

# An observation-based approach for global runoff estimation: exploiting satellite soil moisture and GRACE

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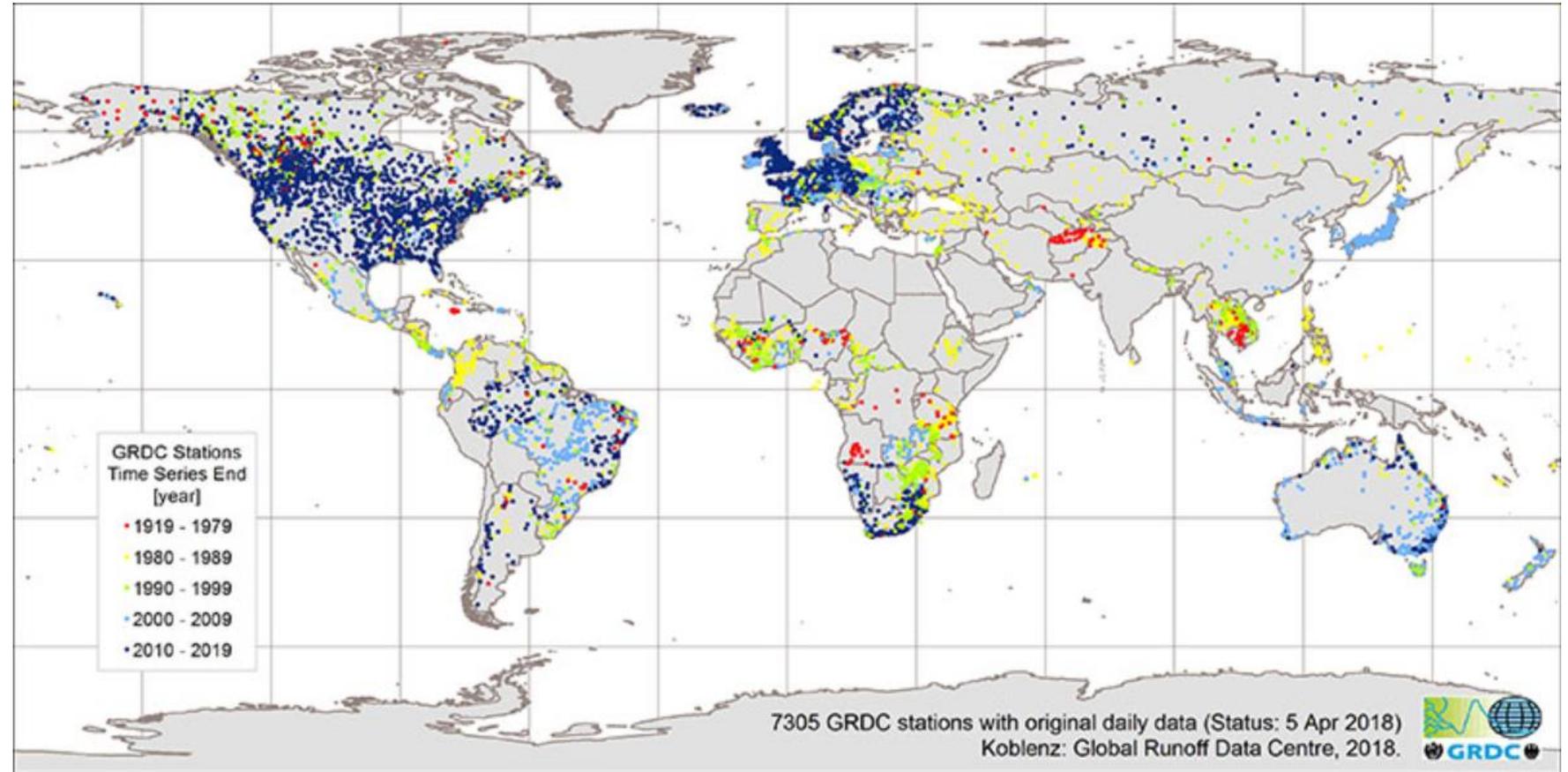


