Global data for local applications

How useful are global data for hydrological modelling?

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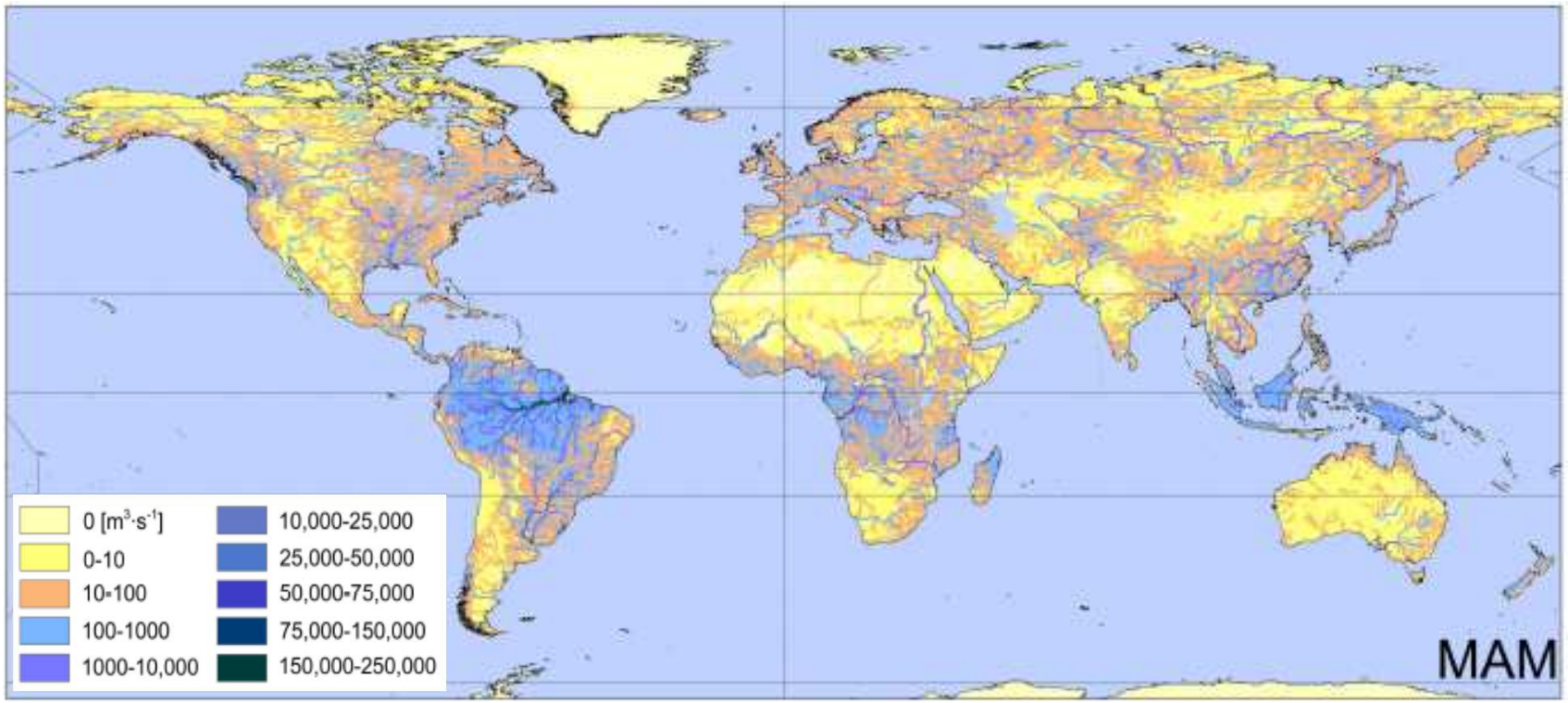
- Matching end-user needs and research

eartH2Observe project and datasets

- Many countries lack information about water availability
  - Especially developing countries
- Aim: to provide better water resources information
  - Earth Observation
  - Global hydrological modelling
- How good are these datasets for local applications?
- Eight case studies to help answer this question

eartH2Observe project and datasets

- Earth Observation data
  - Remote sensing products
- Global forcing data
  - ECMWF – ERA interim 0.5^{o} global data (3 hourly)
- Global Water Resources Reanalysis (WRR) Tier 1
  - Based on ensemble of global hydrological models
  - 30 years; 50 x 50 km; 3-hourly/daily time steps

