

Climate change impacts on hydro-climatic extremes in the Danube basin - How robust are projections?

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Imperial College
London



Budapest
Sewage Works Pte Ltd.

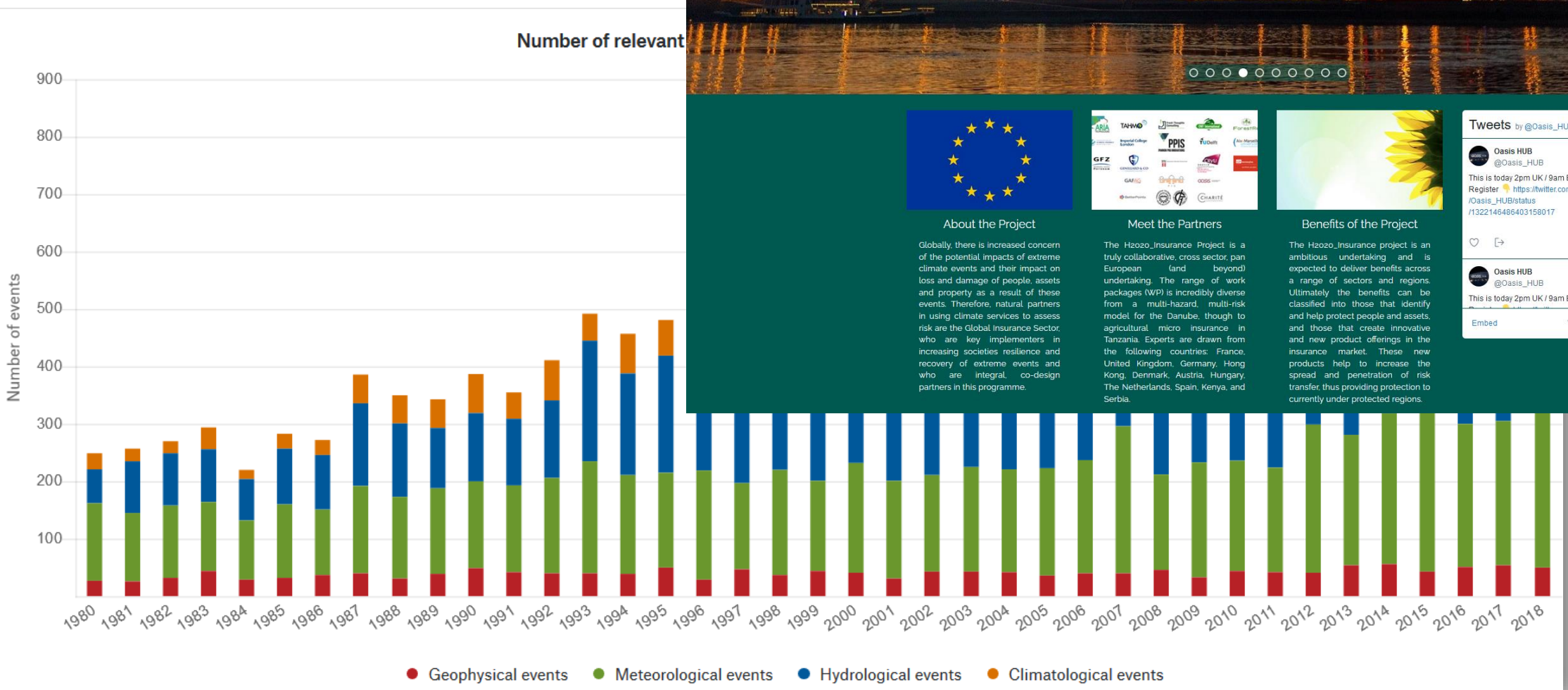




Is this climate change?



Number of natural disasters



WP2.1.3: Support for large scale investments in infrastructure and climate resilience – water treatment plant of Novi Sad

[Read more](#)

About the Project

Globally, there is increased concern of the potential impacts of extreme climate events and their impact on loss and damage of people, assets and property as a result of these events. Therefore, natural partners in using climate services to assess risk are the Global Insurance Sector, who are key implementers in increasing societies resilience and recovery of extreme events and who are integral, co-design partners in this programme.

Meet the Partners

The H2020_Insurance Project is a truly collaborative, cross sector, pan European (and beyond) undertaking. The range of work packages (WP) is incredibly diverse from a multi-hazard, multi-risk model for the Danube, though to agricultural micro insurance in Tanzania. Experts are drawn from the following countries: France, United Kingdom, Germany, Hong Kong, Denmark, Austria, Hungary, The Netherlands, Spain, Kenya, and Serbia.

Benefits of the Project

The H2020_Insurance project is an ambitious undertaking and is expected to deliver benefits across a range of sectors and regions. Ultimately the benefits can be classified into those that identify and help protect people and assets, and those that create innovative and new product offerings in the insurance market. These new products help to increase the spread and penetration of risk transfer thus providing protection to currently under protected regions.

Tweets by @Oasis_HUB

Oasis HUB @Oasis_HUB
This is today 2pm UK / 9am EDT.
Register https://twitter.com/Oasis_HUB/status/11322146486403158017

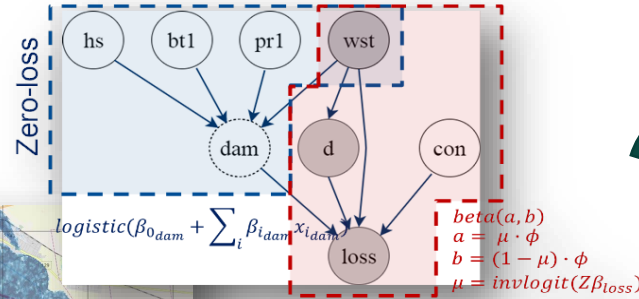
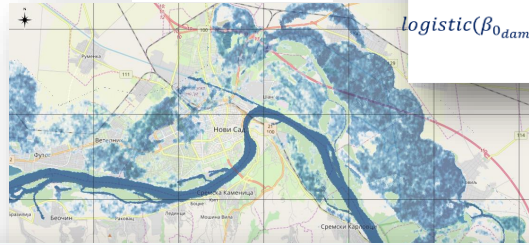
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The workflow in a nutshell



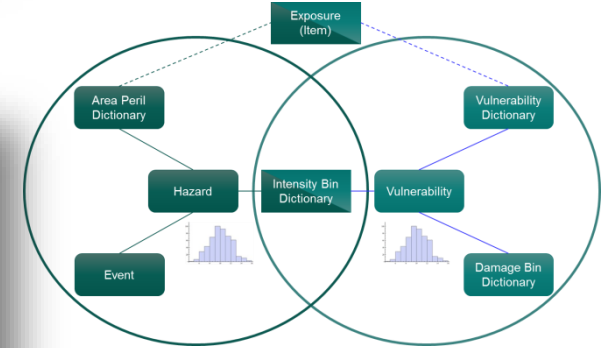
Results



Methodologies



OASIS LMF



Expert workshops

OASIS HUB The Global Window to Free and Commercial Environmental and Risk Data, Tools and Services Login Create Account Feedback