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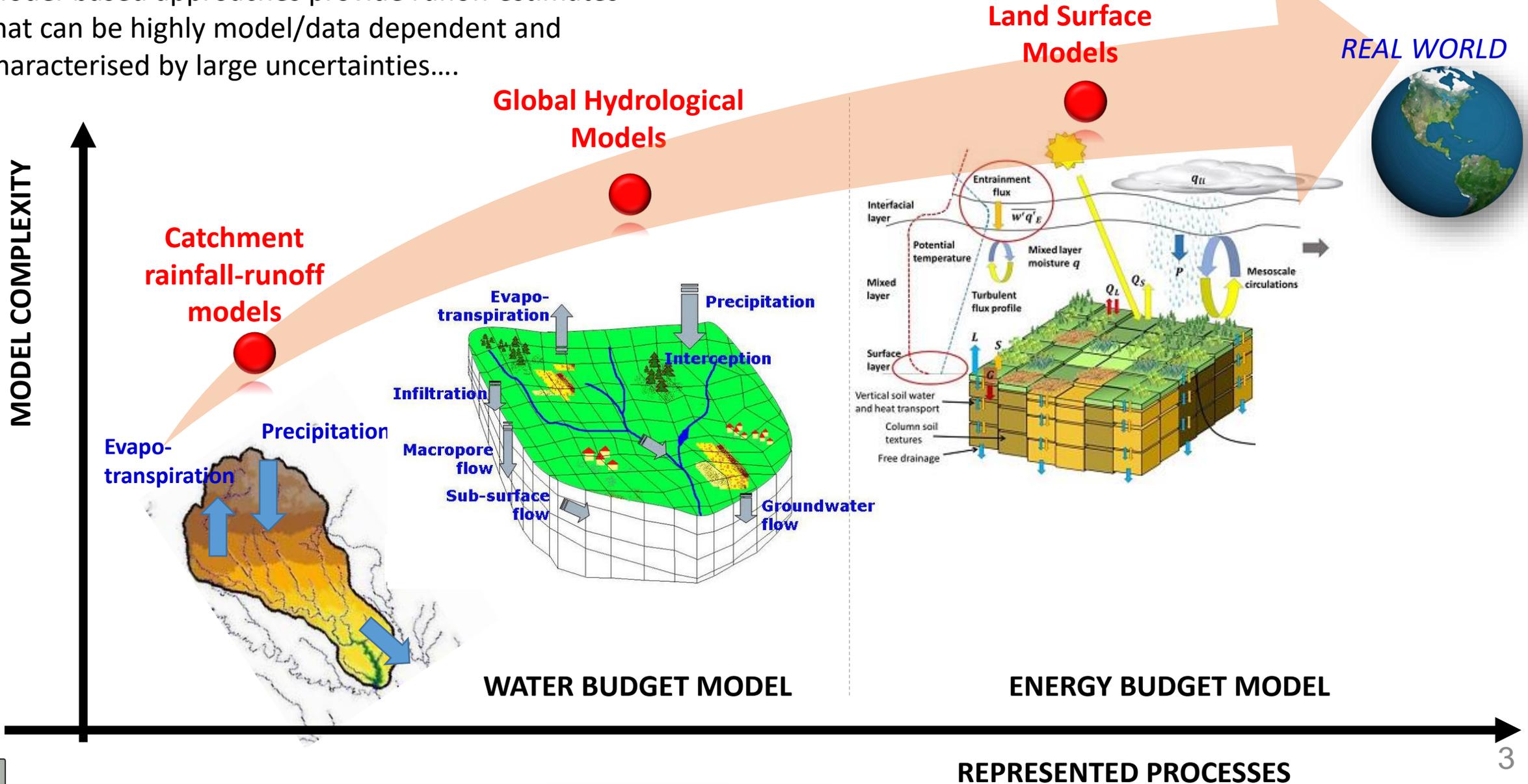
## RIVER DISCHARGE FROM THE TRADITIONAL MONITORING NETWORK

- ❖ Not representative of the global water flow
- ❖ High costs of installation and maintenance
- ❖ Not uniformly distributed in the world
- ❖ Inaccessibility of many remote areas
- ❖ Problems of data sharing among neighbouring countries
- ❖ Reduction of hydrometric stations