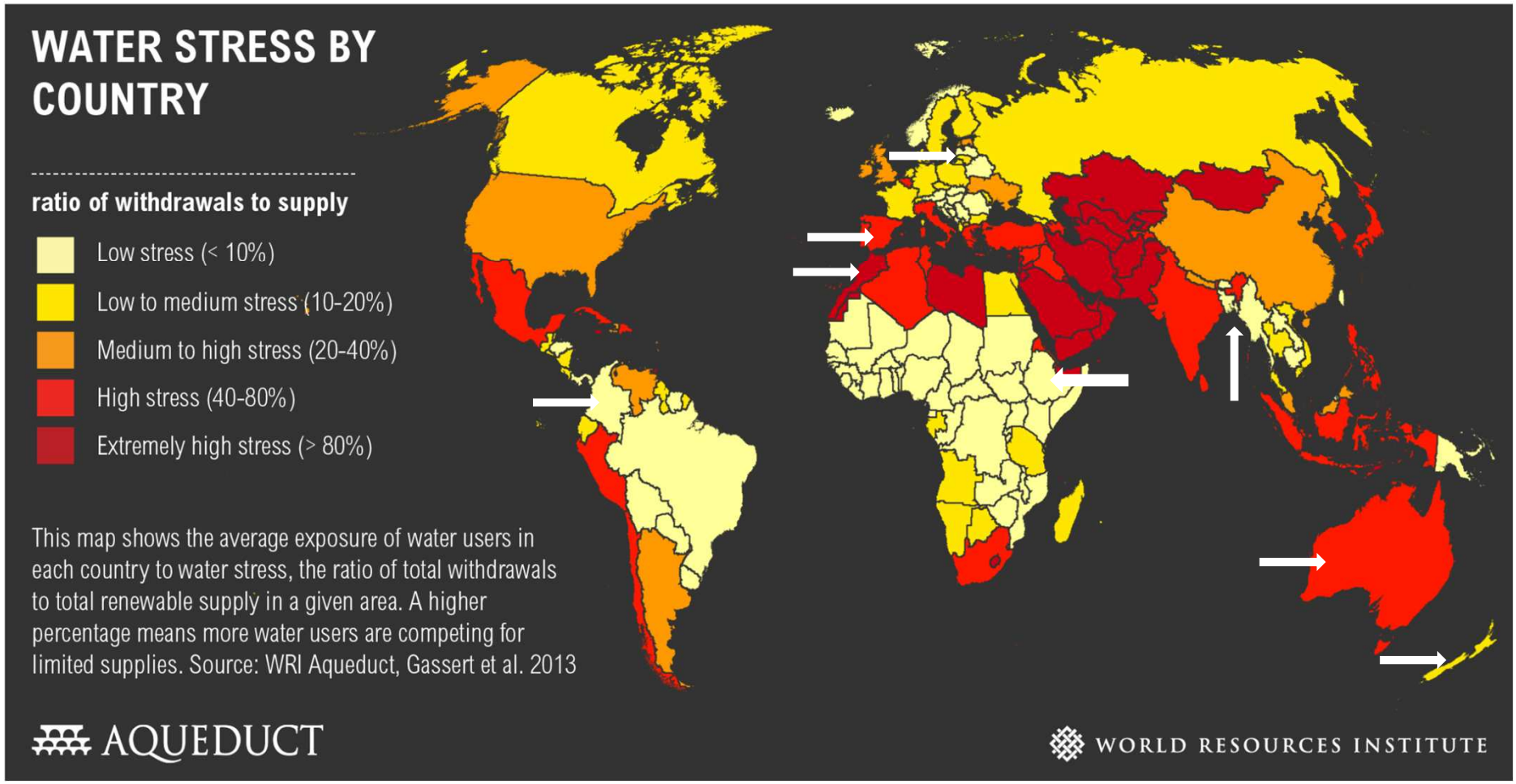


Global river discharge (year 2000; PCR-GLOBWB simulation)

eartH2Observe case studies

- Eight different countries
  - Variation in hydrological conditions
  - Data rich versus data poor

