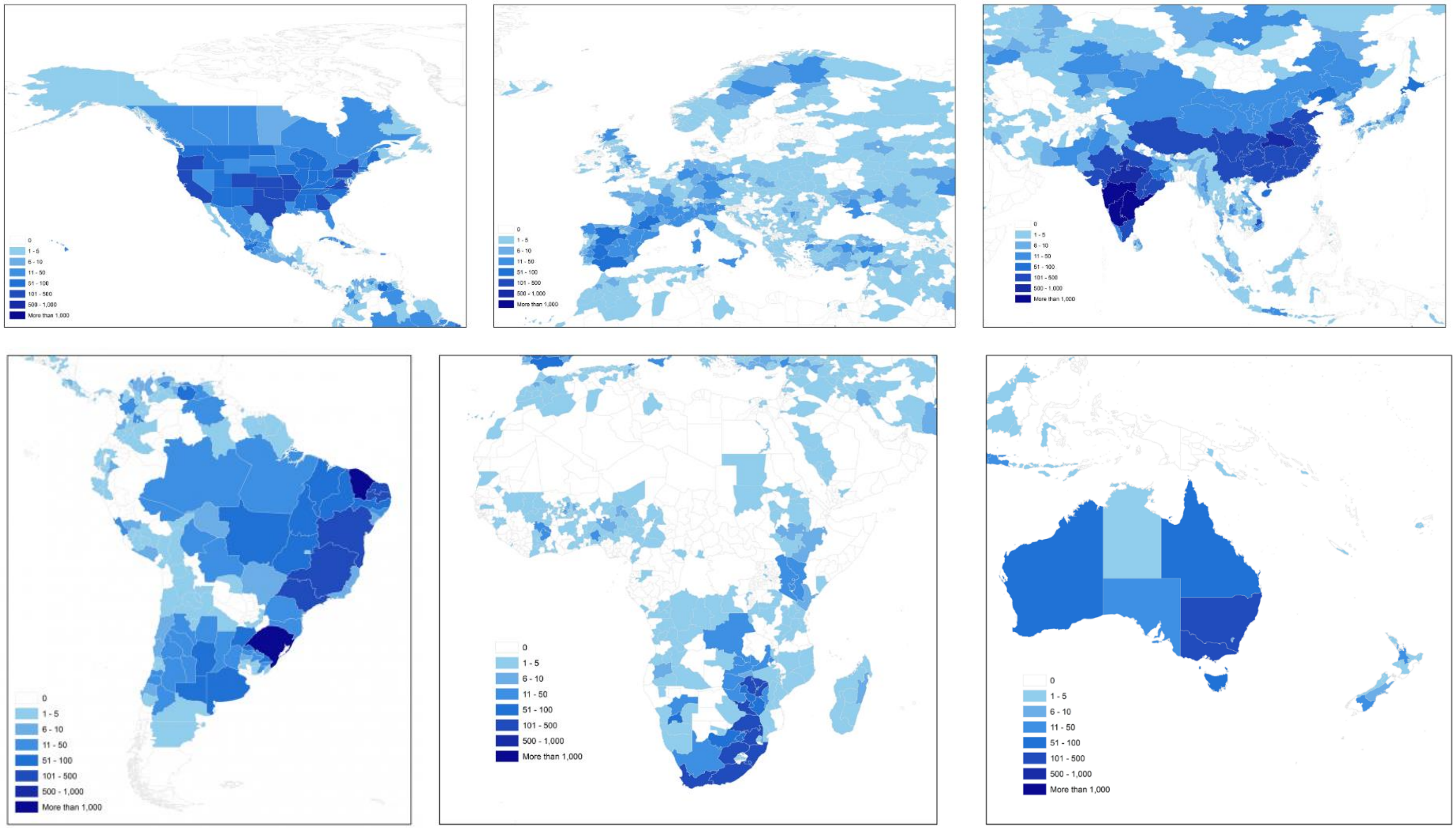
Dam projects need to be evaluated from both the **hydrological** and **sedimentological perspective**