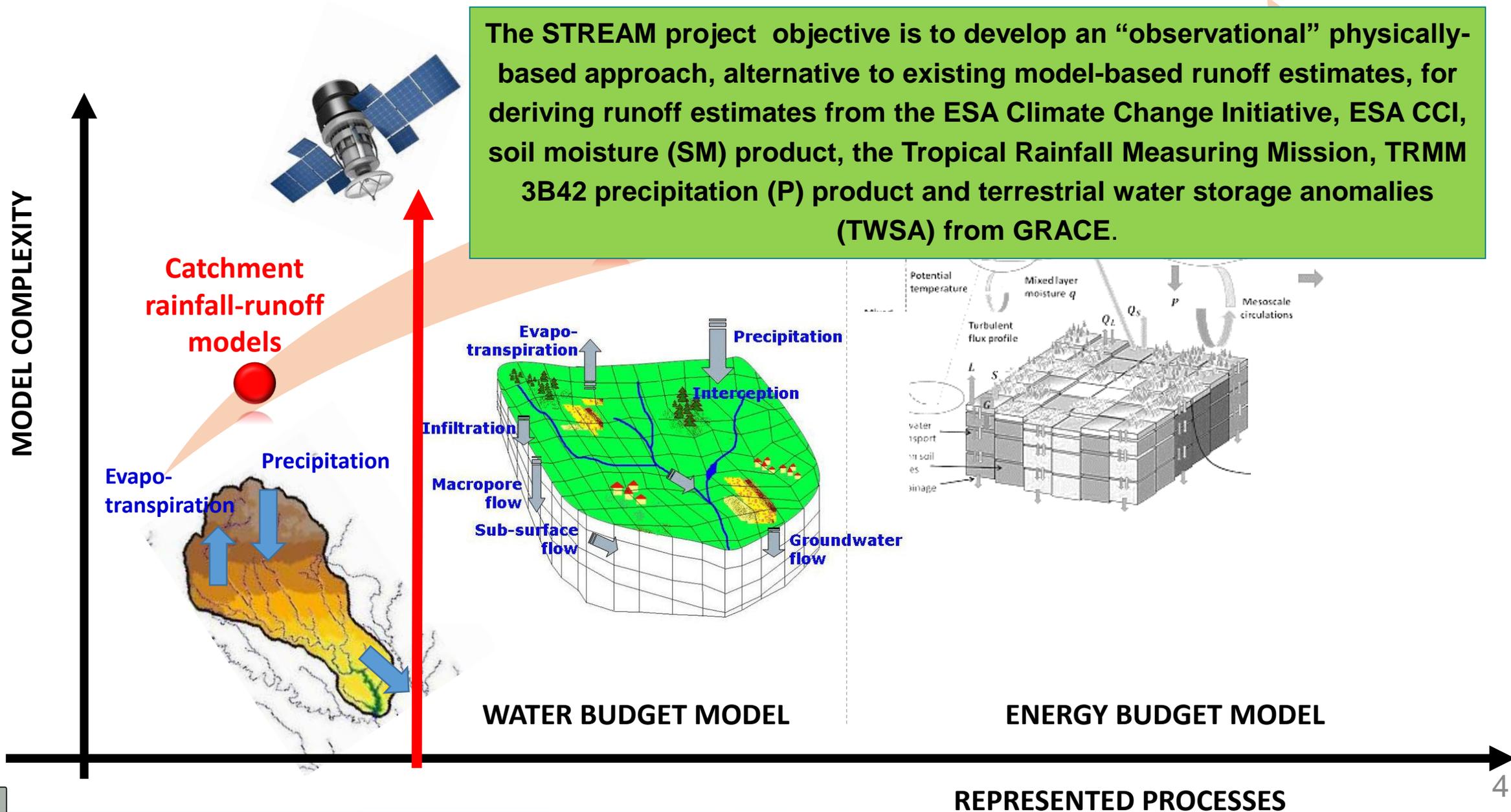


# THE PROBLEM: MODELS

- ❖ Model-based approaches provide runoff estimates that can be highly model/data dependent and characterised by large uncertainties....