E-market

Base Layer: Base Layer, None
Overlays: PIK_future_RP

Legend:
215 - 285
285 - 435
435 - 11450

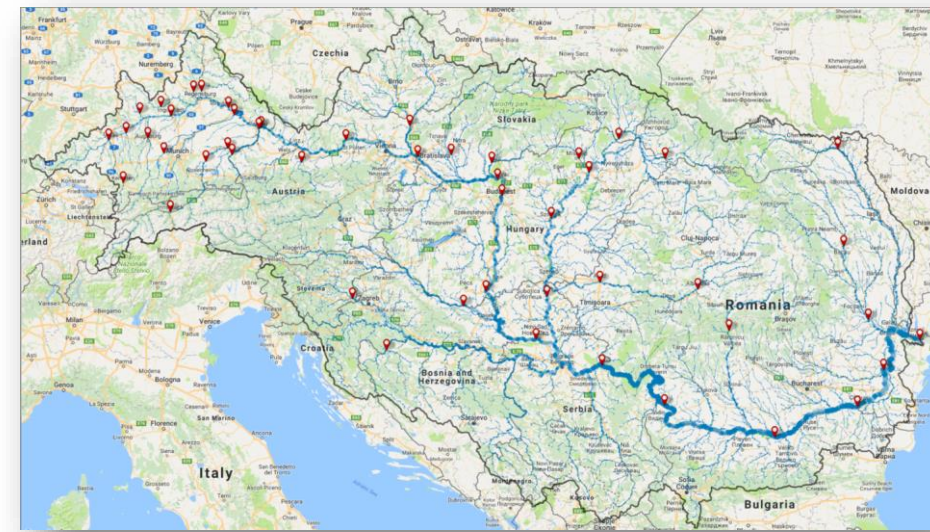
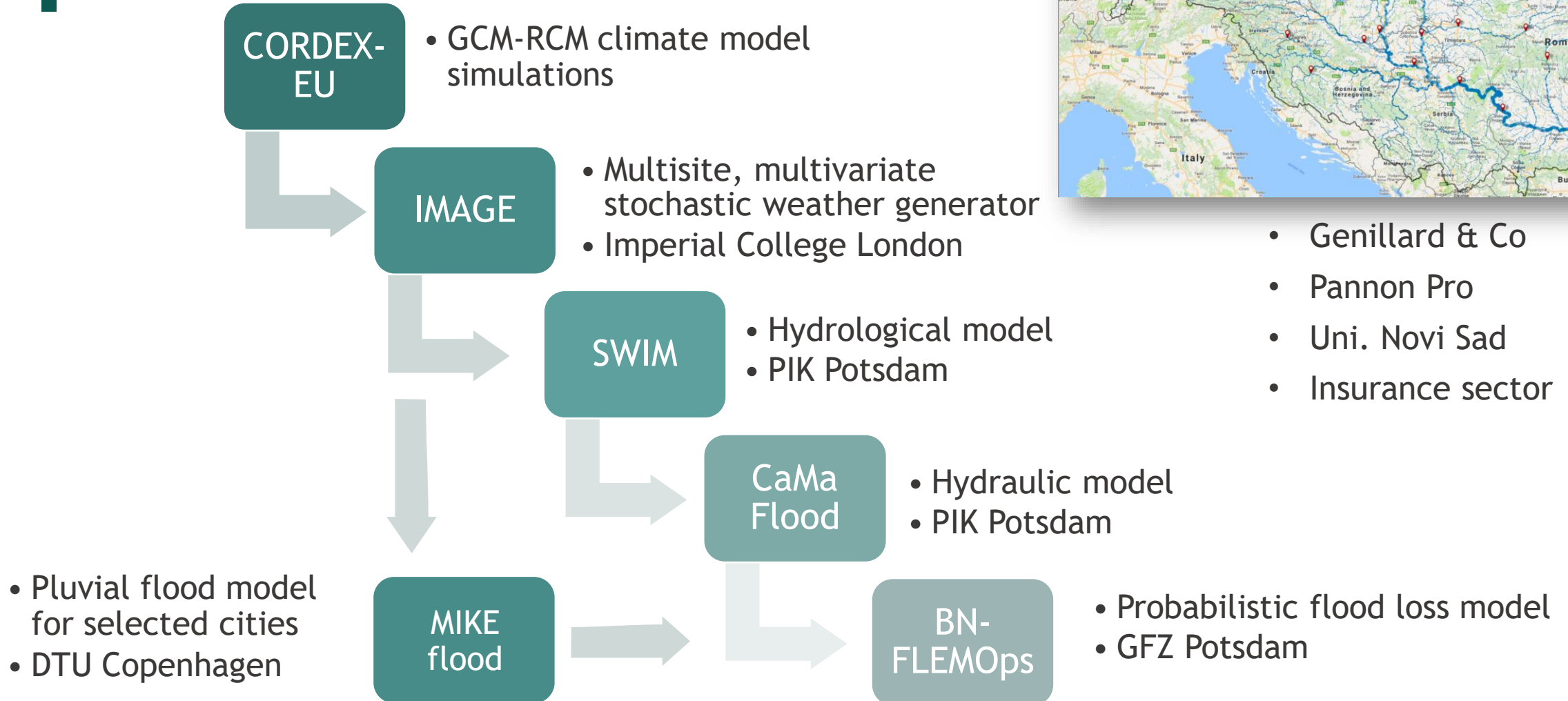
Scale: 0.2 0 0.2 0.4 km



Exposure



Future Danube Model



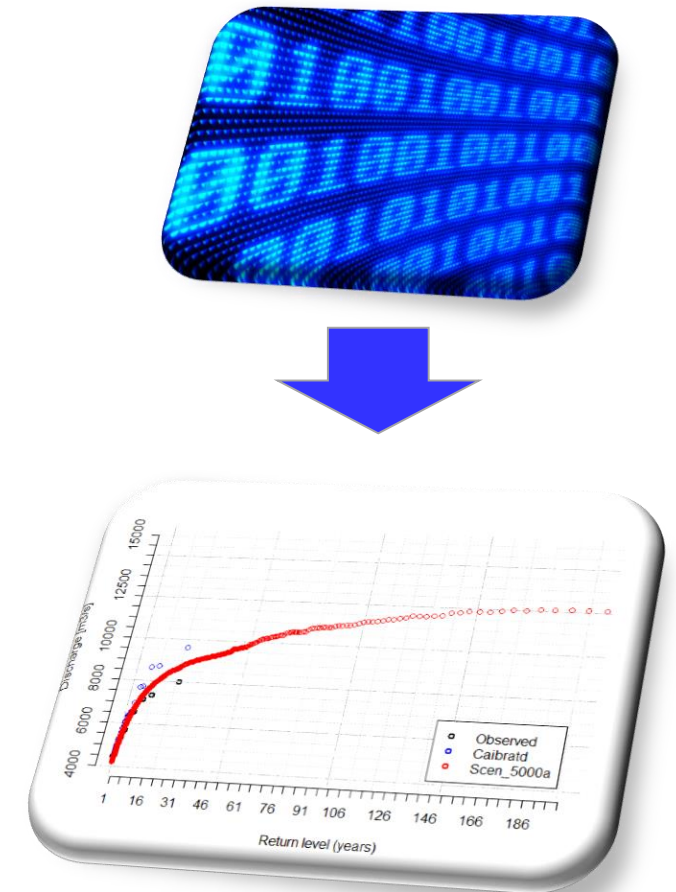
- Genillard & Co
- Pannon Pro
- Uni. Novi Sad
- Insurance sector

Big data -> condensed information

280,000 years of daily climate and hydrological data
~13,0000 river sections ~200,000 spatial units

