

Do GNSS stations see daily hydrological variability over Europe?

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Seasonal and long-term hydrology-induced deformations have been frequently identified in GNSS time series using monthly observed and/or modeled total water storage (TWS) time series. In contrast, short-term (daily) hydrological water mass change has not been assessed due to limited quality and resolution of hydrological models, and is disregarded in GRACE (GRACE-FO) dealiasing. Recently, we assimilated monthly GRACE TWS observations into the Community Land Model version 3.5 (CLM 3.5) over the European CORDEX domain using the Parallel Data Assimilation Framework (PDAF) in order to produce best estimates of terrestrial water storage with high spatial resolution (12 km) at daily time scale.

The assimilated model allows to investigate daily load-induced deformations in Europe where rain events occur frequently inducing sub-monthly mass changes with small-scale spatial patterns. We evaluated daily time series of vertical displacement from more than 700 GNSS stations for the period 2003-2010 and corrected the data set for the effects of atmospheric and oceanic loading using models consistent with GRACE AOD1B products.

The separation of sub-monthly hydrological variability from GNSS measurements is relevant i) with respect to the analysis of other geophysical signals, ii) when addressing the option of using the rapidly growing number of GNSS stations over Europe together with GRACE (GRACE-FO) data and hydrological models for improving our knowledge about the hydrological cycle, and iii) for improved dealiasing products for GRACE-FO or GRACE reprocessings.