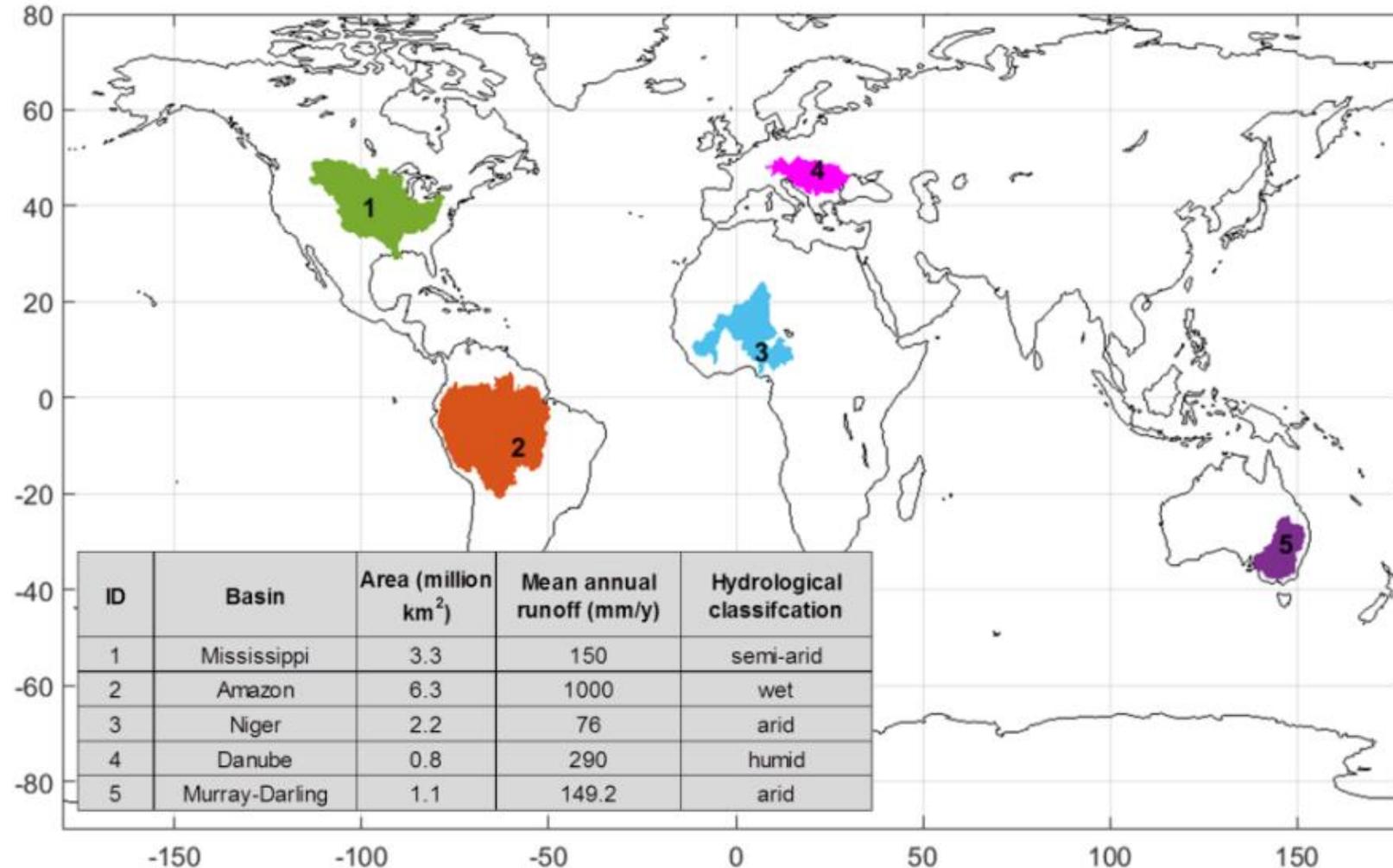


The STREAM project objective is to develop an “observational” physically-based approach, alternative to existing model-based runoff estimates, for deriving runoff estimates from the ESA Climate Change Initiative, ESA CCI, soil moisture (SM) product, the Tropical Rainfall Measuring Mission, TRMM 3B42 precipitation (P) product and terrestrial water storage anomalies (TWSA) from GRACE.

