

Digital twins for safe and sustainable delta development in a changing climate



SURF Seminar Digital Twins for Earth Sciences

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Courtesy Port of Rotterdam







Monitoring salt intrusion in the Rhine-Meuse Delta

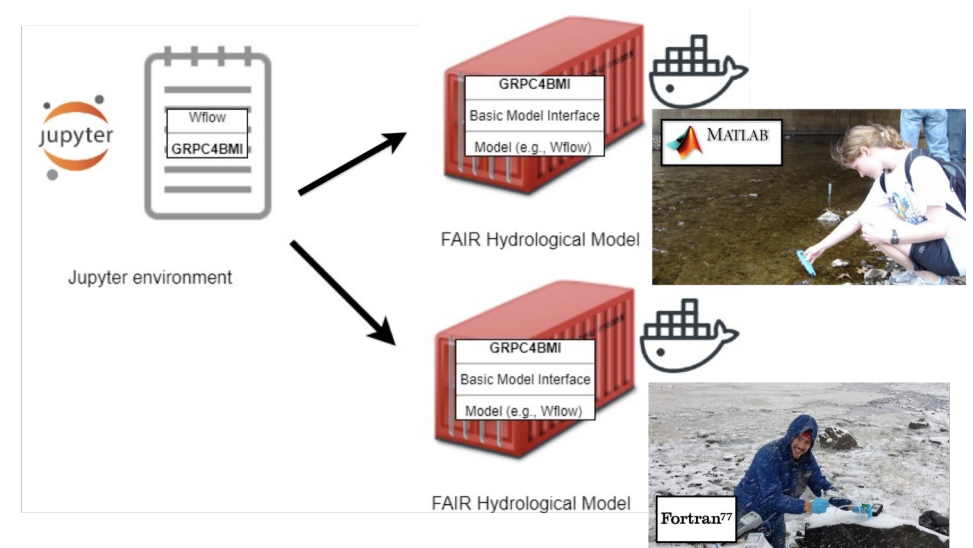


eWaterCycle

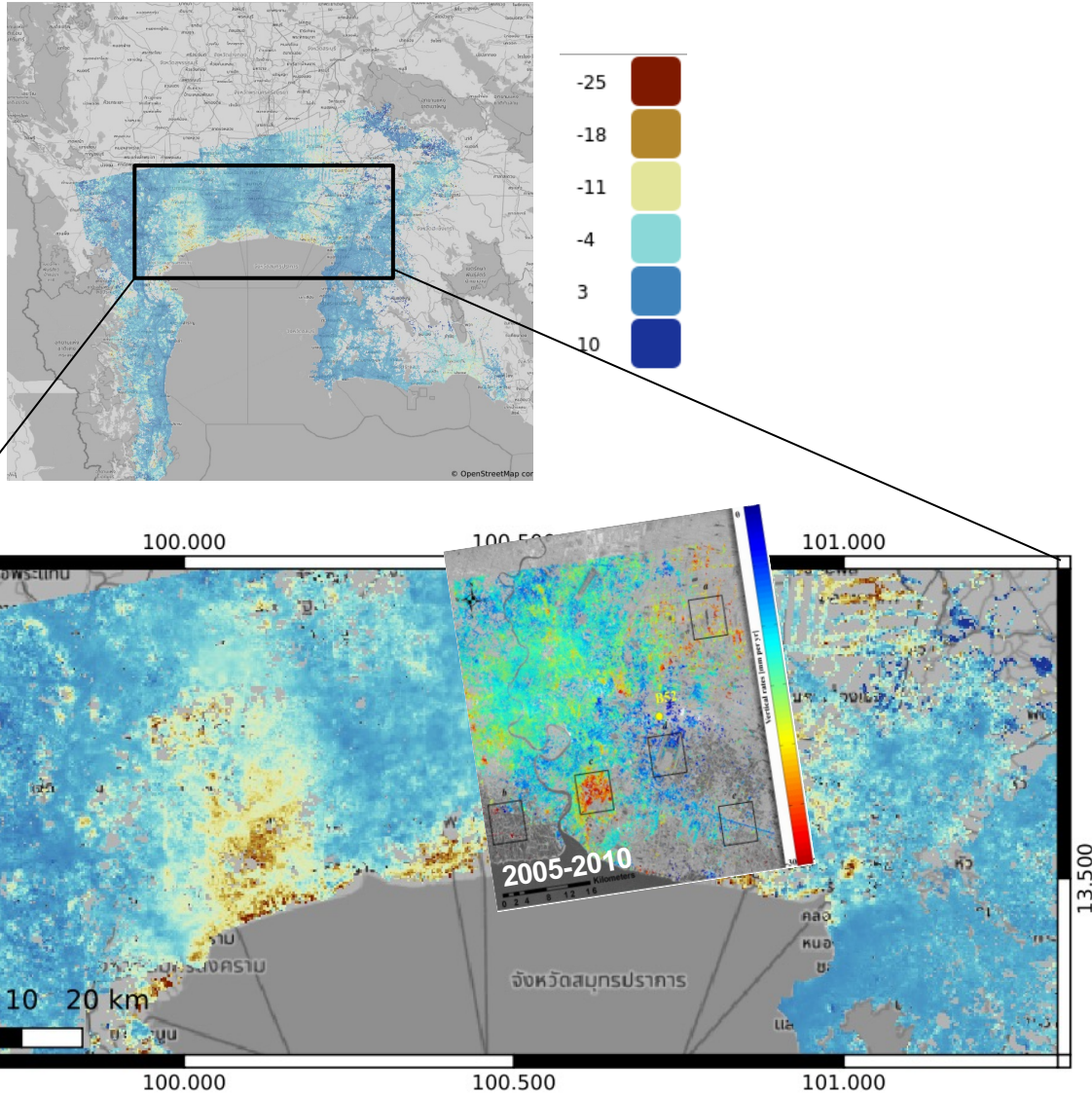
Hydrology:
many models
describing processes