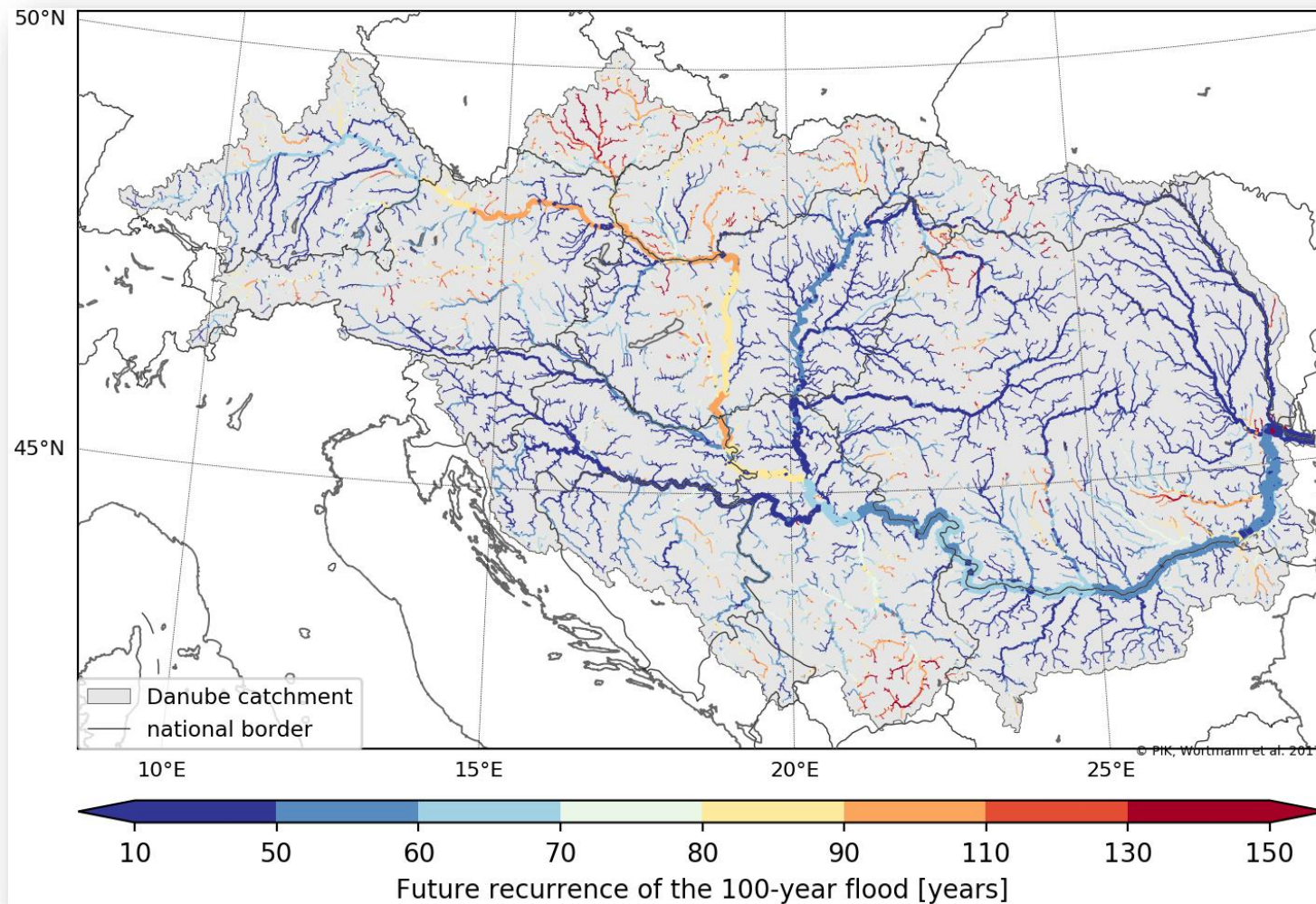


Robust risk information



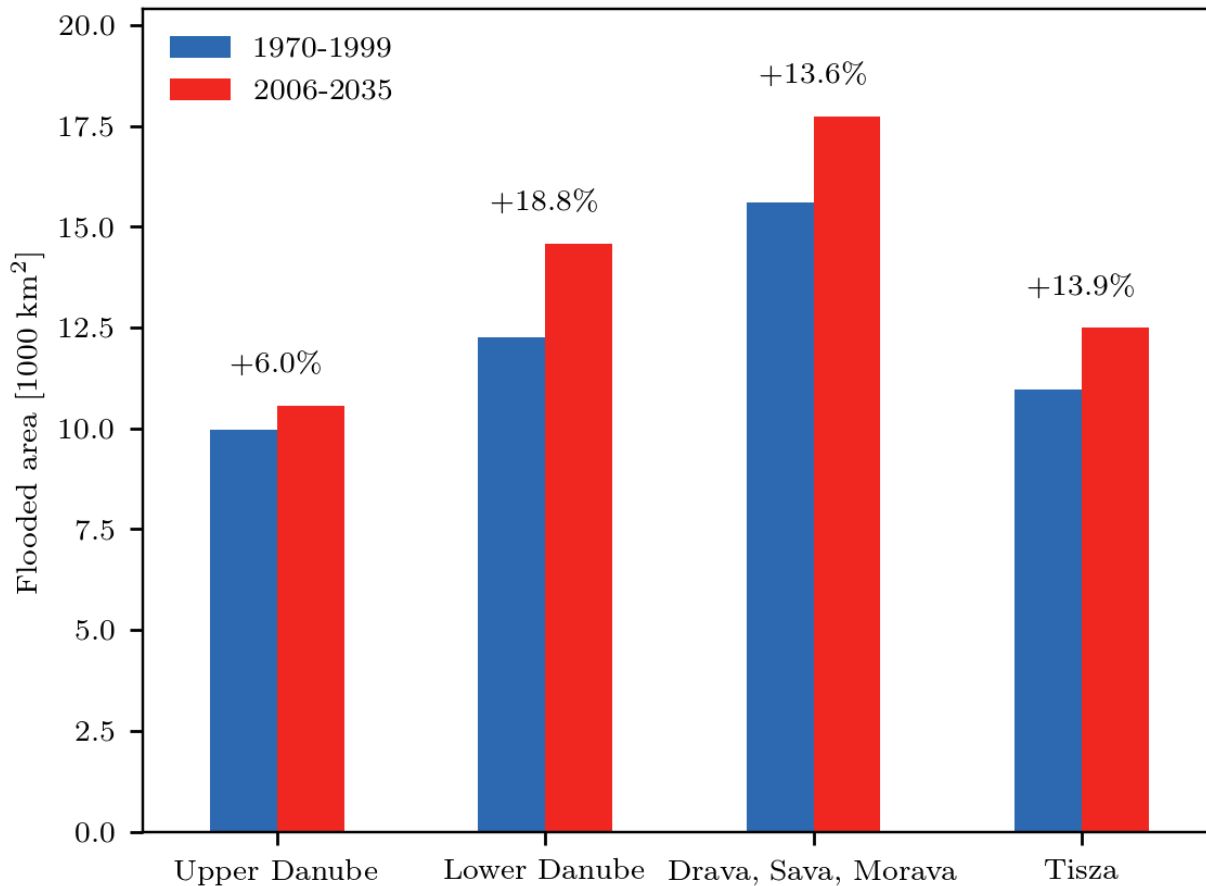
Changes from reference period until “now” 2006-2035

