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Estimating groundwater storage changes for major river basins in France using a regional groundwater data set

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The German Research Unit GlobalCDA has the goal to improve the predictive skills of hydrological models by combining remote sensing information using a calibration/data assimilation (C/DA) approach. In order to validate model results and to assess the success of the C/DA efforts, independent data sets are crucially needed, such as in-situ groundwater observations to assess the ability of the model to describe groundwater storage changes. The main challenge arising from such comparisons is to capture basin-scale groundwater storage from a set of in-situ GW observations settled in highly heterogeneous lithologies with irregular & non-homogeneous sampling. Furthermore, the conversion from groundwater (GW) level measurements to storage variations requires information on specific yield, ideally given site-specific for each monitoring well. However, this information is largely not available and difficult to estimate in areas with highly heterogeneous geology.

In our study we use a data set of groundwater level observations at about 3000 groundwater monitoring wells in France. Based on a high-resolution hydro-geological information system provided by the French geological survey (BRGM) and water authorities (BDLISA), we assign the borehole data to individual hydro-geological units. For the upscaling to river basin averages, we (i) aggregate the measurements that originate from the same unit and (ii) account for the areal fractions of the hydro-geological units within the river basin. For the interpretation of GW level variations to GW storage changes, we tested several approaches to estimate specific yield values for the individual hydro-geological units. Wherever possible, we use the specific yield values explicitly provided in the BDLISA data base, mostly estimated from pumping test analysis. When not available, we assign literature-based specific yield values based on the detailed lithological information provided for each unit. This method is compared to global porosity information provided by low resolution geological data from GHYLMPS (Gleeson et al., 2014)

Besides presenting the methodological approach, this presentation shows the resulting groundwater storage time series, averaged for individual river basins in France and for individual 0.5° grid cells. Additionally, comparisons to simulated groundwater storage variations of the WaterGAP Global Hydrology Model (WGHM) will be presented. We discuss the sensitivity of basin

averaged GW storage time series to different choices of specific yield for individual boreholes.