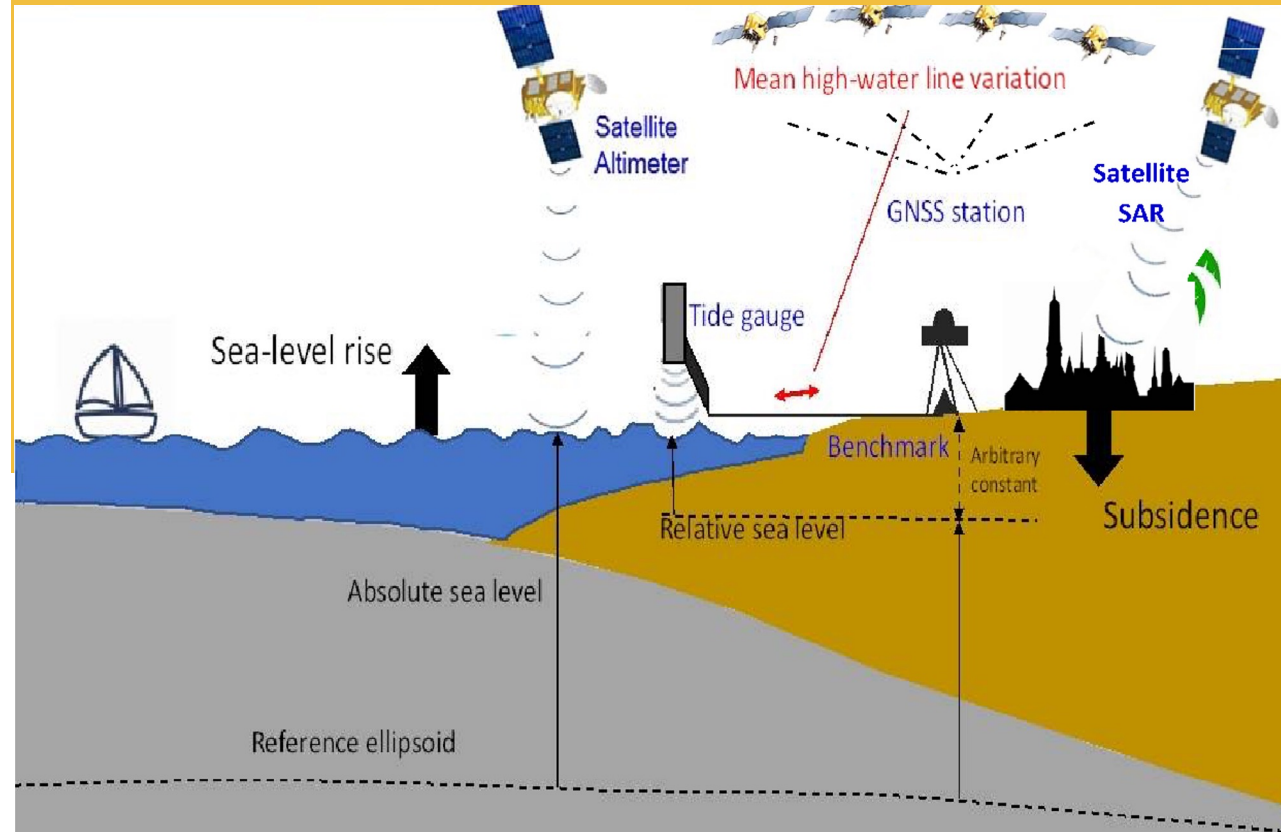
interact with
existing models on
common platform