Future reoccurrence of the 100-year flood

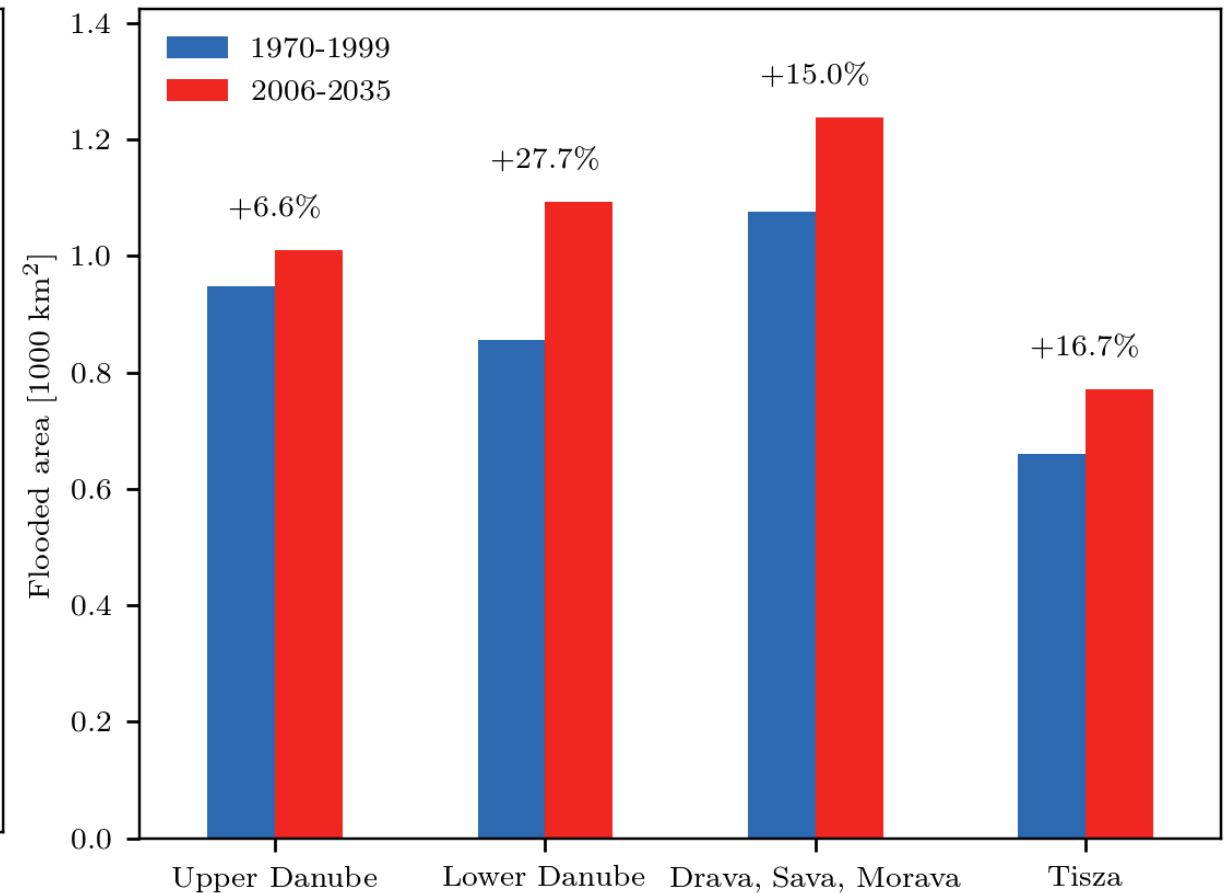


Changes from reference period until “now” 2006-2035

Entire catchment

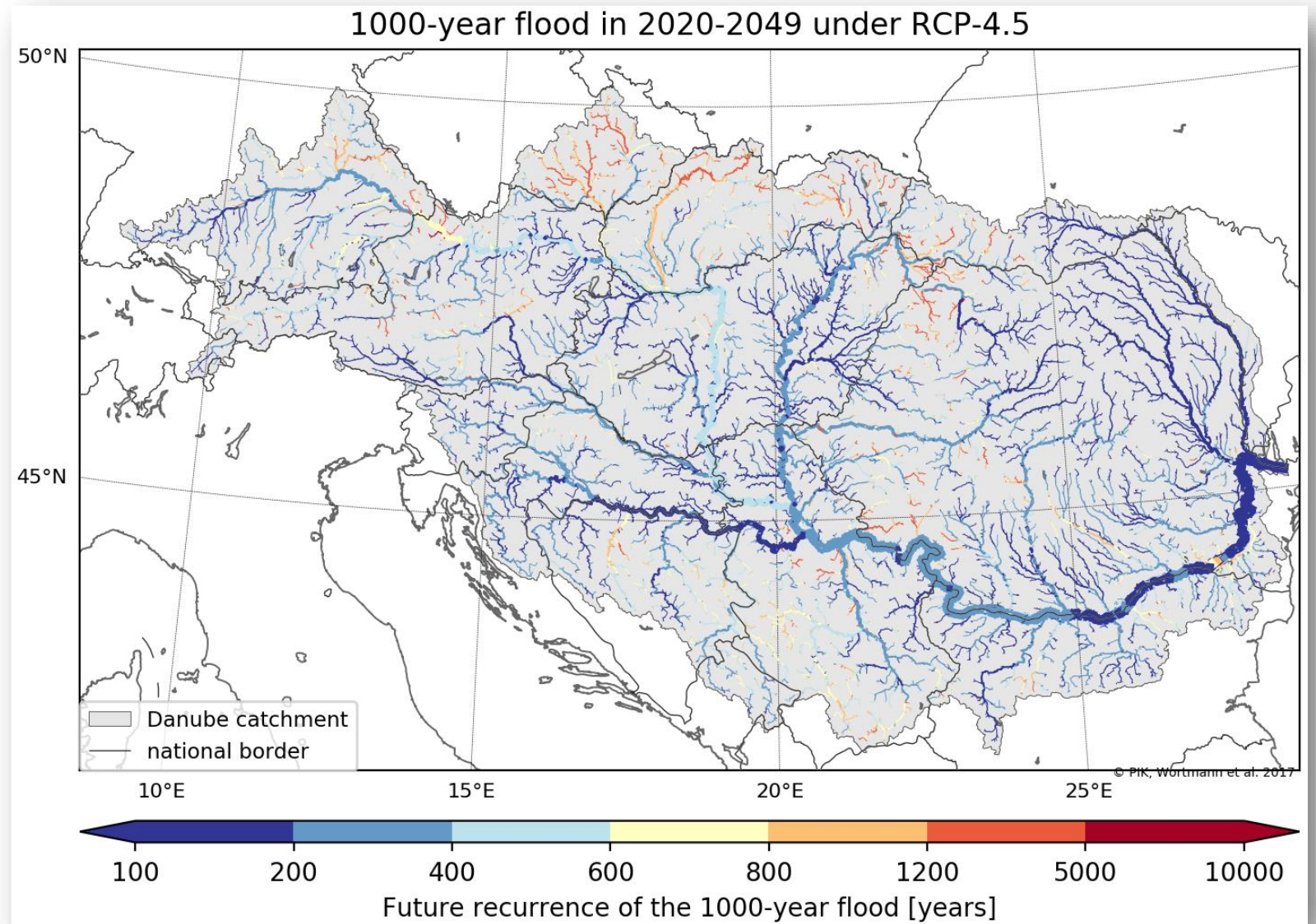


Area populated/industrial



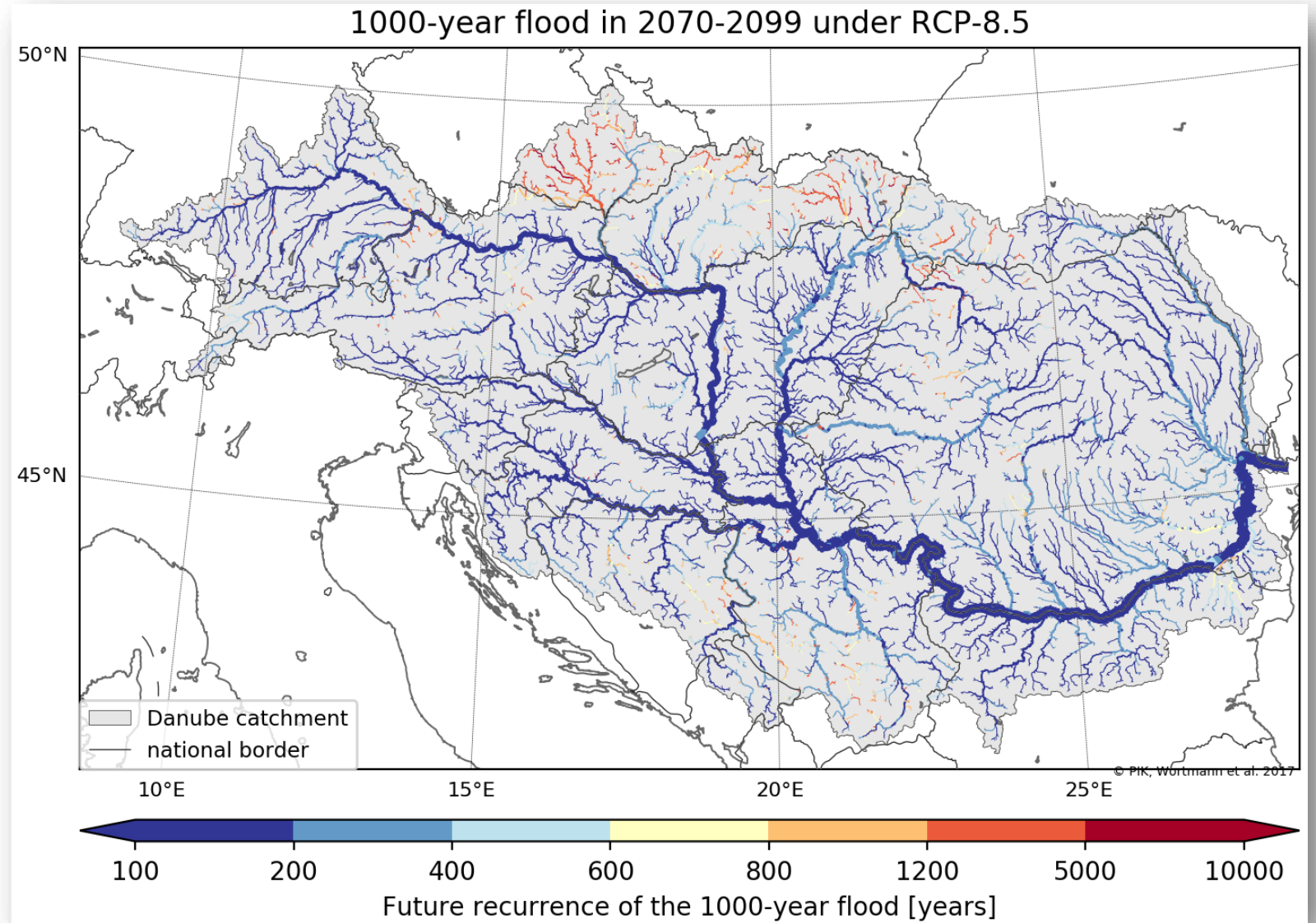
The future reoccurrence of the current 1000-year flood