data source: global damwatch

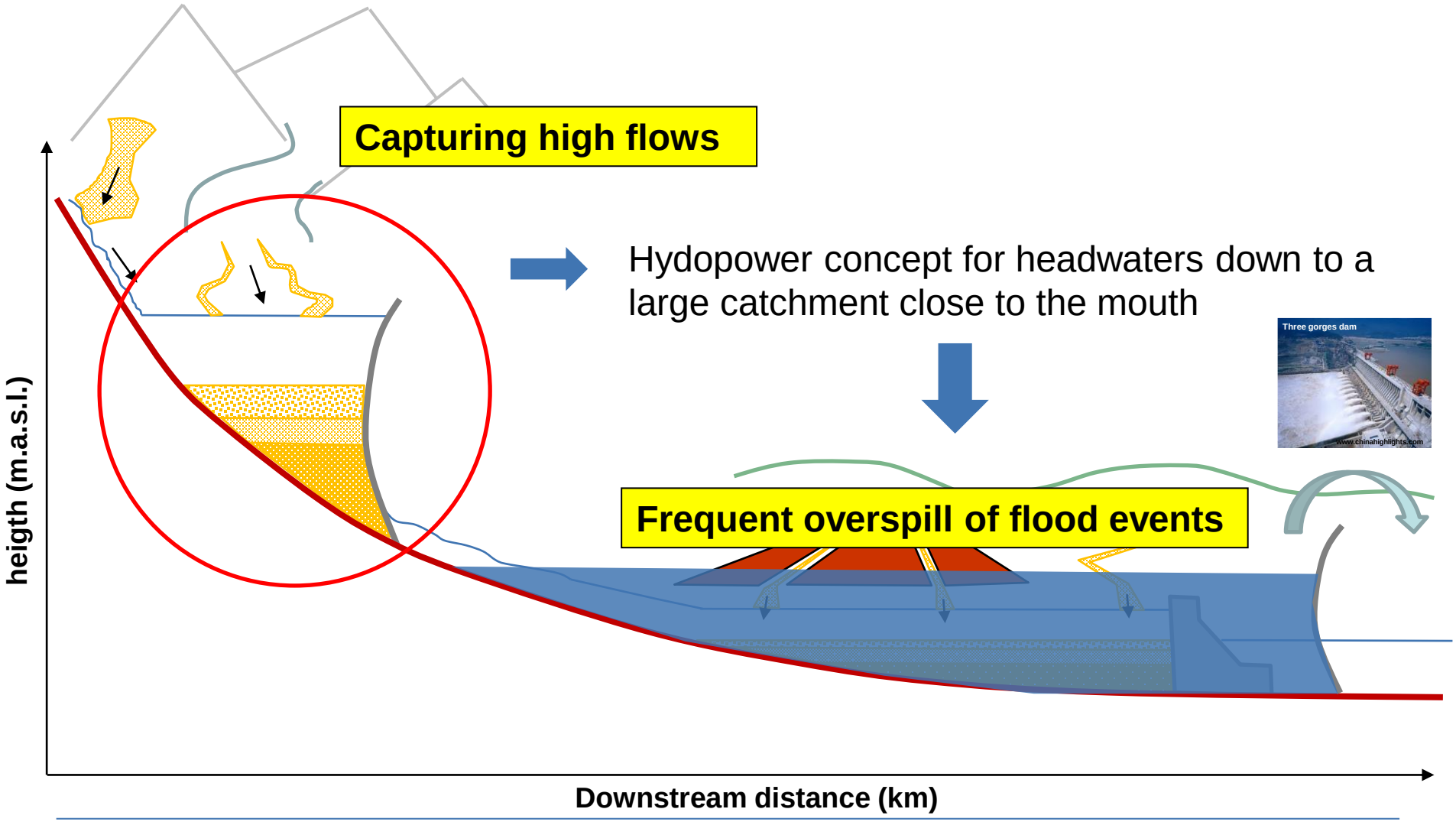
General basics

➡ globally many technical and economical problematic projects were developed