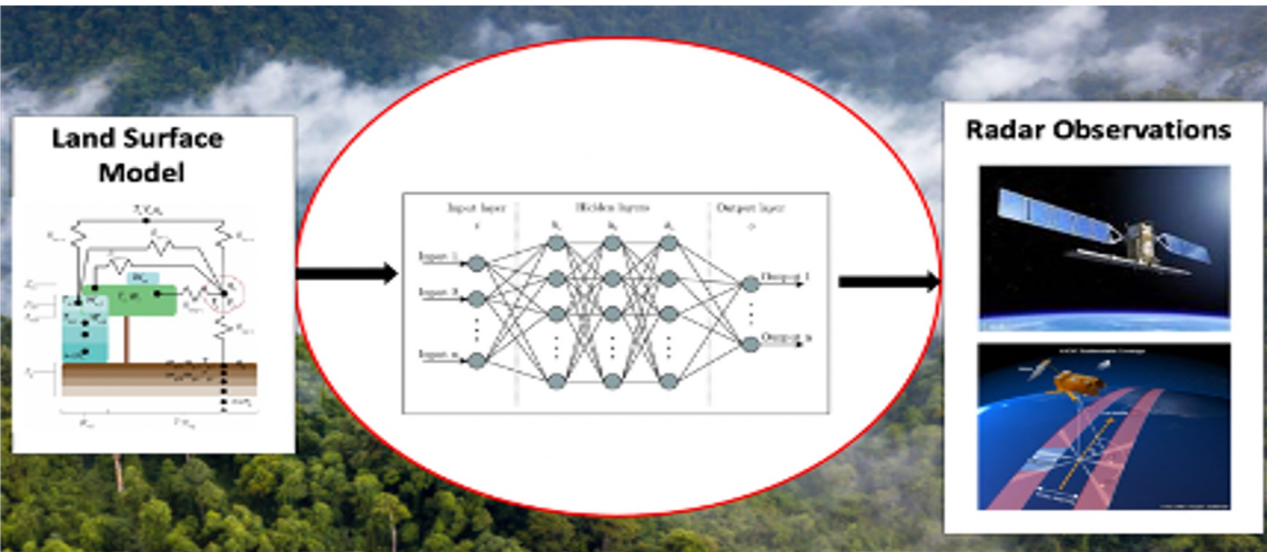
Bangkok subsidence



Data assimilation for coastline changes

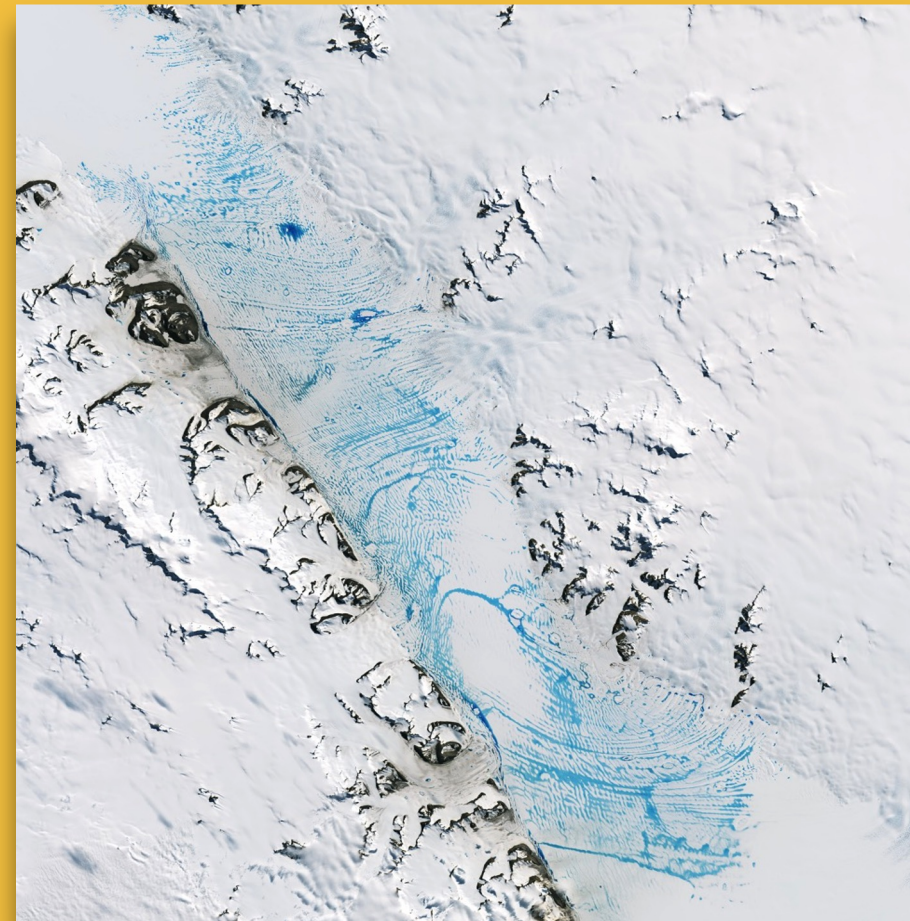


Data assimilation of Advanced Scatterometer (ASCAT) satellite radar data for soil moisture



