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Using SMOS for validation and parameter estimation of a large scale hydrological model in Paraná river basin

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Large scale representation of soil moisture conditions can be achieved through hydrological simulation and remote sensing techniques. However, both methodologies have several limitations, which suggests the potential benefits of using both information together. So, this study had two main objectives: perform a cross-validation between remotely sensed soil moisture from SMOS (Soil Moisture and Ocean Salinity) L3 product and soil moisture simulated with the large scale hydrological model MGB-IPH; and to evaluate the potential benefits of including remotely sensed soil moisture for model parameter estimation. The study analyzed results in South American continent, where hydrometeorological monitoring is usually scarce. The study was performed in Paraná River Basin, an important South American basin, whose extension and particular characteristics allow the representation of different climatic, geological, and, consequently, hydrological conditions. Soil moisture estimated with SMOS was transformed from water content to a Soil Water Index (SWI) so it is comparable to the saturation degree simulated with MGB-IPH model. The multi-objective complex evolution algorithm (MOCOM-UA) was applied for model automatic calibration considering only remotely sensed soil moisture, only discharge and both information together. Results show that this type of analysis can be very useful, because it allows to recognize limitations in model structure. In the case of the hydrological model calibration, this approach can avoid the use of parameters out of range, in an attempt to compensate model limitations. Also, it indicates aspects of the model were efforts should be concentrated, in order to improve hydrological or hydraulics process representation. Automatic calibration gives an estimative about the way different information can be applied and the quality of results it might lead. We emphasize that these findings can be valuable for hydrological modeling in large scale South American basins, where soil moisture or even hydrometeorological monitoring can be very scarce.