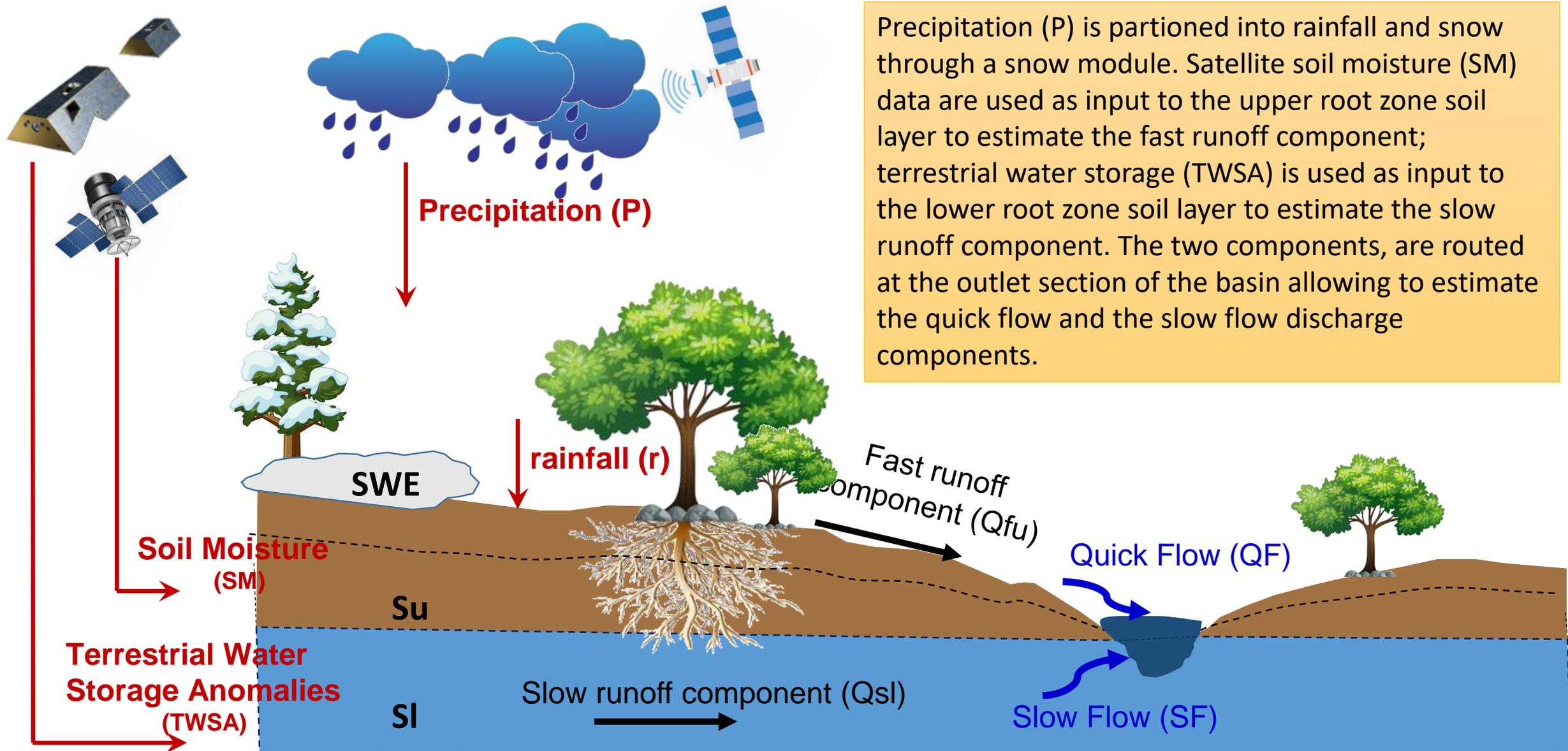


# SaTellite based Runoff Evaluation And Mapping (STREAM) PROJECT

Discharge and runoff estimates have been simulated for the period 2003-2017 at 5 pilot basins across the world (Mississippi, Amazon, Niger, Danube and Murray Darling) characterised by different physiographic/climatic features.



# SaTellite based Runoff Evaluation And Mapping (STREAM) PROJECT

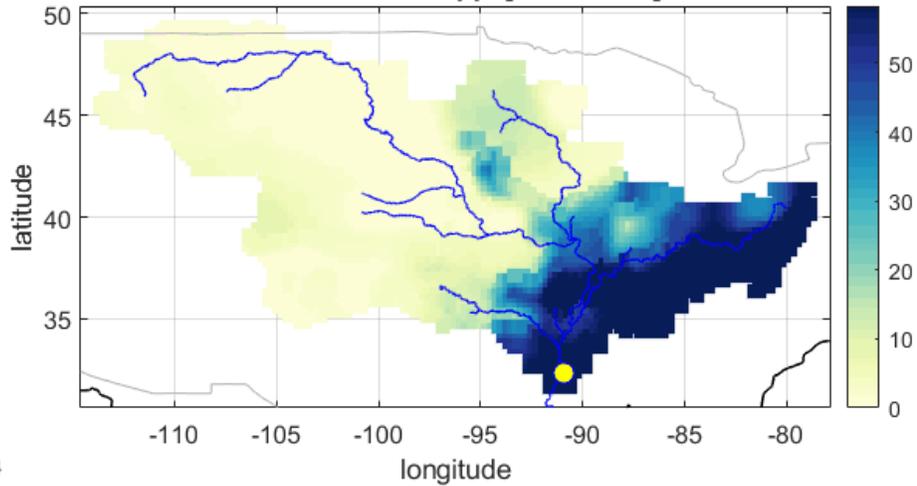


Precipitation (P) is partitioned into rainfall and snow through a snow module. Satellite soil moisture (SM) data are used as input to the upper root zone soil layer to estimate the fast runoff component; terrestrial water storage (TWSA) is used as input to the lower root zone soil layer to estimate the slow runoff component. The two components, are routed at the outlet section of the basin allowing to estimate the quick flow and the slow flow discharge components.