Shan et al. (2021, in review)
Collaboration MeteoFrance, TU Wien, ESA

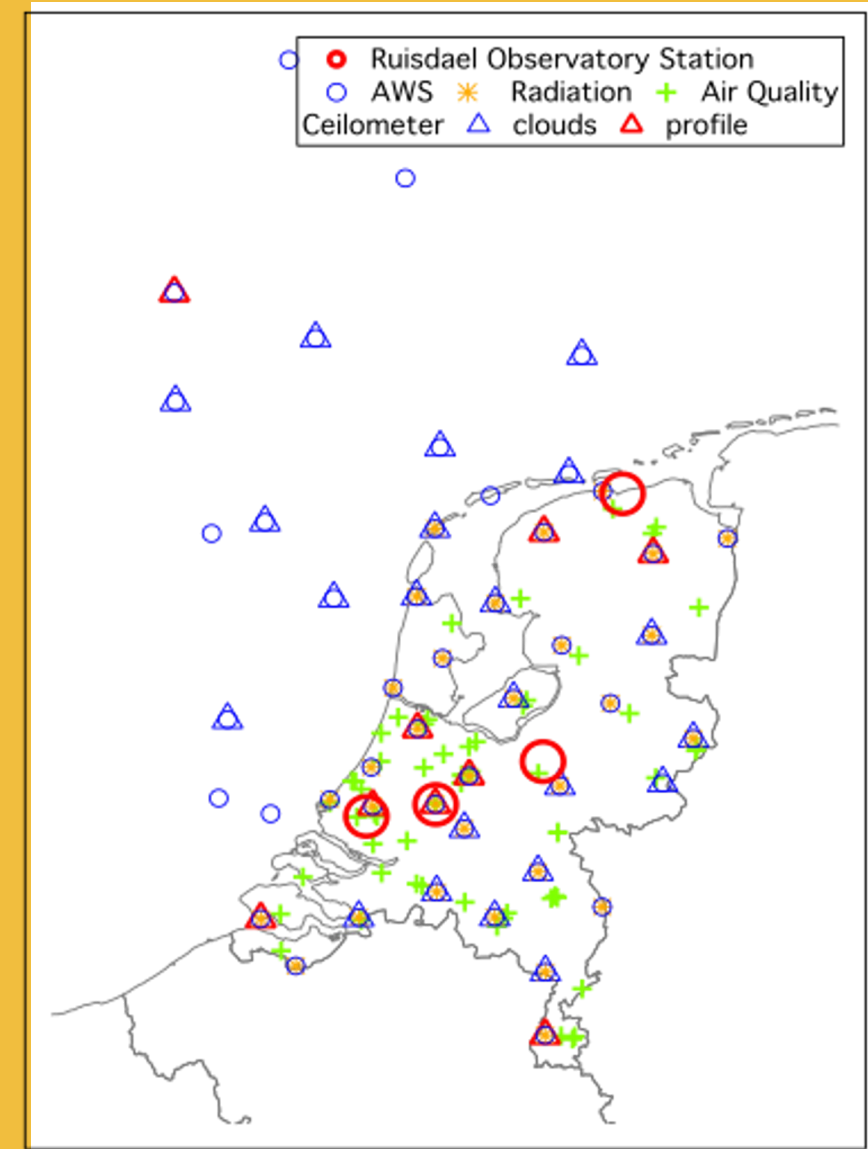
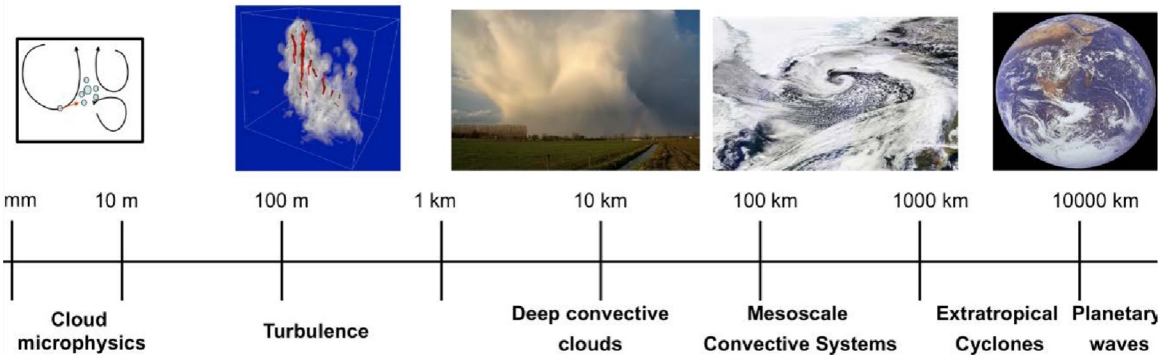
Machine Learning in climate models for ice sheet Antarctica



