Short Project Summary

High resolution precipitation in near-real time from satellites

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Accurate high resolution precipitation information in near real time is critical for sustainable water management in semi-arid regions. This need for high quality precipitation information is in contrast to the observed decrease of in situ measuring gauges worldwide *(Lorenz et al. 2014).* In this context satellite-based rainfall products provide area-wide precipitation observations with high spatio-temporal resolution, which renders them attractive for hydrological management in ungauged basins. This is also true for the semi-arid research regions in the SaWaM project. Therefore, the aim of the subproject was to combine the advantages of second-generation GEO systems and the new GPM IMERG rainfall product to develop regionally adapted rainfall retrieval techniques with high spatio-temporal resolution based on machine learning algorithms.

Methods and Data

The general workflow is depicted in Figure 1. The algorithm is based on the infrared bands of GEO satellites. Random forest models using microwave-only GPM IMERG rainfall data as a reference were developed to (i) delineate the rainfall area and (ii) to assign the rainfall rate. The method was validated against independent MW-only GPM IMERG rainfall data not used for model training.

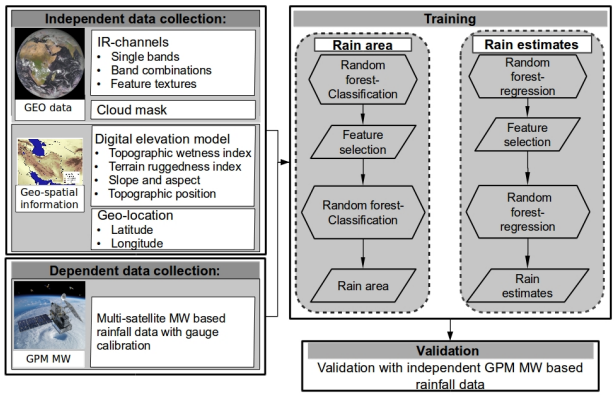

Figure 1: Schematic view of the rainfall retrieval workflow.

Results and Conclusions

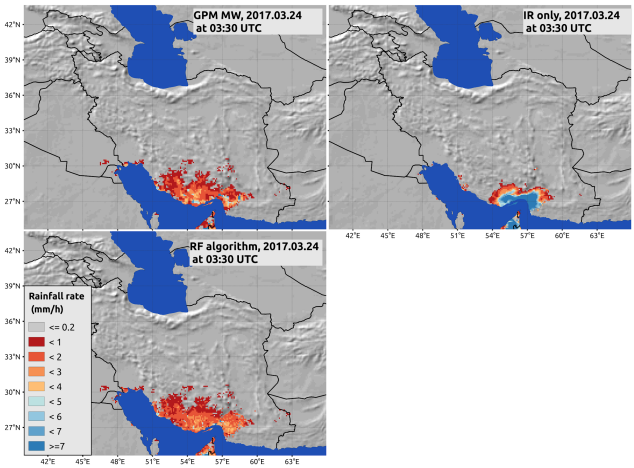

Figure 2: Sample satellite scene from 24 March 2017 03:00 UTC from GPM MW, IR only and the corresponding RF algorithm estimate (Turini, Thies, and Bendix 2019).

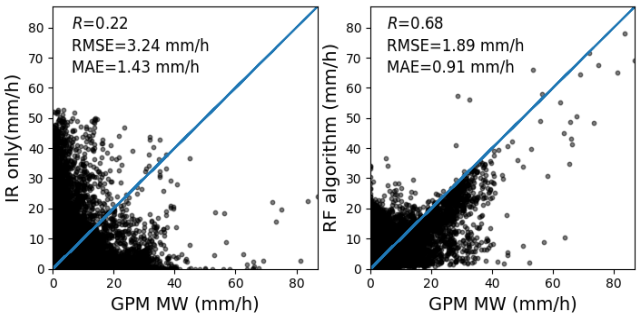

Figure 3: Validation results against independent GPM MW for IR only (left) and RF algorithm (right) for a case study in Iran (February 2017-February 2018).

A new satellite-based technique for precipitation retrieval in high spatio-temporal resolution (2-3 km, 10-15 min) in near real time is presented. The algorithm is based on the infrared bands of second generation GEO satellites. The validation results show a promising performance of the new rainfall retrieval technique, especially when compared to the single IR channel GEO algorithm GPM IMERG IR-only. The algorithm is adapted and applied to the different GEO systems covering the respective research regions in the SaWaM project (Iran, Brazil, Ecuador, Sudan and West Africa) and provides input for hydrological models in the research regions.

References

Lorenz, Christof, Harald Kunstmann, Balaji Devaraju, Mohammad J. Tourian, Nico Sneeuw, and Johannes Riegger. 2014. "Large-Scale Runoff from Landmasses: A Global Assessment of the Closure of the Hydrological and Atmospheric Water Balances." *Journal of Hydrometeorology* 15 (6): 2111–39. https://doi.org/10.1175/JHM-D-13-0157.1.

Turini, Nazli, Boris Thies, and Joerg Bendix. 2019. "Estimating High Spatio-Temporal Resolution Rainfall from MSG1 and GPM IMERG Based on Machine Learning: Case Study of Iran." *Remote Sensing* 11 (19): 2307. https://doi.org/10.3390/rs11192307.