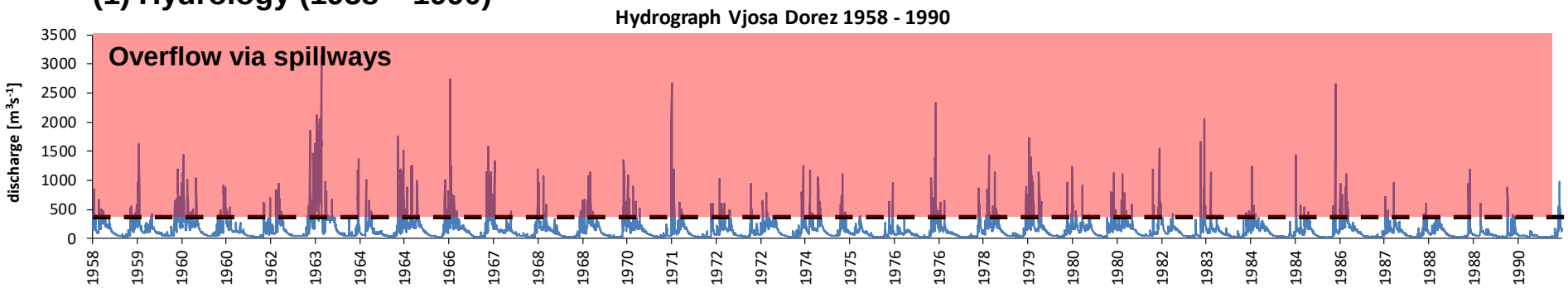
data source: global damwatch

Wrong concepts are frequently applied!



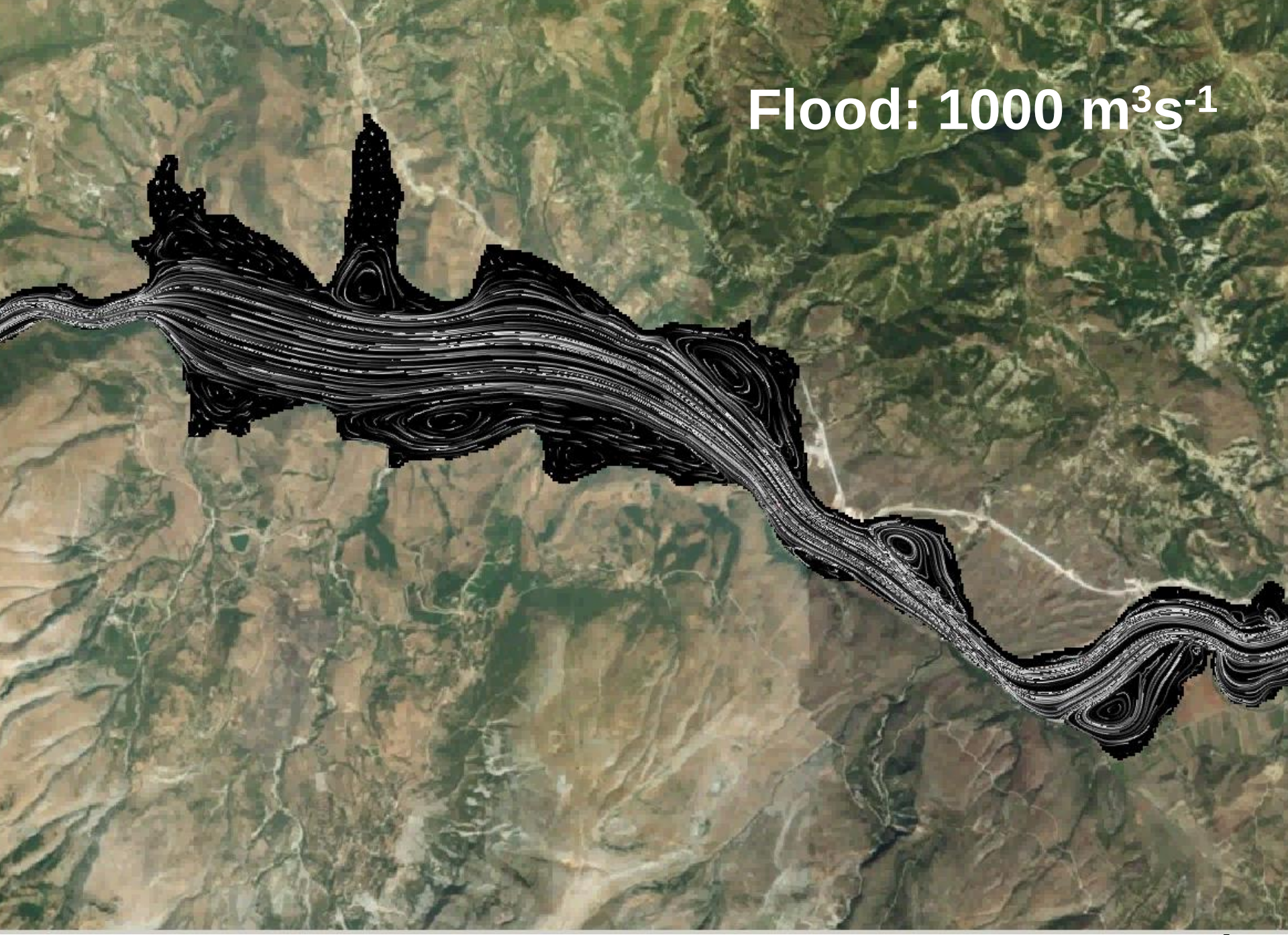
What problems?