RCP4.5, 2020-2049



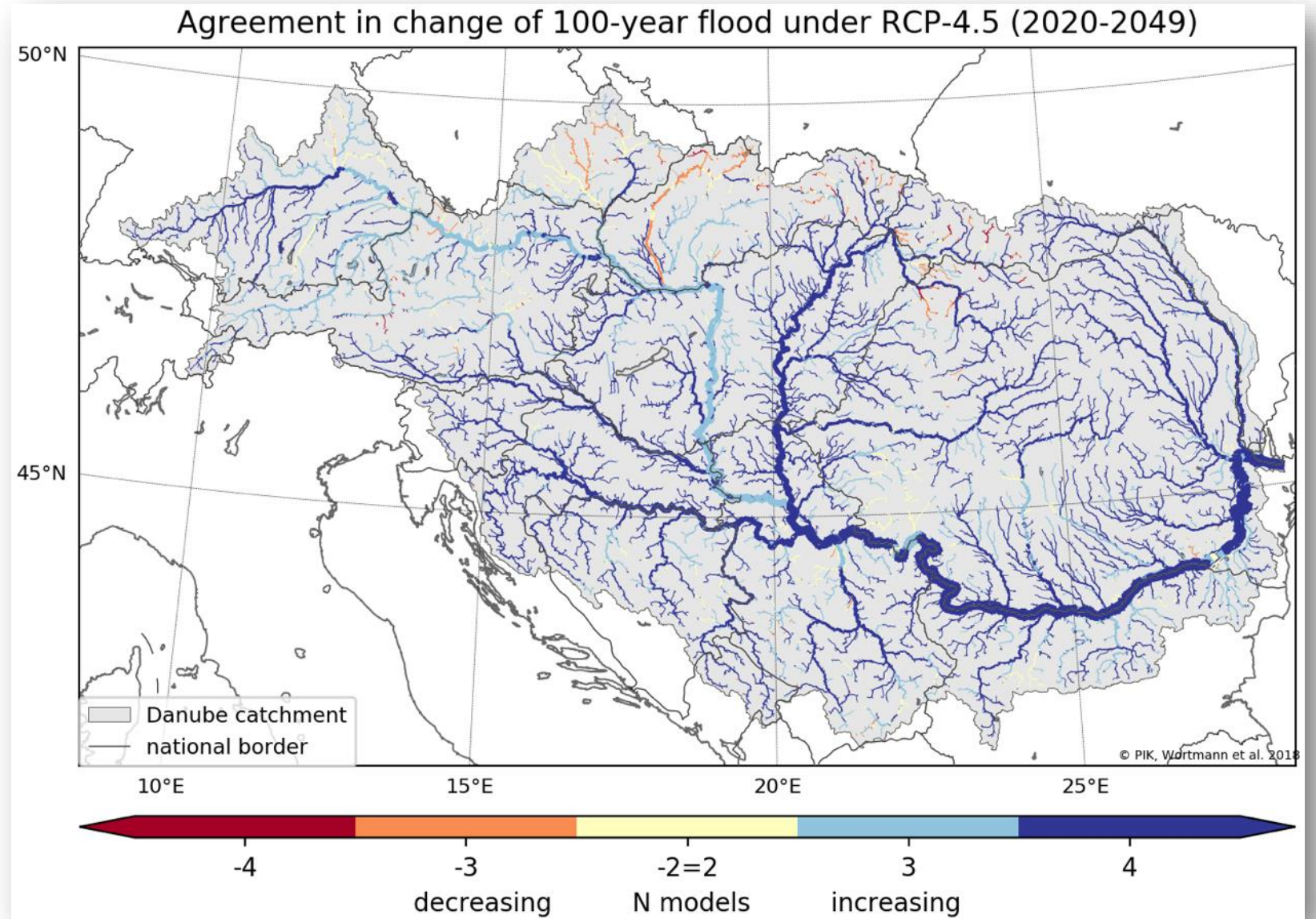
The future reoccurrence of the current 1000-year flood

RCP8.5, 2070-2099



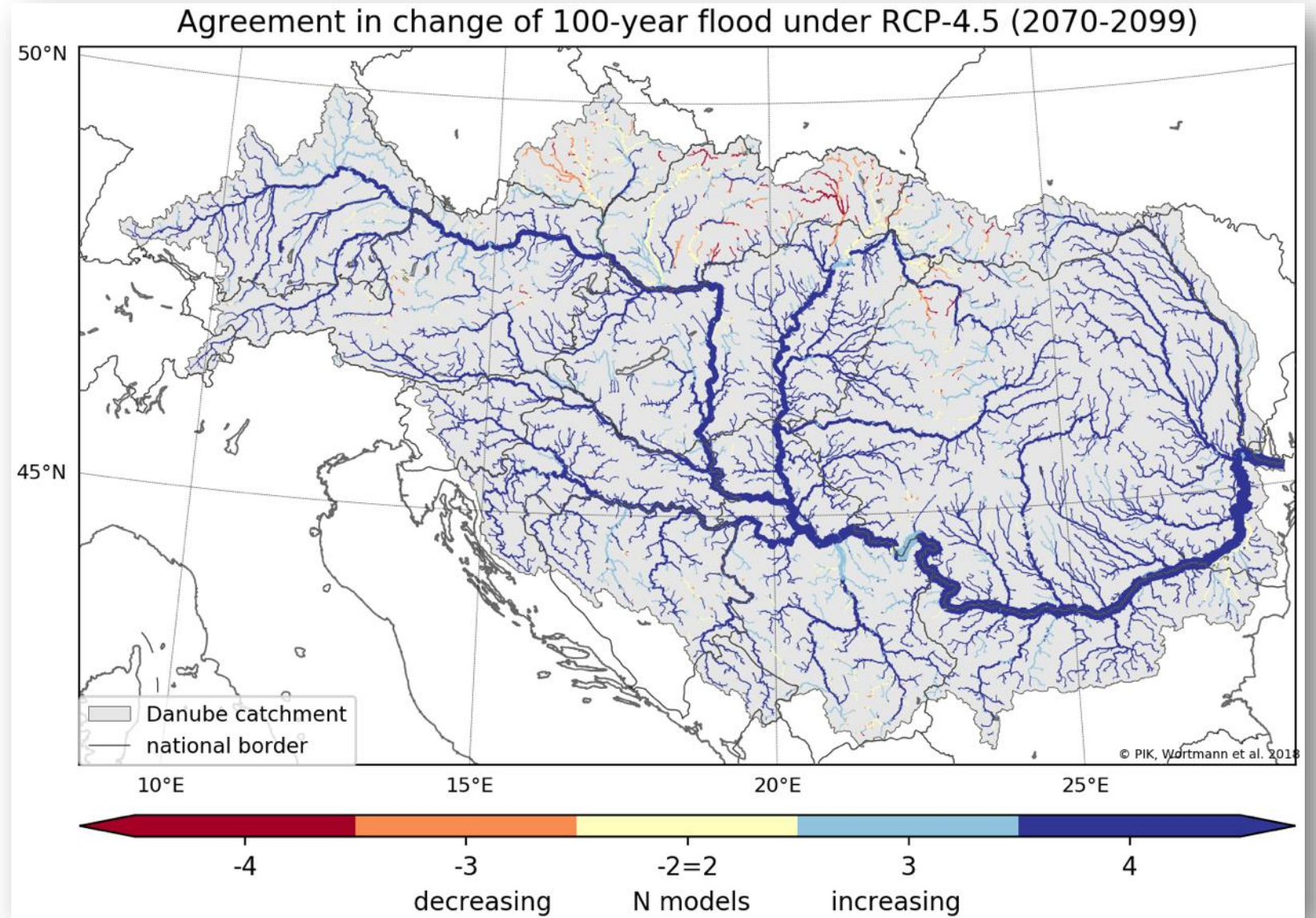
Ensemble agreement of change in the 100-year flood