- Each case study has its own focus
  - Flooding, drought, groundwater, water quality, etc.
  - Collaboration with scientific partner and end-user(s)



eartH2Observe case study countries

eartH2Observe case studies

- Project is mid-way
  - 2014 - 2017

- Preliminary results only
  - We have two more years

Preliminary results: forcing data

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- ECMWF – ERA-Interim reanalysis
  - 0.5^{o} spatial resolution
  - 3 hourly
- Used in six countries
  - For modelling
  - For rainfall comparison
- Some mixed results

Preliminary results: forcing data

- Colombia (Magdalena basin)
  - Good seasonality; but overestimation of total rain
- Ethiopia (upper Blue Nile)
  - Rainfall from forcing not as good as EO products
- Bangladesh (Brahmaputra)
  - Good seasonality; but overestimation of total rain
  - Better model efficiency with forcing than with EO rain

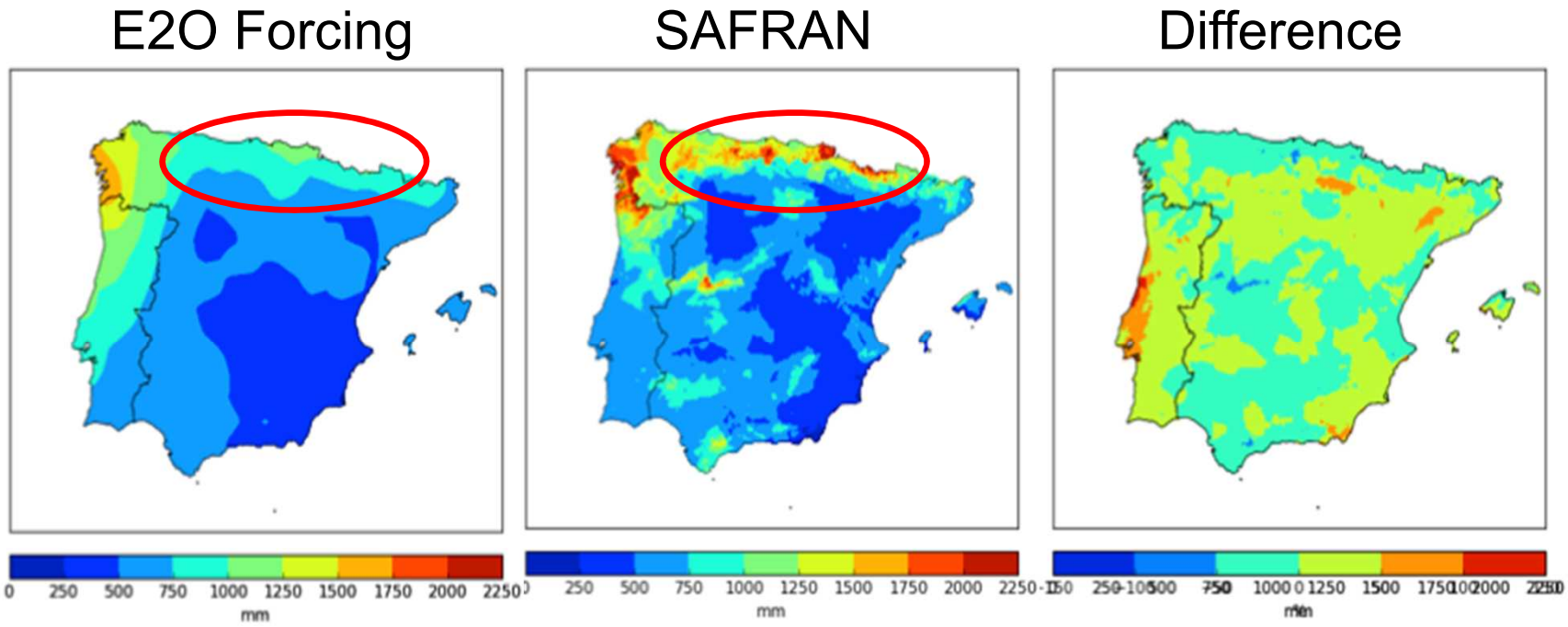
Preliminary results: forcing data

- Spain
  - Comparison with local climate product (SAFRAN)

- SAFRAN