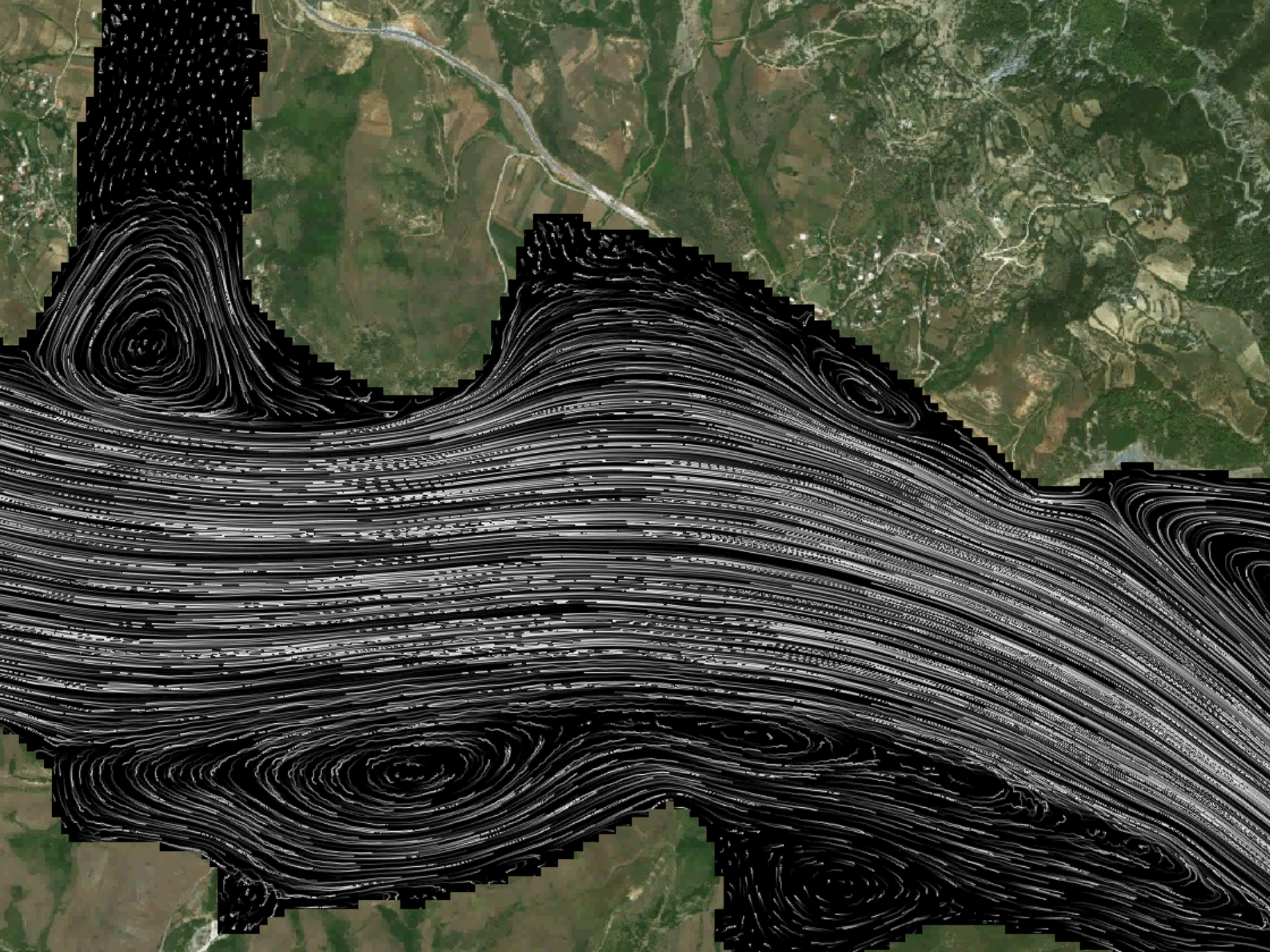
(1) Hydrology (1958 – 1990)



