How can hydrological modeling help to understand process dynamics in sparsely gauged tropical regions – case study Mata Âtlantica, Brazil

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To ensure long-term water security for domestic, agricultural and industrial use in the emerging country of Brazil with fast-growing markets and technologies, understanding of catchment hydrology is essential. Yet, hydrological analysis, high resolution temporal and spatial monitoring and reliable meteo-hydrological data are insufficient to fully understand hydrological processes in the region and to predict future trends. Physically based hydrological modeling can help to expose uncertainties of measured data, predict future trends and contribute to physical understanding about the watershed.

The Brazilian Atlantic rainforest (Mata Atlântica) is one of the world's biodiversity hotspots. After the Portuguese colonization, its original expansion of 1.5 million km^2 was reduced to only 7% of the former area. Due to forest fragmentation, overexploitation and soil degradation, pressure on water resources in the region has significantly increased. Climatically, the region possesses distinctive wet and dry periods. While extreme precipitation events in the rainy season cause floods and landslides, dry periods can lead to water shortages, especially in the agricultural and domestic supply sectors. To ensure both, the protection of the remnants of Atlantic rainforest biome as well as water supply, a hydrological understanding of this sparsely gauged region is essential.

We will present hydrological models of two meso- to large-scale catchments (Rio Macacu and Rio Dois Rios) within the Mata Âtlantica in the state of Rio de Janeiro. The results show how physically based models can contribute to hydrological system understanding within the region and answer what-if scenarios, supporting regional planners and decision makers in integrated water resources management.