  - 5 x 5 km
  - ERA-interim combined with local meteo data

- Forcing quite OK, but bias in mountainous areas

Preliminary results: forcing data



Mean annual rainfall for Iberian Peninsula

Preliminary results: forcing data

- In conclusion
  - Forcing data are pretty good
  - But coarse resolution is a problem
- Australia
  - Downscaling from 50 x 50 to 10 x 10 km
  - Improved results for Murrumbidgee river
- Downscaling will be tried in all case studies

Preliminary results: EO data

Preliminary results: EO data

- Precipitation
  - Colombia, Ethiopia, Bangladesh
  - Comparison with in-situ data
  - Used in modelling

- Colombia:
  - CMORPH and TRMM data give good rainfall estimates
  - Not yet used in modelling

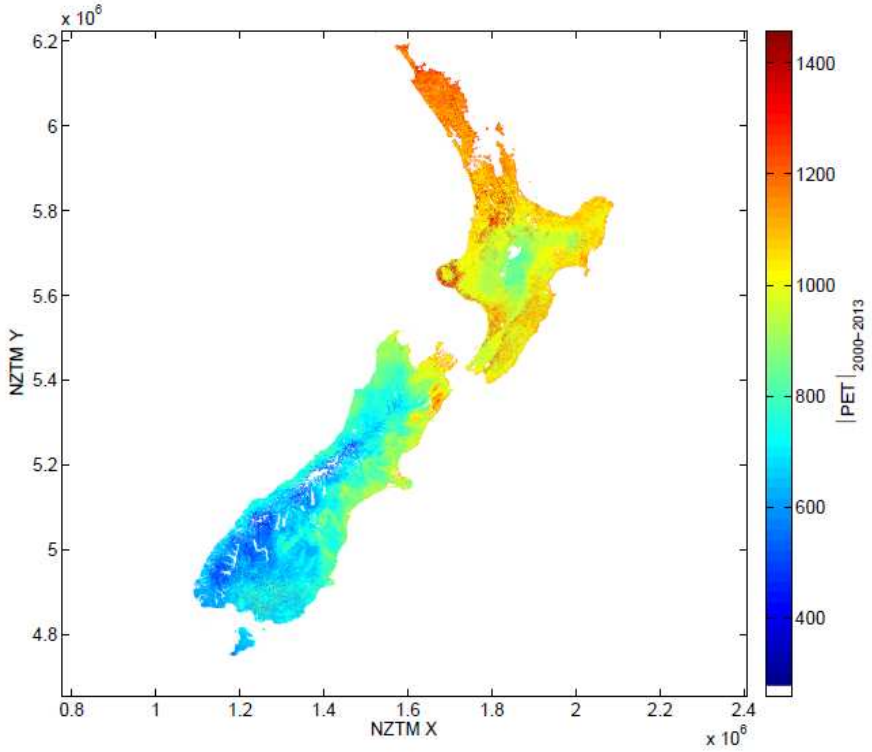
Preliminary results: EO data

- Ethiopia
  - CMORPH gave best estimates for Blue Nile
  - In modelling (sub-basin), TRMM and CMORPH provide reasonably good estimates
- Bangladesh
  - TRMM data best for modelling (underestimation though)
  - CMORPH and GSMap very poor in modelling

