Short Project Summary

Hydro-sedimentological modelling of the river catchments Karun-Dez, Iran, and Rio São Francisco, Brazil

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Besides water scarcity, soil erosion and sediment deposition in reservoirs are among the biggest challenges for water security in semi-arid environments. Hydrological and sedimentological variables are modelled with the Water Availability In Semi-Arid Regions Including Sediment (WASA-SED) model.

Methods and Data

Within SaWaM, the WASA-SED model system was adapted for catchment sizes of the upper mesoscale (Müller et al. 2010, WASA-SED Model 2020).

Necessary input data for model set up and parametrization (e.g. DEM, land-cover, soil, waterbodies) originate predominantly from globally available open-source data. Observed runoff and sediment data for model validation and calibration were provided by local SaWaM-project partners.

Pre-processing of climate data for model input includes, e. g., the aggregation of rainfall P from different sources to areal means for gridded P products compared to interpolation to sub-catchment from observed P station data.

Results and Conclusions

Hydro-sedimentological modelling was carried out for the catchments of Karun-Dez, Iran (ca. 60 200 km²), and Rio São Francisco, Brazil (ca. 743 000 km²) (e. g. Smetanová et al. 2020). Analyses of runoff and sediment dynamics show, that different precipitation (P) products may vary significantly. Observed P station data in the target areas pose challenges for modelling, too, due to lacks of spatial and temporal coverage or additional uncertainty introduced by the chosen interpolation method and parameters.

Novel sediment model results are possible for the target regions, given reliable rainfall information. For hydro-sediment modelling, ERA5-Land climate data proved as the most adequate model driver, due to a high spatial resolution (0.1°), availability of all required model input climate variables, and reasonable results for runoff (validation with observed runoff data).

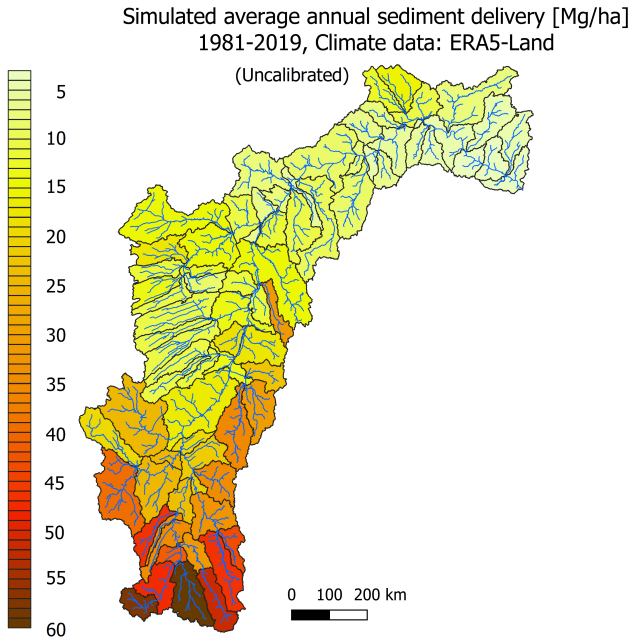

Figure 1: Modelled average annual Sediment delivery, São Francisco Basin, Brazil

We stress the importance of good quality regional climate and physiographic data for any model setup, calibration, and validation. Using ensembles of different data sources may enhance robust results. Documentation of extensive data (pre-)processing and open-source publication of data and software are of high importance for result reproducibility.

Both catchments of Karun-Dez, Iran, and Rio São Francisco Basin, Brazil, are characterized by intense water management and a high number of hydraulic structures. Reservoir sedimentation poses a high, yet underrated risk for water security, e. g. endangering water supply and hydroelectric water power generation.

Field measurements (such as reservoir bed level changes) and modelling can provide valuable information for quantifying reservoir sedimentation and reservoir life time.

In order to decrease sedimentation rates, a sustainable and long-term catchment management is required (Müller et al. 2020).

References

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Smetanová, A., Müller, A., Zargar, M., Suleiman, M. A., Gholami, F. R., Mousavi, M. (2020) Mesoscale Mapping of Sediment Source Hotspots for Dam Sediment Management in Data-Sparse Semi-Arid Catchments, *Water* **12**(2), 396, doi: 10.3390/w12020396

WASA-SED Model (2020) WASA-SED Model documentation, source code, and data example, c/o Till Francke, Universität Potsdam, Karl-Liebknecht-Str 24-25, 14473 Potsdam, Germany, GitHub repository, https://github.com/TillF/WASA-SED