Turbines operate to a maximum discharge level!

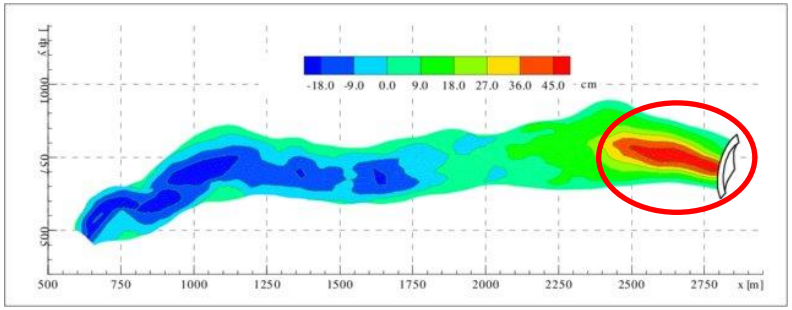
Impact on flow dynamics and sedimentation in the reservoir!


Flood: 1000 m^3s^{-1}



Bottom outlet as critical point

Annual check required if its operating!



Deposition at Swiss-hydropower plant after a flood event

Althaus *et al.* (2009)

Albania already has a „case study“ which is discussed on an international scale concerning sediment management problems

„Devoll HP“

Bottom outlet as c

Bottom outlet as critical point (case Devoll)

…..Devoll is an international case for sedimentation problems in reservoirs!

How fast will the reservoirs will be filled up with sediments at the Vjosa?