Preliminary results: EO data

- New Zealand
  - Evapotranspiration based on MOD16 EO data
  - AET and PET at 1 x 1 km and monthly time step
  - Patterns are quite good
  - Strong bias in mountainous areas

Preliminary results: EO data

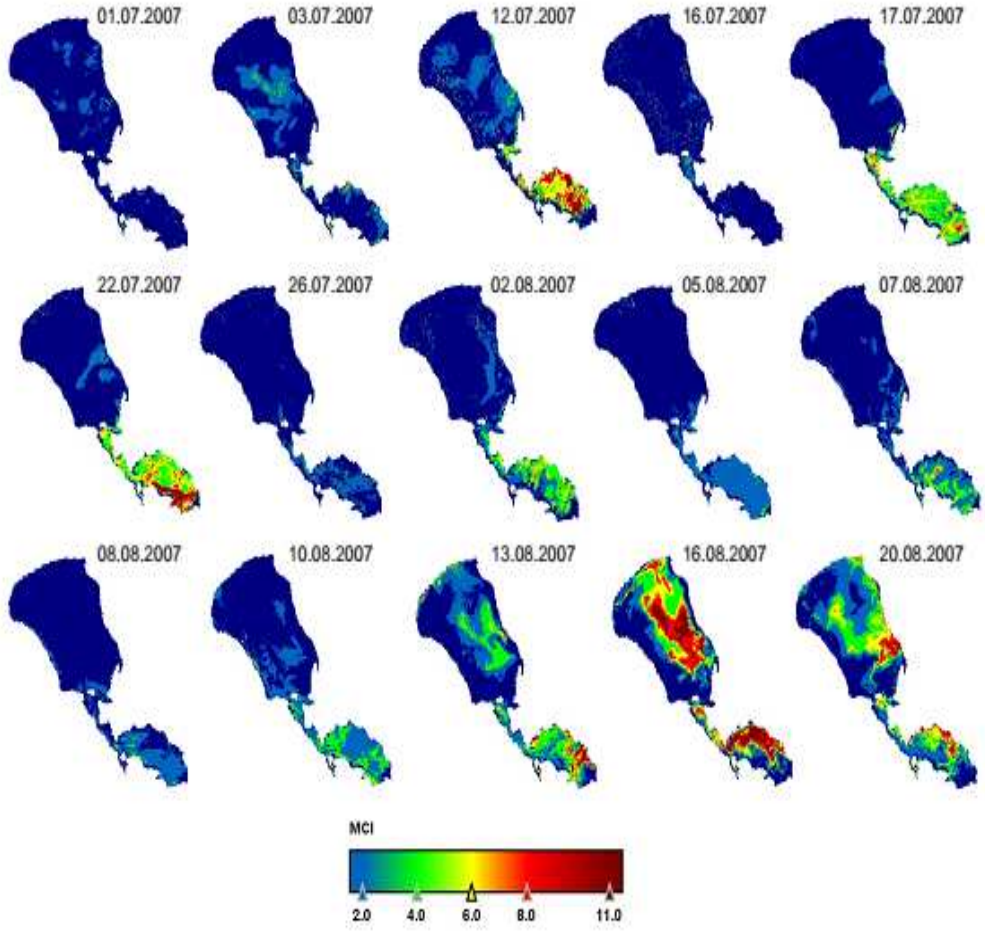


Mean annual Penman PET based on Mod16 data

Preliminary results: EO data

- Estonia
  - MERIS data (Envisat) + improved algorithm
  - Accurate quantification of chlorophyll in lake Peipsi
  - High temporal and spatial resolutions

