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Investigation on Inter Cell Correlations of GRACE monthly solutions over the globe

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The correlations of aggregated GRACE signal time series between different catchments (Inter Catchment Correlation) show a specific pattern mainly created by the periodic local climatic conditions. Inter Catchment Correlations of monthly residuals of GRACE signals - monthly values minus mean monthly values - show a sinusoidal dependence on latitude. This is surprising as monthly mass residuals on landmasses are supposed to originate from monthly water balance variations and correlations of climatic variability over the hemispheres are not expected. Monthly residuals of corresponding hydrologic storage changes (P-Eta-R) and atmospheric storage changes from moisture flux divergence (-divQ-R) do not show comparable correlation patterns. In fact, there is not enough runoff data available to certainly verify that there is no hydrological correlation existing for catchments on different hemispheres. Hence, an extension from catchments to a global coverage is needed in order to recognize differences between landmasses and oceans. Therefore, grid based (5°x5°) time series are generated and correlated with respect to a reference cell. The spatial distribution of Inter Cell Correlations (ICC) of monthly GRACE signals reflect landmasses and oceans while ICC of monthly residuals doesn't show any reflection of landmasses and oceans. Instead, a dominant latitudinal and less dominant longitudinal dependence over the globe can be recognized. This means that there must be a signal component in the monthly GRACE residual over the globe not depending on the specific characteristics of landmasses and oceans. Neither its form nor origin is recognized so far, and thus is deteriorating the signal quality for hydrology and oceanography.
The objective of this investigation is to identify this signal component in the GRACE residual and check possible sources. As possible sources of ICC, GRACE outliers and de-aliasing products are considered and EOF analysis is applied to identify possible modes responsible for the ICC.