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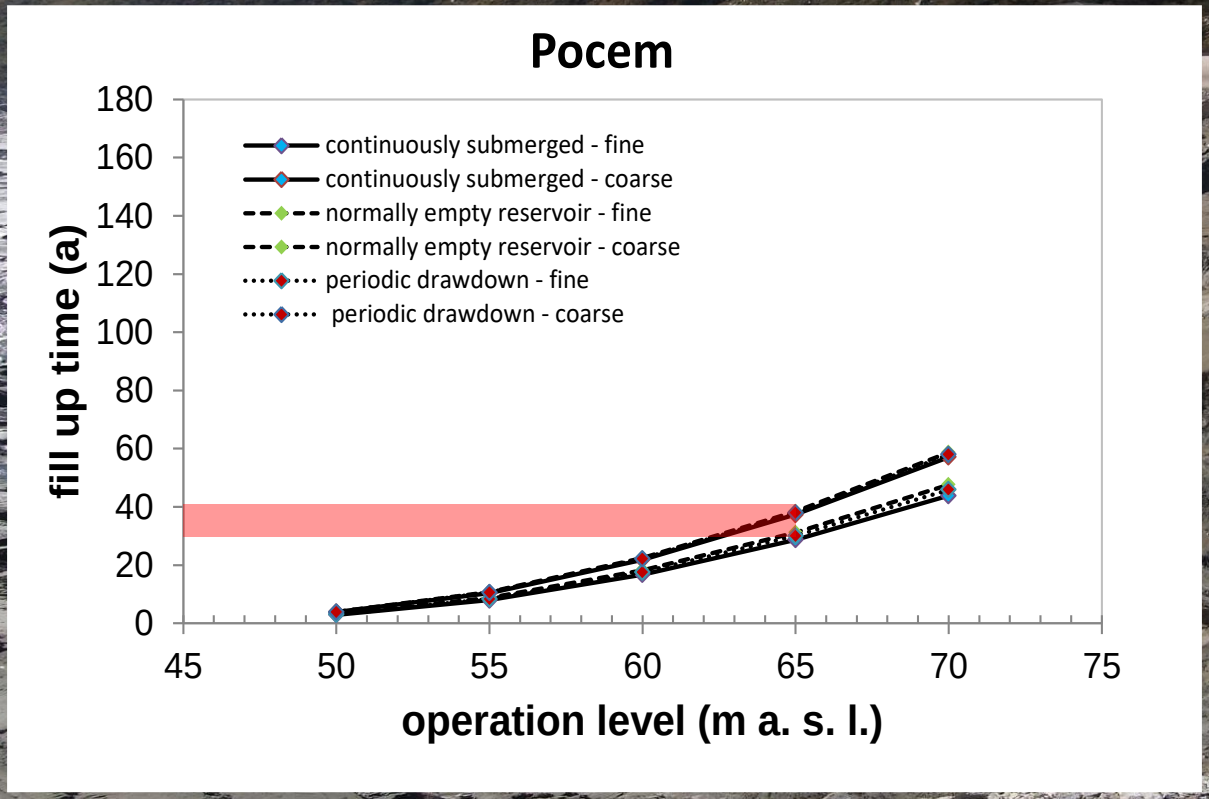
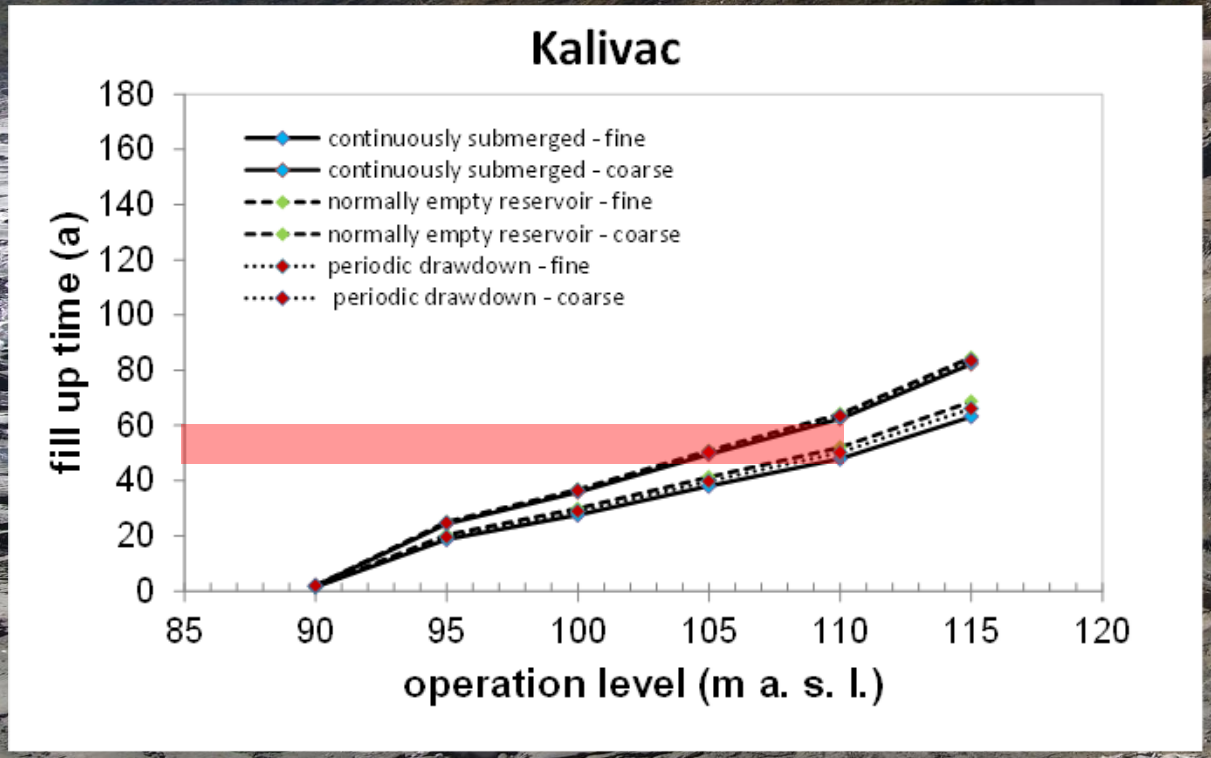