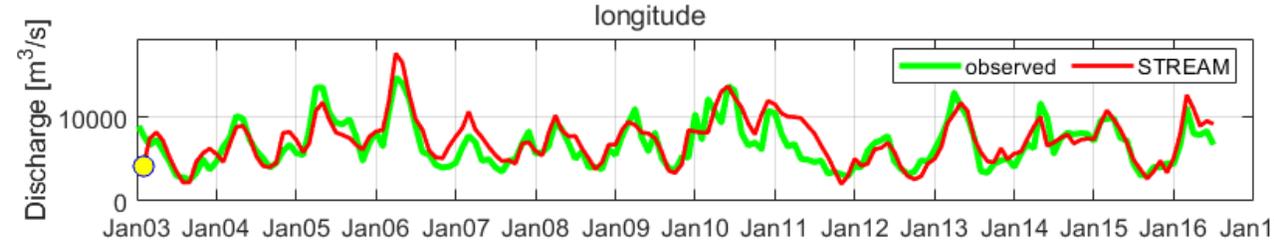
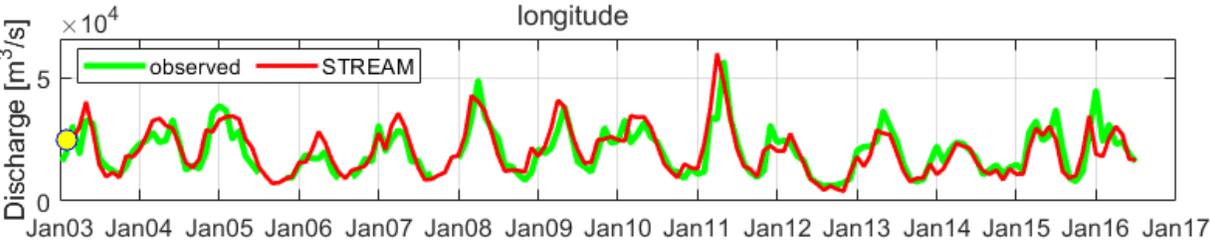
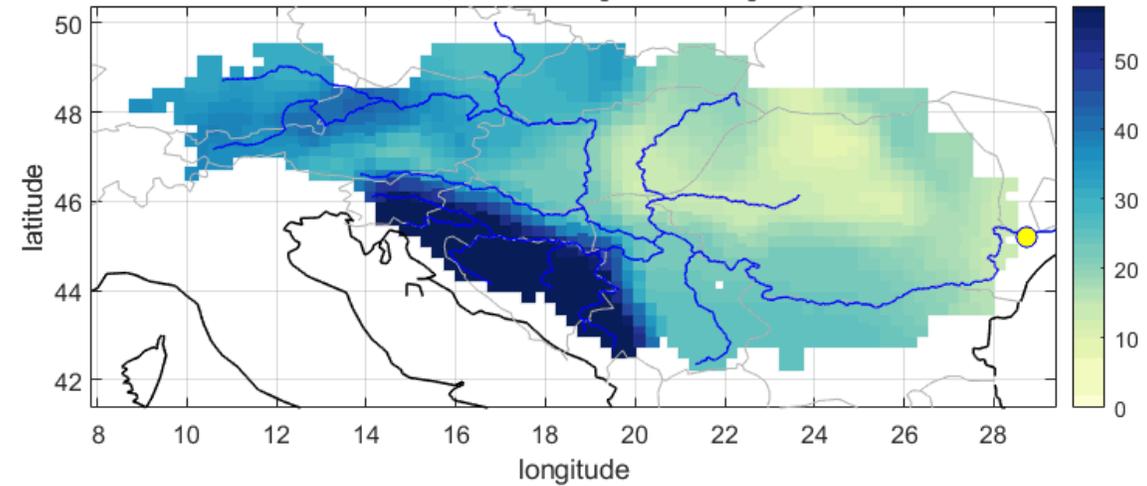
# THE STREAM RESULTS



STREAM Runoff Mississippi [mm/month]: 2003-02



STREAM Runoff Danube [mm/month]: 2003-02



Performance scores in terms of monthly discharge time series for the period 2003-2016