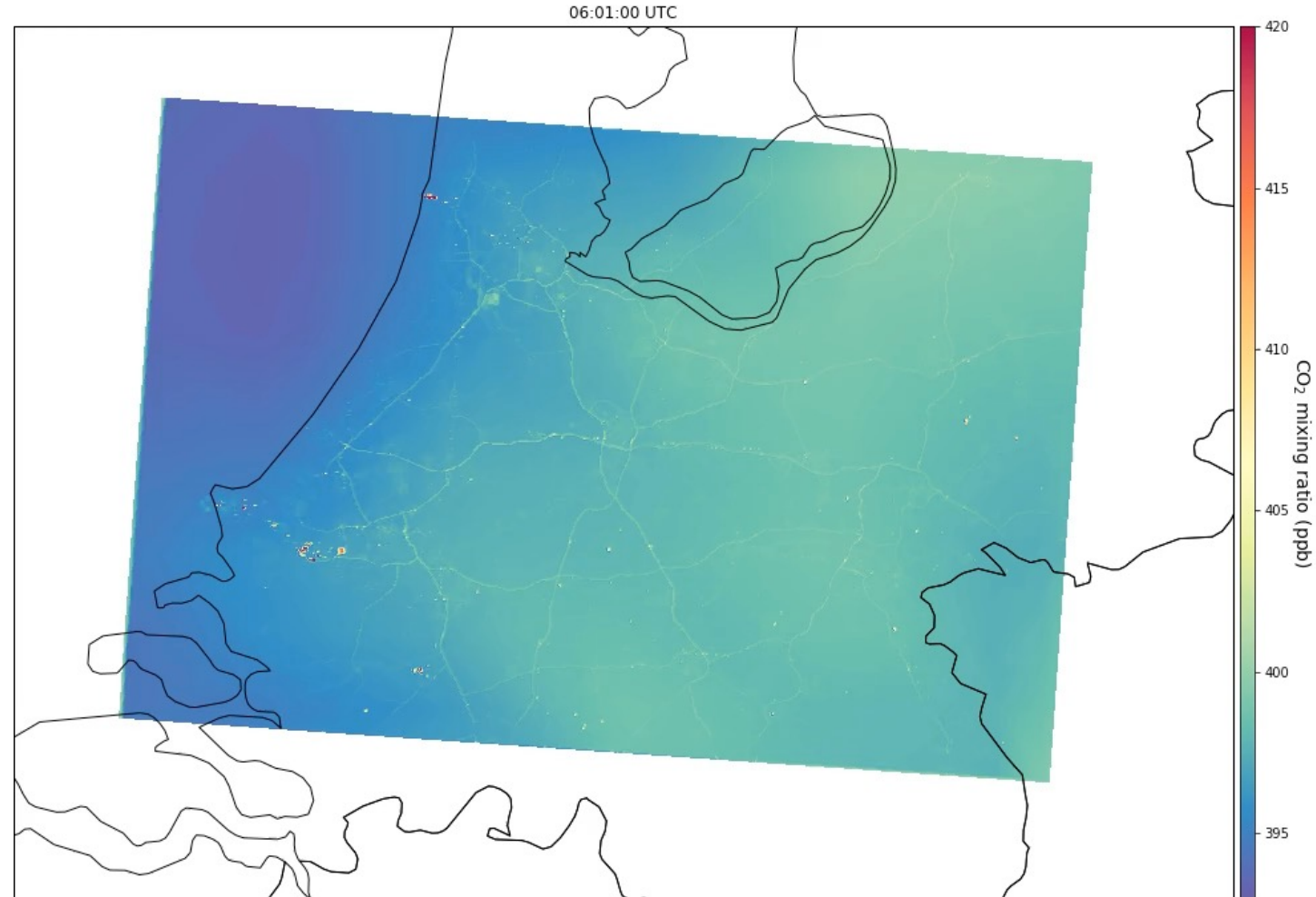
Banwell et al, 2021

Ruisdael Observatory

Measurements of the atmosphere for more concrete detailed forecasts of weather and air quality



Assimilating observations of the Ruisdael Observatory



Climate action: urban cooling and sponge cities



Cooling Cities

Maiullari et al., 2021

a fully-integrated **hydro-meteorological observation-modelling program** for the assessment of the effectiveness of **urban planning and design strategies** (e.g., green, blue, and sustainable solutions) in **mitigating urban heat (stress)** in different urban morphologies.



Sponge Cities

De Urbanisten, 2013

Sponge Cities **soak up rainwater to prevent flooding and store it to make it available during drought, while producing co-benefits in terms of ecosystem services and improved spatial quality.**