Pocem = 30 – 40 years

©Göckler

How fast will the reservoirs will be filled up with sediments at the Vjosa?



Kalivac = 45 – 60 years

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How important are river sediments for Albanian tourism?

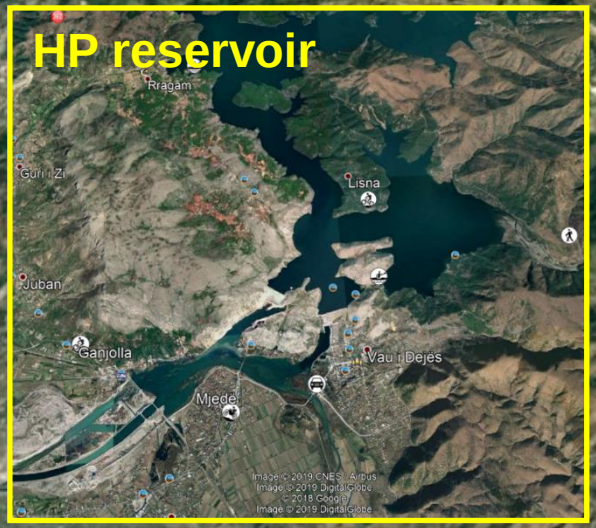
…..very, very important!

River sediments = Albanian tourism

River sediments = Albanian tourism

Lack of river sediments

Skadar lake



Summary and Conclusions

- ***Superimposition*** of ***negative impacts*** on hydropower production due to ***increased evapotranspiration*** and ***higher erosion rates*** can be expected for many parts around the globe.

- ***Critical evaluation*** for various hydropower concepts will exhibit ***challenges*** for ***run-of-the river***, due to more stochastic flows and increased low flow periods, as well as for ***storage power plants***, increased evapotranspiration and sedimentation.

- ***Requested ecological standards*** for ***residual flow*** (ROR) as well as ***restrictions for hydropeaking*** (or hydropeaking) **mitigation** will cause additional cost in the netto production rate.

- Important to evaluate the ***local / reach scale disturbance*** in hydrology (discharge / groundwater) and sediment dynamics on ***the catchment scale*** for the ***trade-off*** between ***benefits*** and ***costs for a society***.

Thank you for your attention!

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