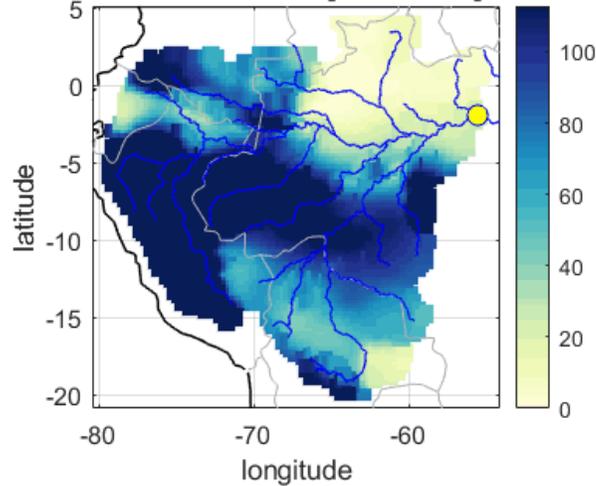
KGE= 0.87; RRMSE =22%; R=0.89

KGE= 0.87; RRMSE =21%; R=0.87

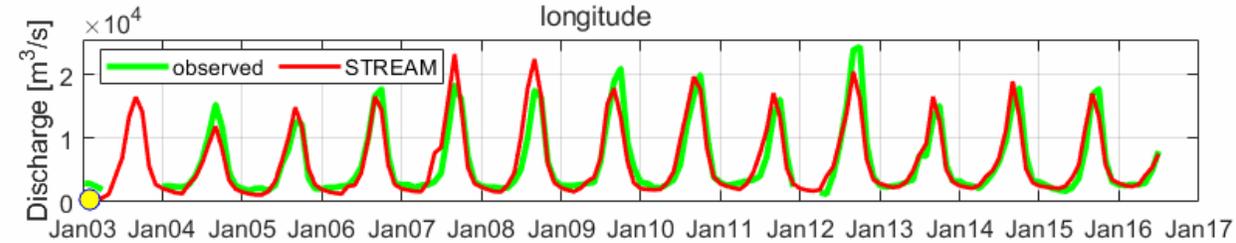
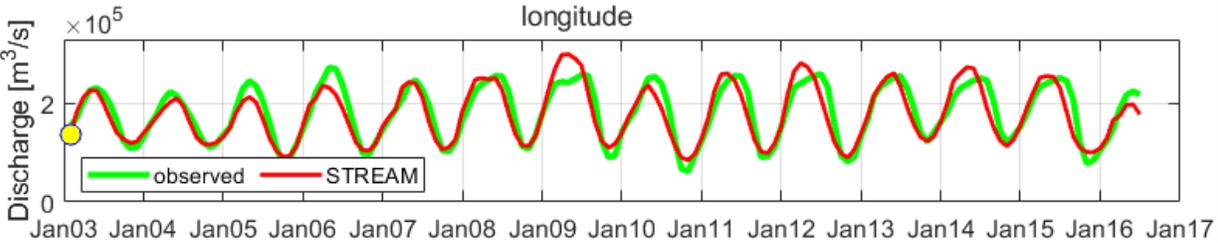
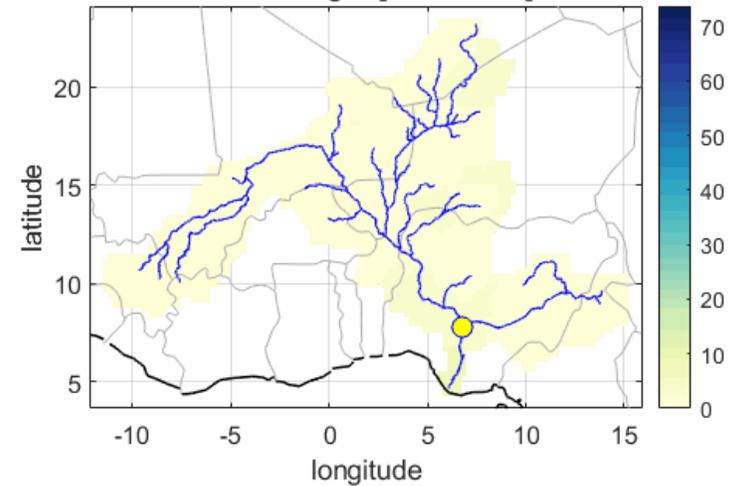
# THE STREAM RESULTS