Convergence/Resilient delta

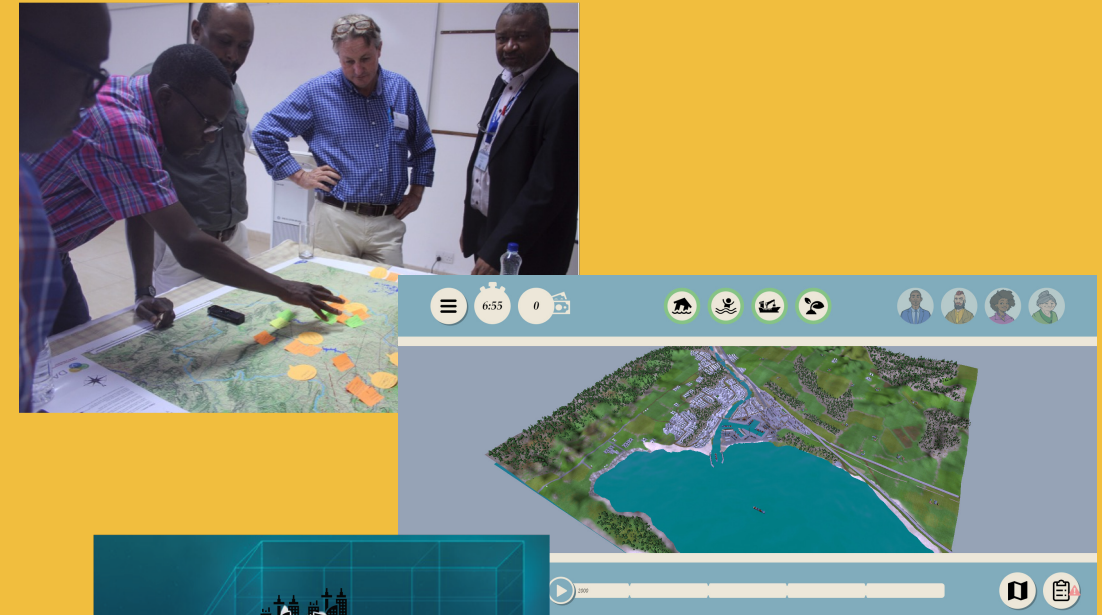
Structure



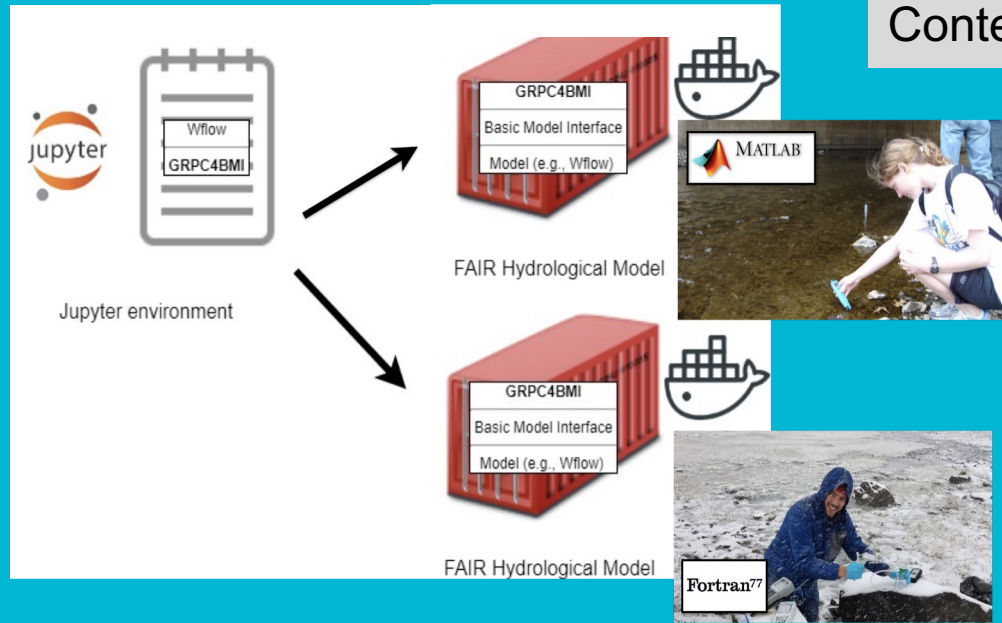
Policy support

All ongoing work involves coupled natural systems and **decisions about human interventions**. To support these decisions:

- Negotiation simulation lab
- Game Lab
- Workshops at the Lorentz Center: “Climate Risks for Infrastructure in Deltas” and “Digital Bastards for a Resilient Delta”







How to best share data and knowledge

- Simulation capacity and accessibility: interfaces with national and international simulators, e.g., interface DestinE Climate Digital Twin and eWatercycle
- Accessibility of data, overarching data base that connects to, a.o., Ruisdael observatory and EPOS-NL
- ...

