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Augmenting the meso-scale hydrological model (mHM) for seasonal forecasting of lake-hydrology systems

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It is expected that by the first quarter of the 21^{st} century approximately 1.8 billion people will suffer from absolute water scarcity. This is especially true for semi-arid regions where large fluctuations in annual precipitation are observed. Seasonal water management and storage is the key and the challenge in such regions. Seasonal water management with natural and/or artificial storage requires seasonal hydrological forecast, with tools having the capacity to simulate complex lake-regulated hydrology. The meso-scale hydrological model (mHM), a well established scale-independent hydrological model, is augmented with a new lake module for the task.

As a part of the Seasonal Water Management (SaWaM) project, the experiments are set in multiple semi-arid regions of the world having lake hydrology systems. The lake module is intended to fit the observations independent of model spatial resolution, upholding the multi-scale paradigm of mHM. The proposed multi-scale lake model (mLM) delineates natural or man-made lakes (reservoirs) based on the fine morphology input (ℓ_0, 0.2 – 1 km). Apart from the basic lake water balance, mLM includes design-based reservoir spill calculations, the possibility to incorporate inter basin water transfers, and dynamic volume-area relationships due to sedimentation and sluicing. These additional features of mLM allow to forecast reservoir storages at seasonal time scales in semi-arid regions (e.g., Karun in Iran and Sao Francisco in Brazil).

This proof-of-concept aims at exploring the potential alternatives to implement and to parameterize the mLM module into mHM, to investigate pros-and-cons of the various alternatives and to evaluate the benefits of using satellite altimetry to parameterize mLM.