2020-2049



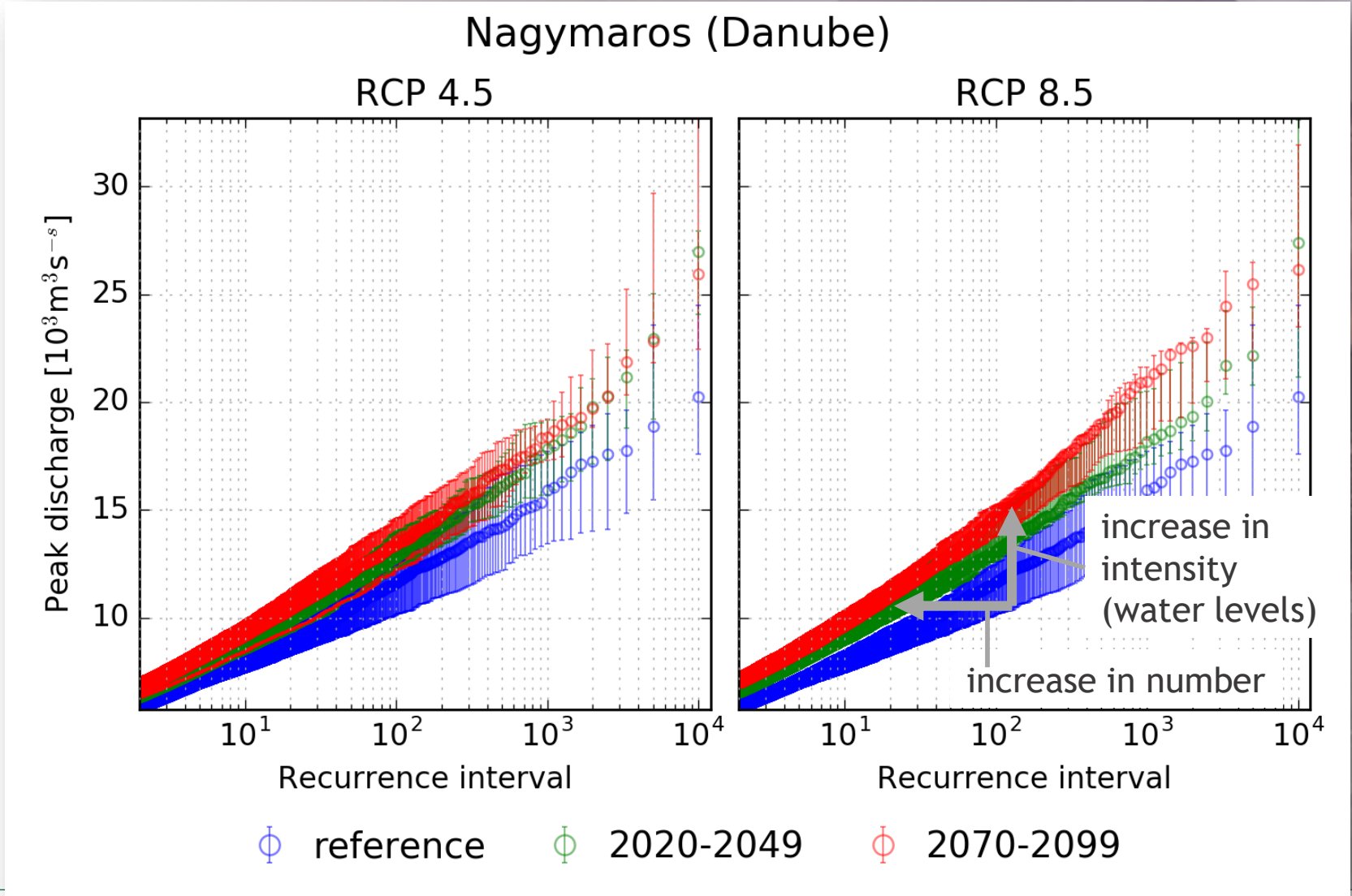
Ensemble agreement of change in the 100-year flood

2070-2099



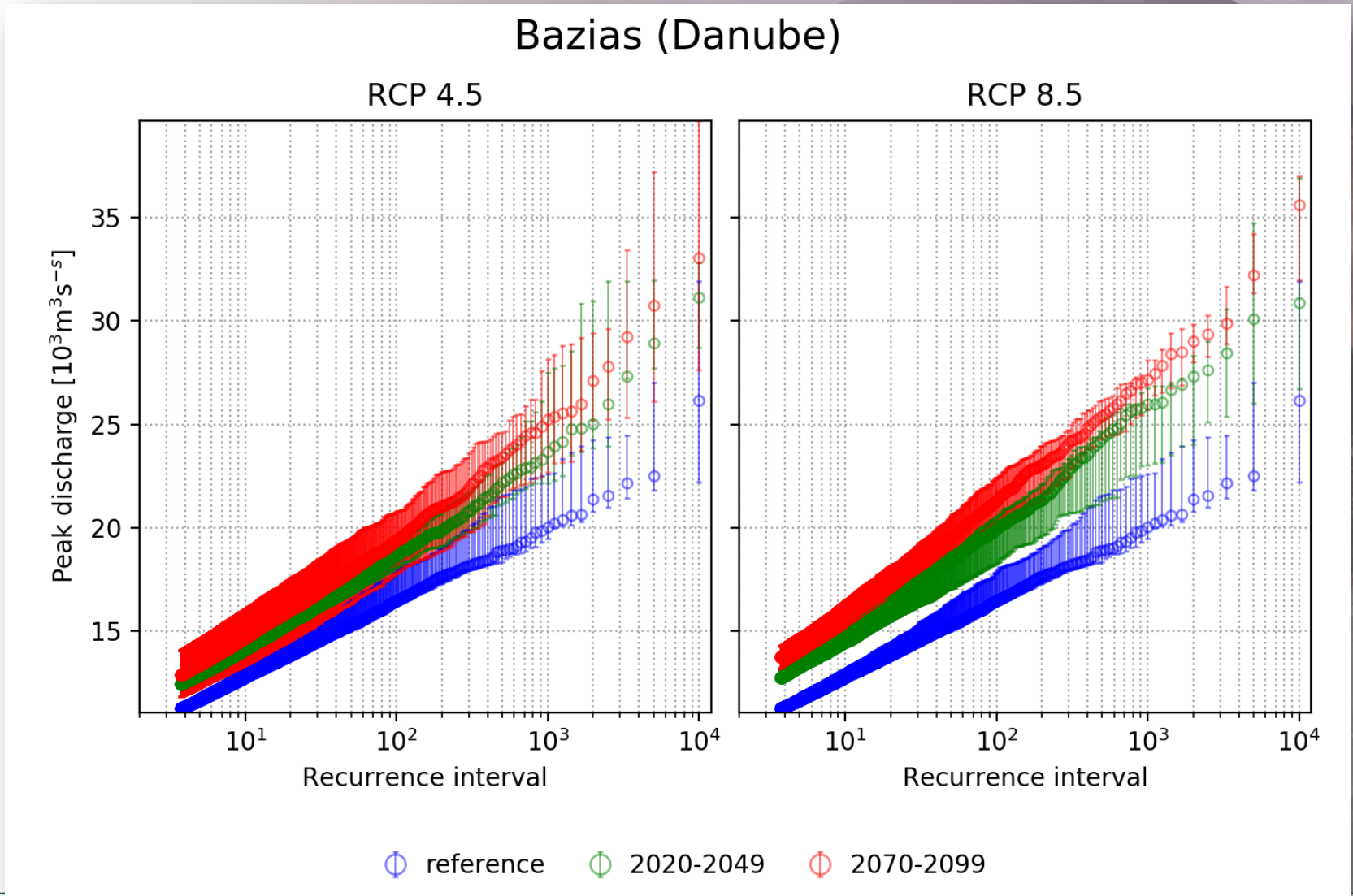
Current and future flood reoccurrence Hungary