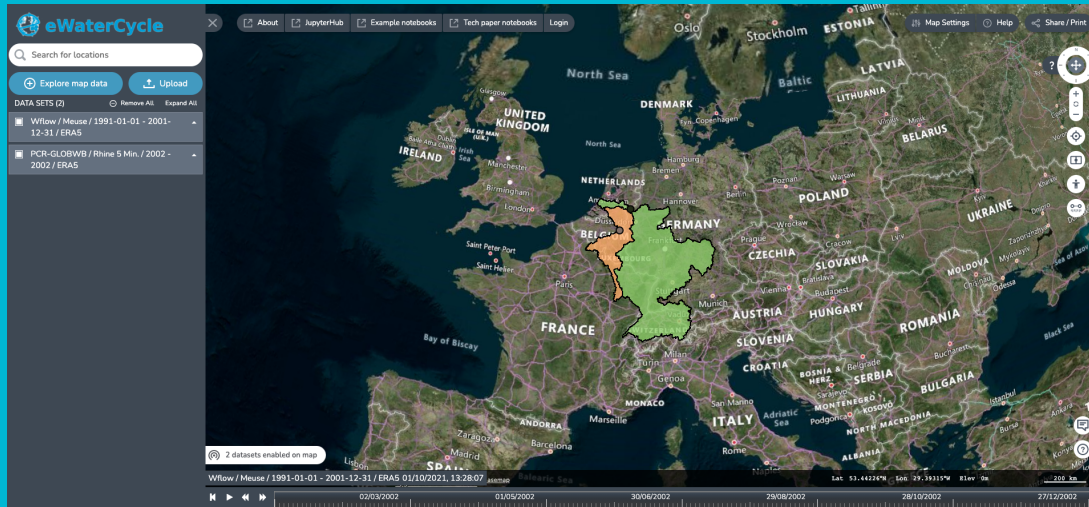
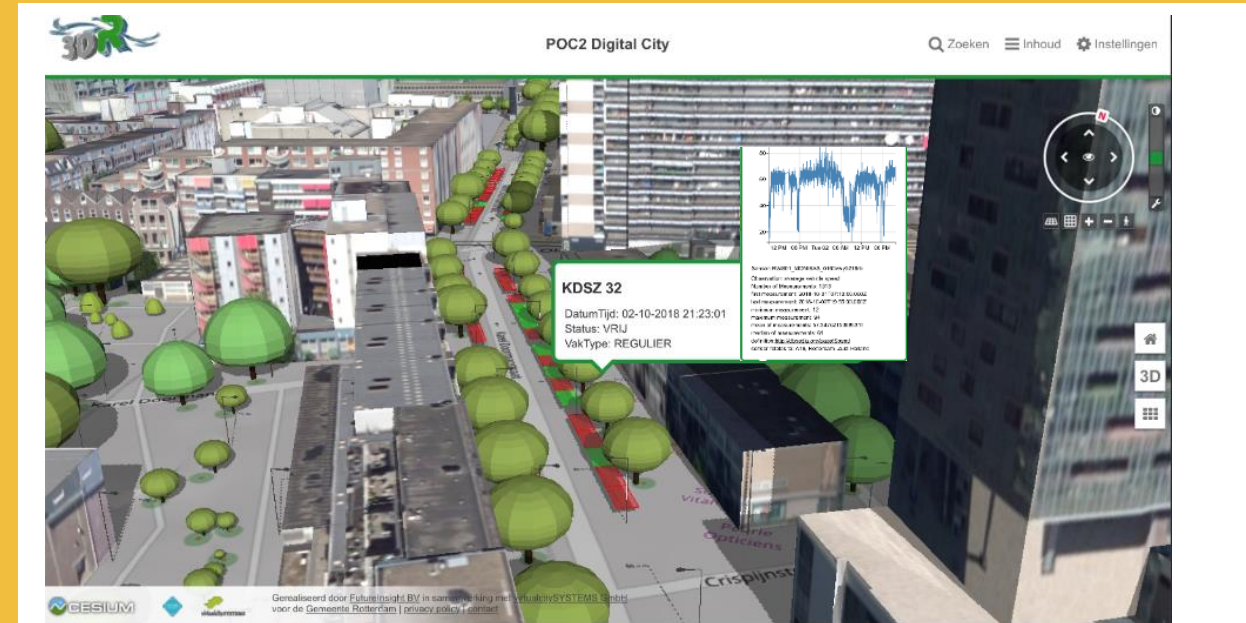


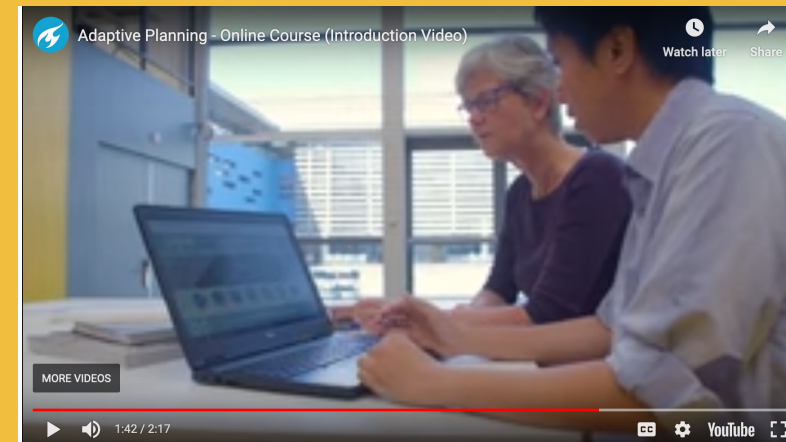
Figure 3. Screenshots of the Explorer, which allows users to explore and select models available based on regions for which they are available (ie. suitable forcing and parameter sets are available). Background maps ©Microsoft Bing Maps 2018 screen shot(s) reprinted with permission from Microsoft Corporation.

Involve stakeholders

- Connect to local initiatives and accessibility to policy makers (e.g., Municipality of Rotterdam, Ports, RWS, ...)
- Interactive browsing and scenario modelling by end users (link to serious gaming?)



Roland van der Heijden., Municipality Rotterdam



<https://online-learning.tudelft.nl/courses/adaptive-planning-for-infrastructure-and-water-management/>



Thank you