Preliminary results: EO data



MERIS-based chlorophyll concentrations in Lake Peipsi, July-August 2007

Good match with in-situ measurements

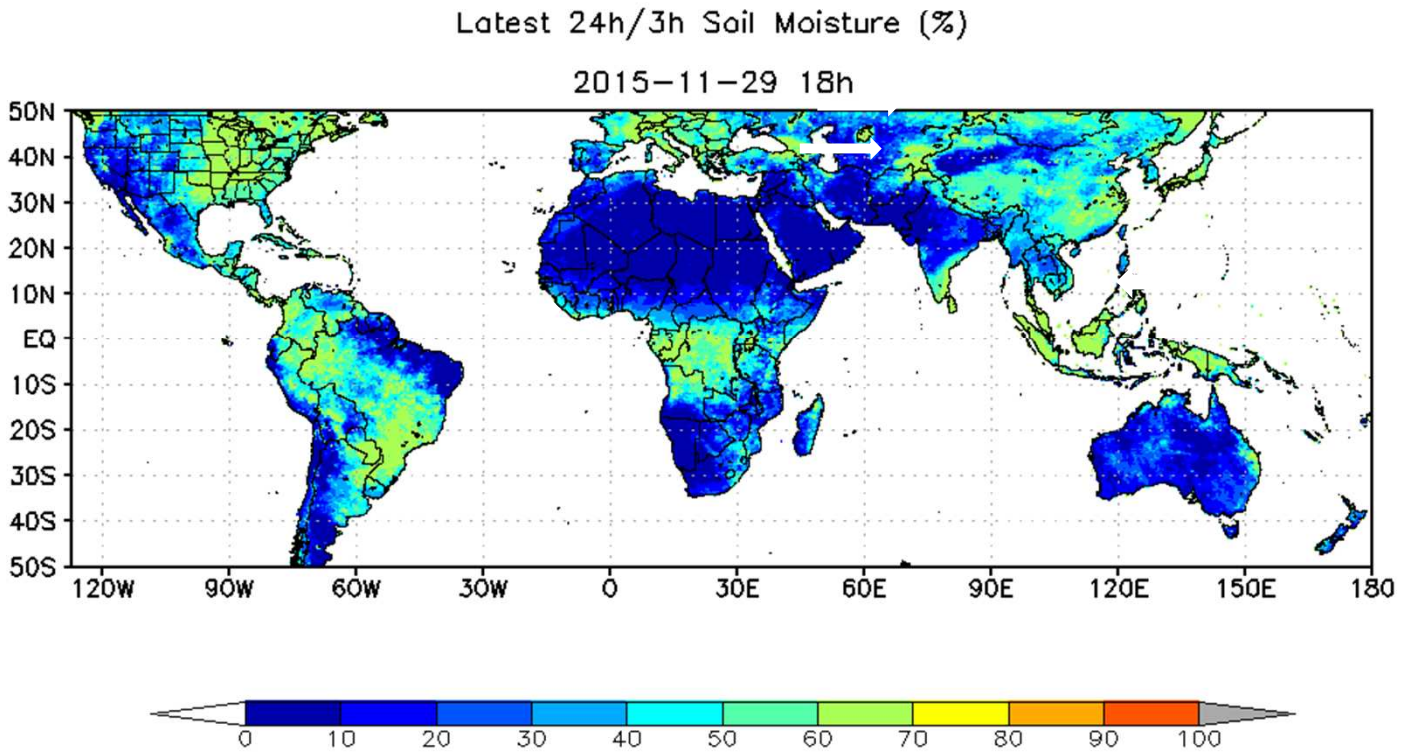
Preliminary results: EO data

- In conclusion:
  - EO rainfall products can provide good estimates
  - But quality seems location dependent

  - MOD16 product good for ET estimation
  - Requires validation using station data

  - MERIS data: accurate quantification of chlorophyll
  - High temporal and spatial resolutions