These statistics are there for each of the ~13,000 river sections



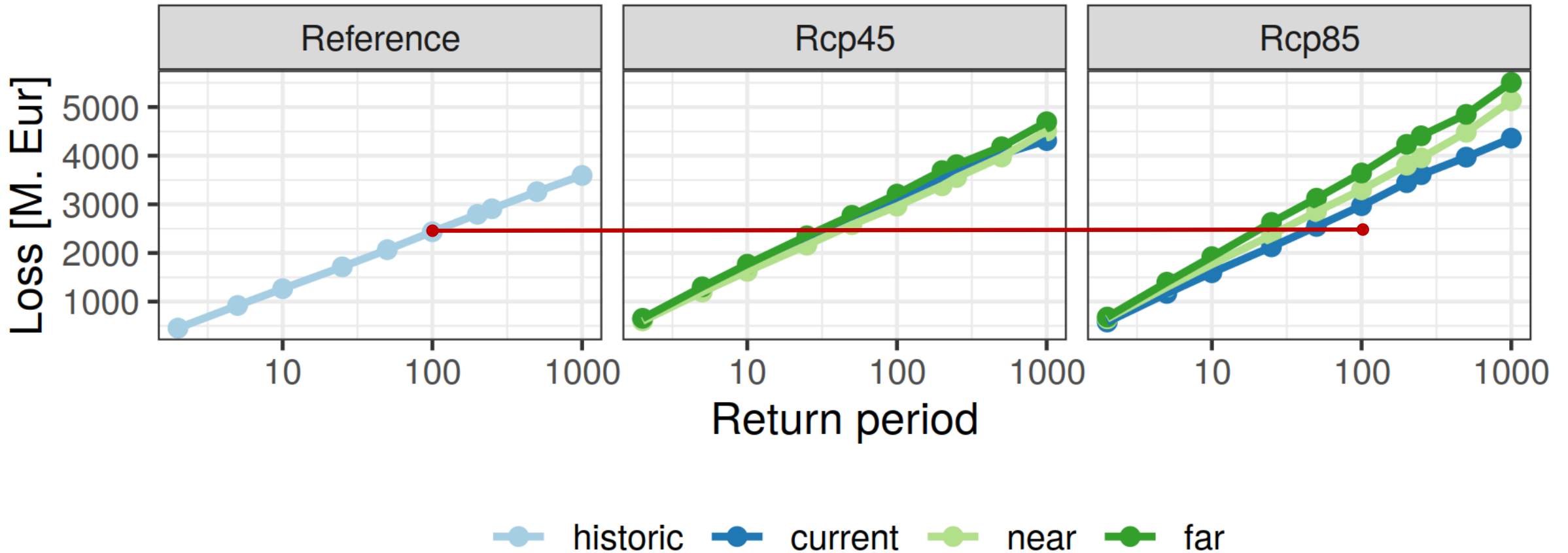
Current and future flood recurrence

Romania

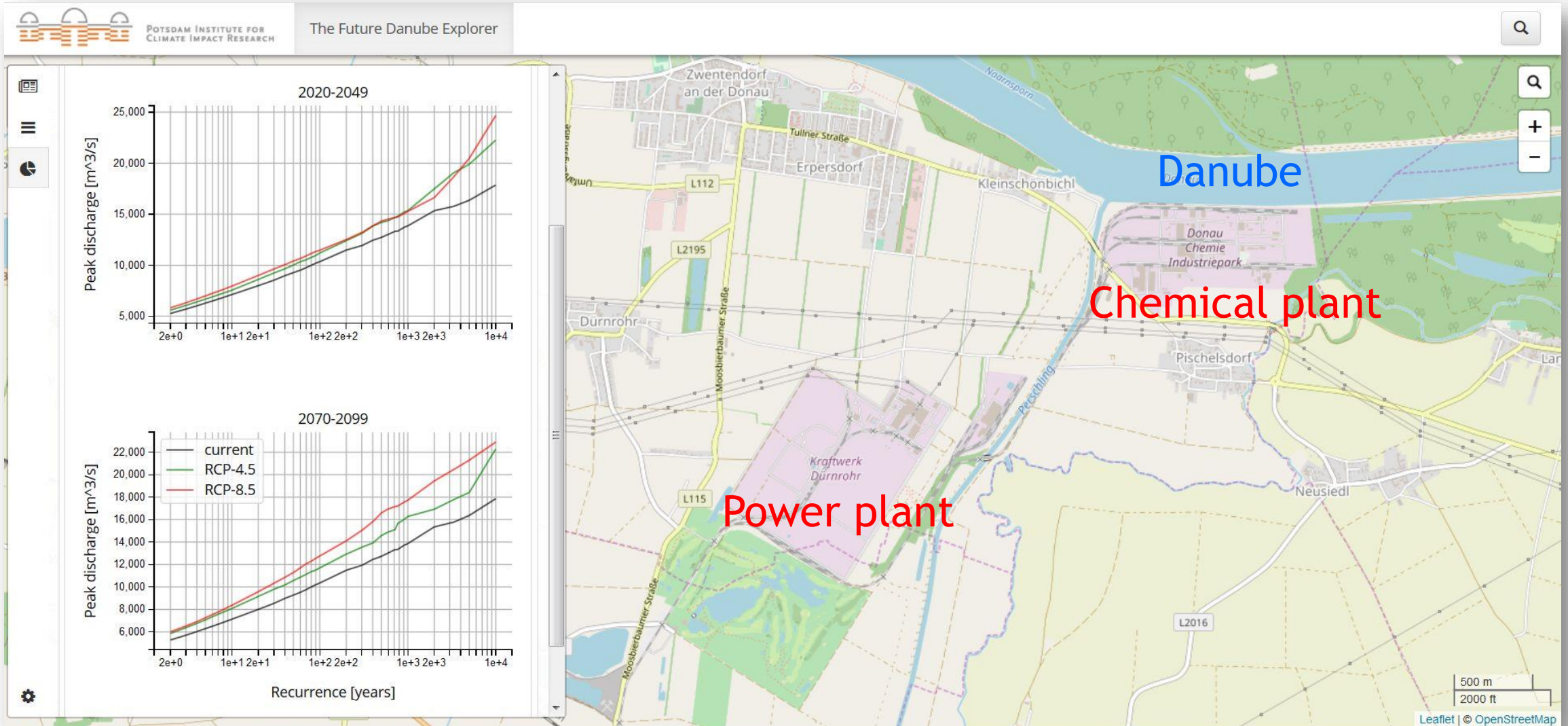


AEP curves for fluvial flood risk of commercial buildings

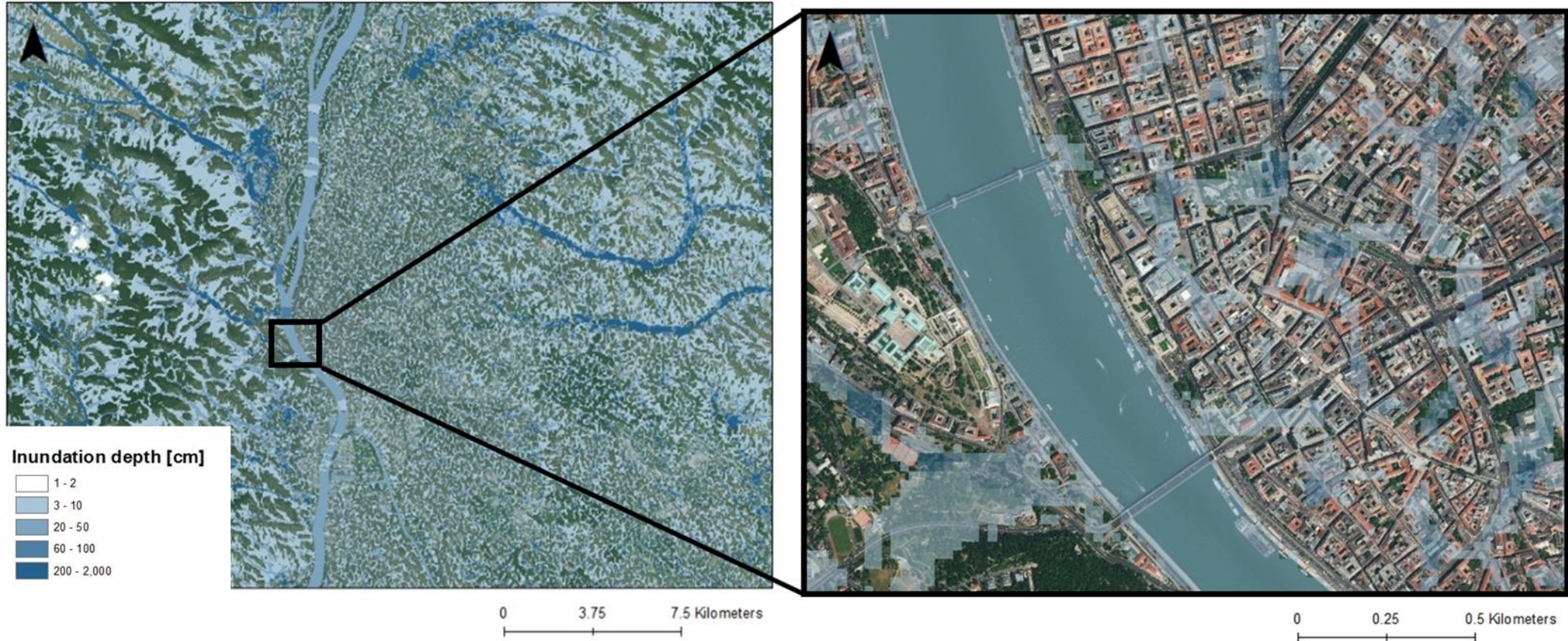
Entire Danube catchment for historic, current and future climate periods and two RCPs



Critical infrastructure



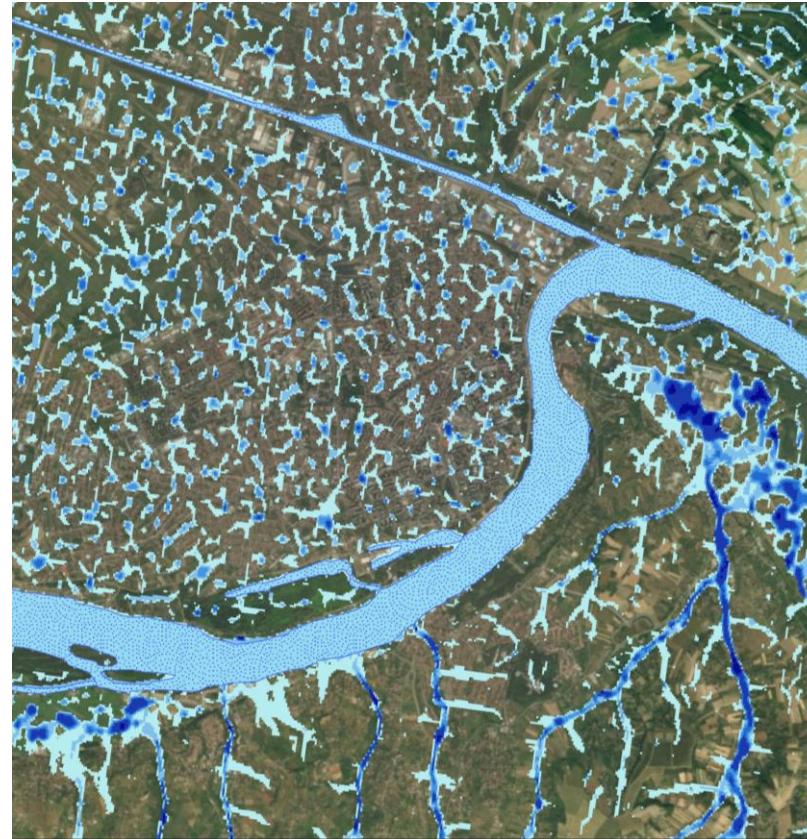
Pluvial flood risk in Budapest (100 year event current conditions)