STREAM Runoff Amazon [mm/month]: 2003-02



STREAM Runoff Niger [mm/month]: 2003-02

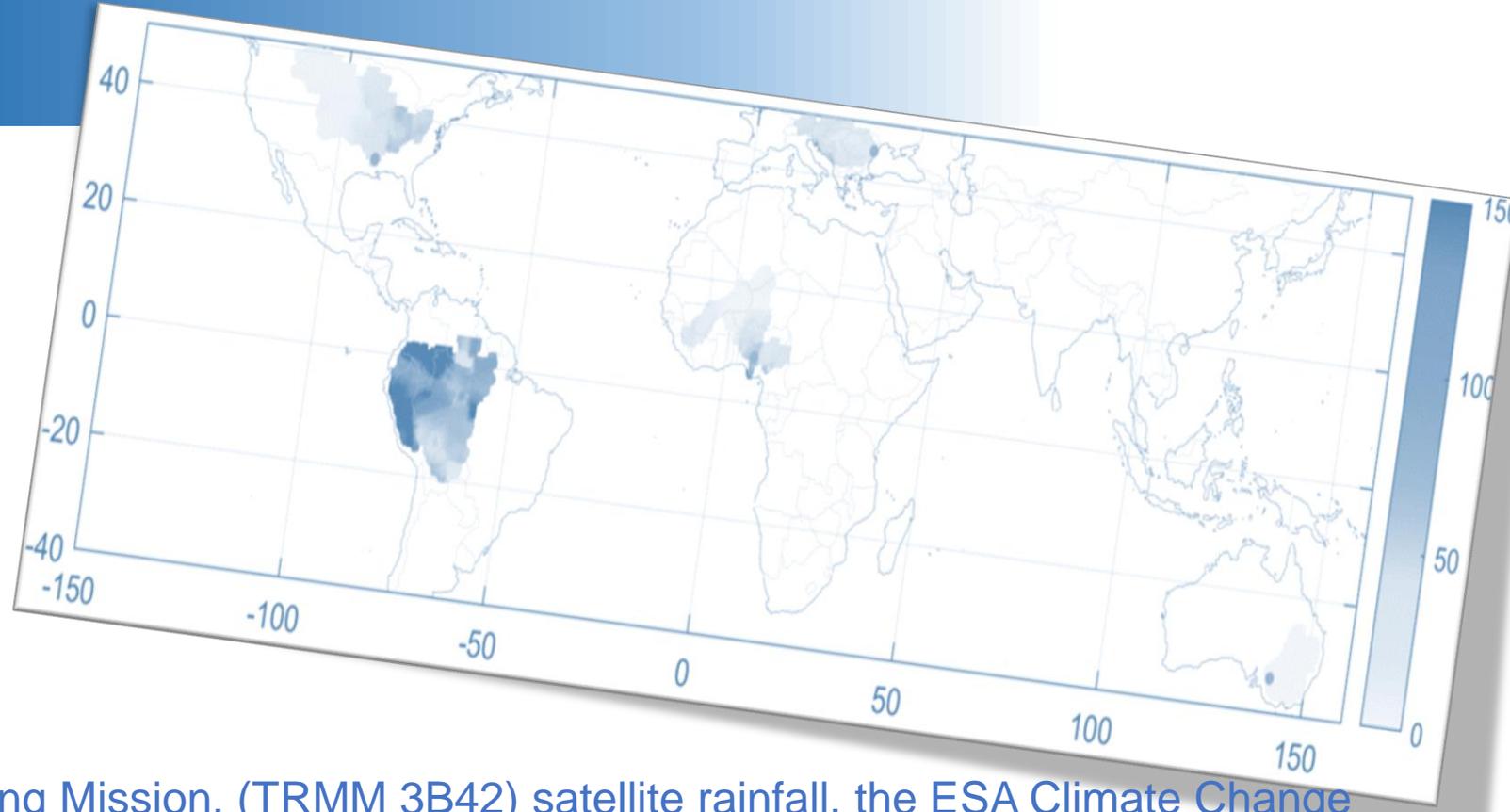


Performance scores in terms of monthly discharge time series for the period 2003-2016

KGE= 0.93; RRMSE =12%; R=0.94

KGE= 0.96; RRMSE =25%; R=0.96

- ❑ An “observational” approach, exploiting space-only observations of Precipitation (P), Soil Moisture (SM) and Terrestrial Water Storage Anomalies (TWSA) to derive total runoff has been developed and validated within the ESA STREAM project.
- ❑ By using the Tropical Rainfall Measuring Mission, (TRMM 3B42) satellite rainfall, the ESA Climate Change Initiative, ESA CCI, soil moisture products and the TWSA time series are obtained from the latest Goddard Space Flight Center’s global mascon model, daily runoff estimates have been simulated for the period 2003-2017 at the closure and inner sections of 5 pilot basins across the world (Mississippi, Amazon, Niger, Danube and Murray Darling) characterised by different physiographic/climatic features.
- ❑ Results proved the potentiality of satellite observations to estimate runoff at daily time scale and at spatial resolution better than GRACE spatial sampling.



# Thank you for for having viewed the slides

"For further information on the STREAM Project, please write to: [stefania.camici@irpi.cnr.it](mailto:stefania.camici@irpi.cnr.it) and visit:

<http://hydrology.irpi.cnr.it/projects/stream>

and

<https://eo4society.esa.int/projects/stream/>

for updates"