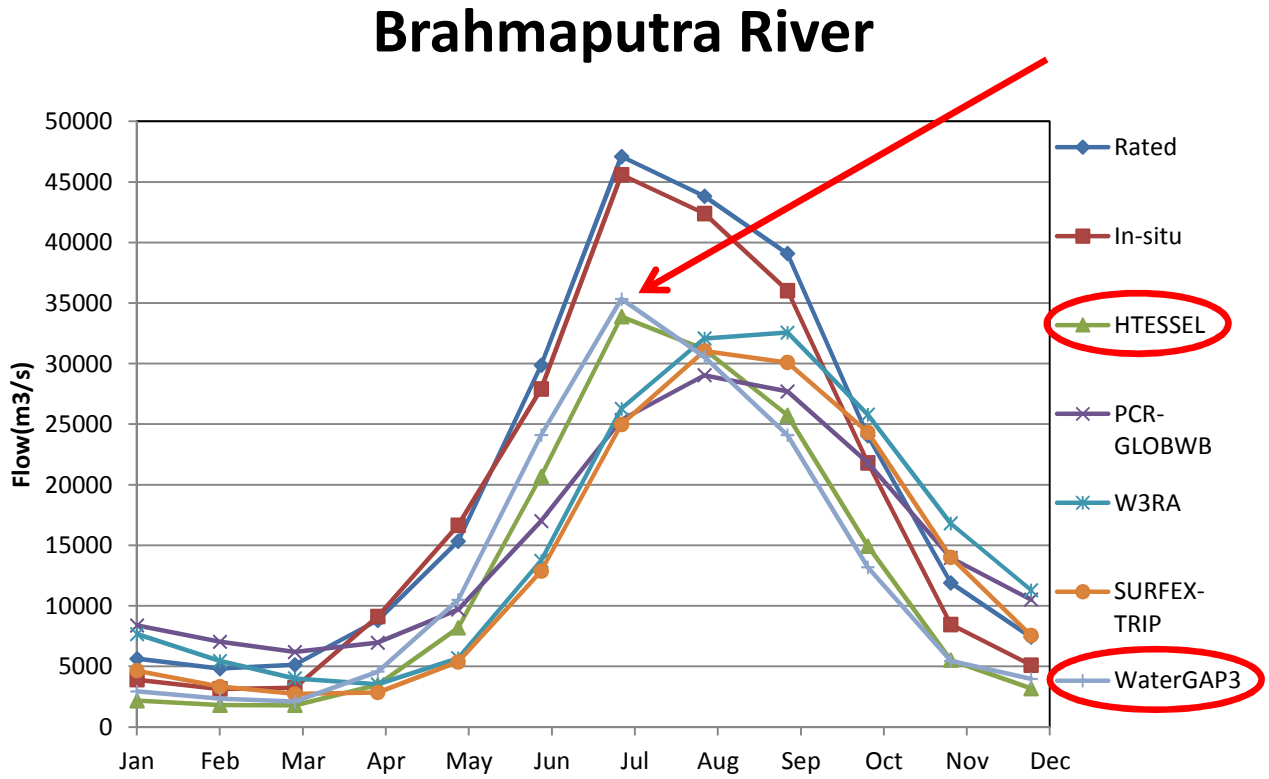
Preliminary results: WRR-Tier 1 data



Preliminary results: WRR-Tier 1 data

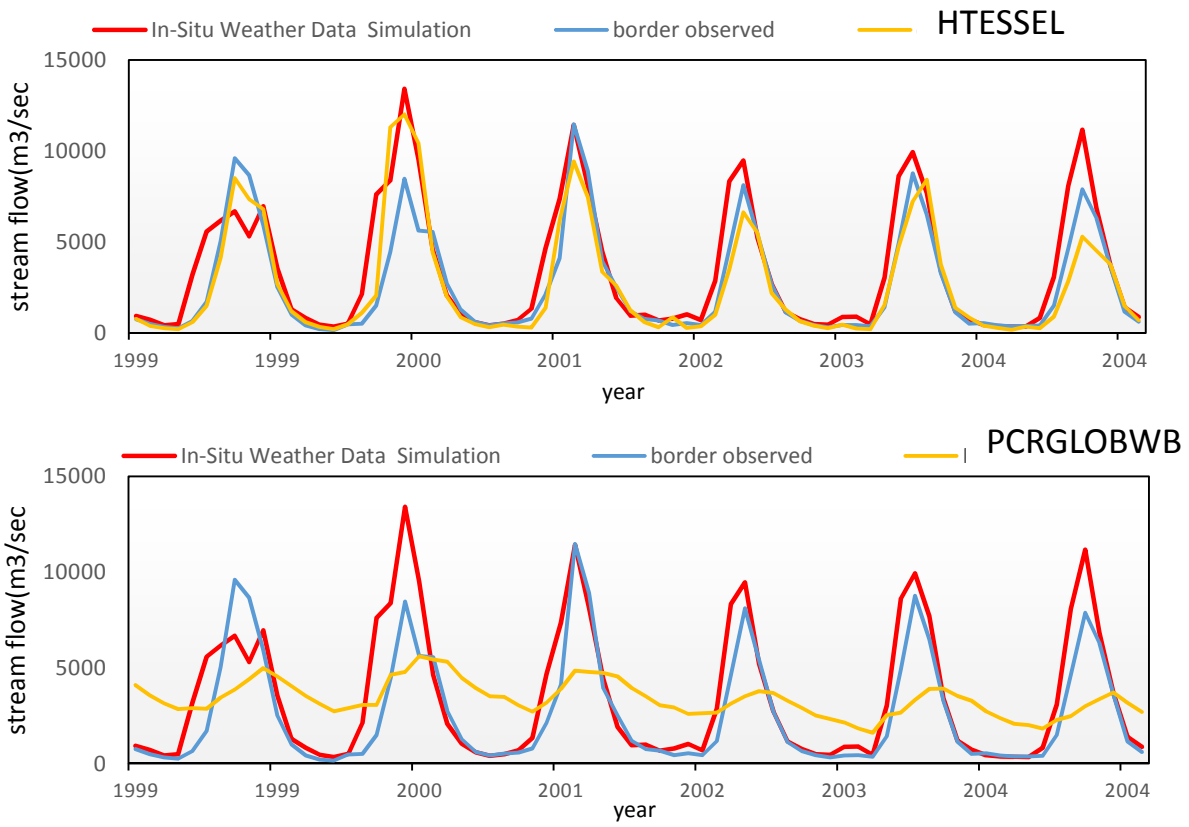
- Ethiopia, Colombia, Bangladesh
  - Comparison modelled with measured discharge
- Mixed results
  - The same model (PCR-GLOBWB) reasonable in one place (Brahmaputra) and the worst in another (Blue Nile)

Preliminary results: WRR-Tier 1 data



Comparison of mean monthly discharge with WRR Tier 1

Preliminary results: WRR-Tier 1 data



Modelled and measured mean monthly discharge, Blue Nile

Preliminary results: WRR-Tier 1 data

- In conclusions
  - WRR Tier 1 not much used yet in case studies
  - Discharge results differ per model
  - Requires in-situ data to select best model

  - Need for more research
  - Model structure, specific conditions, etc.
  - How good is the ensemble median discharge?

Preliminary results: global data

- So, is it useful all those global data?
- I think it is, especially for the data scarce areas
- But what about the end users in the case studies?
  - Will they be happy with the global data?

End-user needs and wishes

- Water managers, policy makers, etc.
  - In most case studies
- In general they want prediction tools
  - Future water resources, optimising water delivery
- But eartH2Observe looks backward (so far)
  - Typical behaviour for hydrologists
  - Similar to social scientists – historians!

Second part of eartH2Observe

- Match end-user needs with E2O research
- Work towards prediction tools:
  - Requires understanding of hydrological systems
  - Provide user-friendly models
  - Provide case study specific scenario's
- Not easy, but we will try!

Thank you!

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www.earth2observe.eu