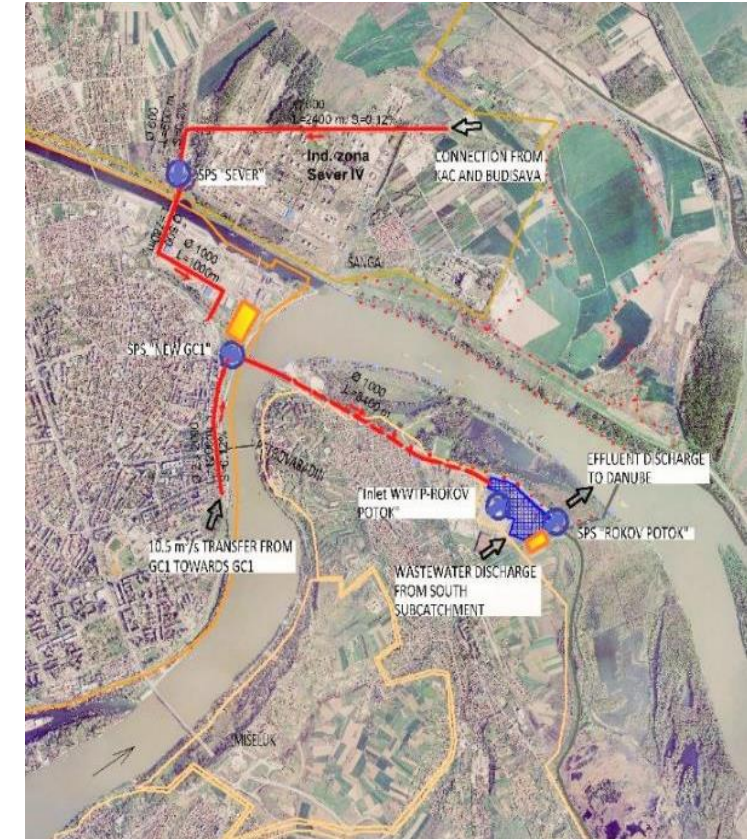
Flood risk for new wastewater treatment plant (Novi Sad, Serbia)

Stakeholder engagement and pluvial flood simulations

- 3 stakeholder workshops in Novi Sad with
- Completed Climate Change Impact Assessment for the wastewater treatment plant
- Detailed flash-flood simulations incl. high-resolution weather simulations

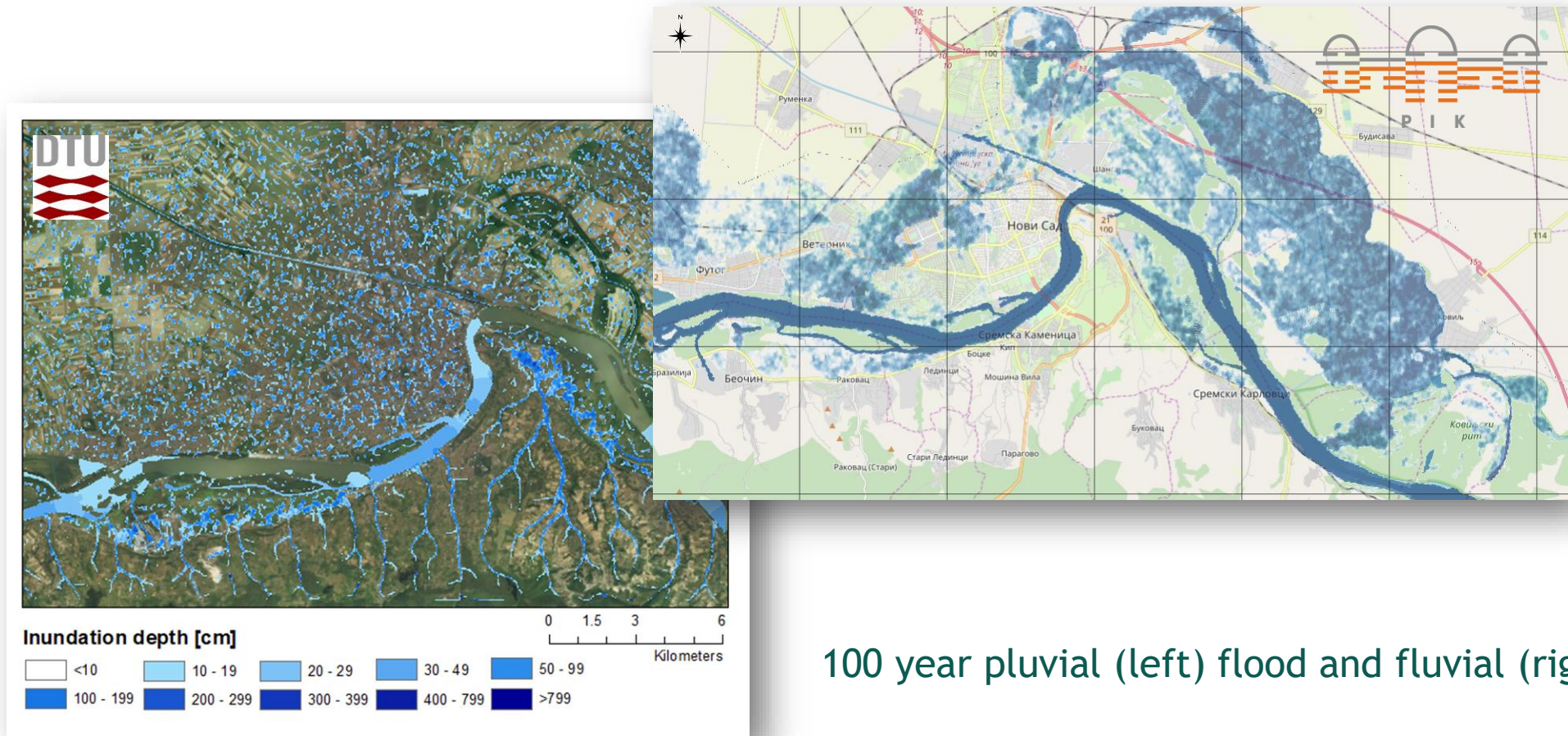


Model simulations (100-year event)



Selected site

Compound events - pluvial and fluvial floods



100 year pluvial (left) flood and fluvial (right) floods

Thinking out of the box

Or thinking the unthinkable?

There are strong indications that hydro-climatic extremes will increase in number and intensity

What is possible?

- Highest historical event?
(In Germany Magdalenen-Flood in 1342 with an recurrence >> 1000)
- How good are climate models in reproducing extremes?
(For example concerning compound events, large scale circulation pattern)
- “Constructed events”
(Example of the Rhine basin with to flood generation processes - how does a combined event look like?)

Thank you

Hattermann, F.F., Wortmann, M., Liersch, S., Toumi, R., Sparks, N., Genillard, C., Schröter, K., Steinhausen, M., Gyalai-Korpos, M., Máté, K., Hayes, B., Drews, M., Maria del Rocio Rivas Lopez, Rácz, T. (2018) **Simulation of flood hazard and risk in the Danube basin with the Future Danube Model.** *Climate Services*.

Sparks, N.J., Hardwick, S.R., Schmid, M., Toumi, R., (2017) **IMAGE: a multivariate multi-site stochastic weather generator for European weather and climate.** *Stoch Environ Res Risk Assess* 1-14.

- Lüdtke, S., Schröter, K., Steinhausen, M., Weise, L., Figueiredo, R. and Kreibich, H. (2019) **A Consistent Approach for Probabilistic Residential Flood Loss Modeling in Europe,** *Water Resources Research*, 55(12), 10616-10635.
<https://doi:10.1029/2019WR026213>.

Martin Drews, Morten Andreas Dahl Larsen, Michel Wortmann, Gwendoline Lacressonnière, Mads Lykke Dømgaard, Céline Déandreis, Fanny Velay Lasry and Fred Hattermann (2020) **Compound effects of atmospheric and soil conditions on flash flood severity in prep. for a special issue of Hydrological Processes.**