Geophysical Research Abstracts
Vol. 18, EGU2016-3003, 2016
EGU General Assembly 2016

A century-long simulation of terrestrial water storage change and its contribution to global sea-level

Marc F.P. Bierkens (1,2), Joyce Bosmans (1), Inge de Graaf (3), Edwin Sutandjaja (1), Oliver Schmitz (1), Yoshihide Wada (4,5,1), Niko Wanders (6), and Ludovicus P.H. van Beek (1)

(1) Utrecht University, Physical Geography, Utrecht, the Netherlands (m.f.p.bierkens@uu.nl), (2) Deltares, Utrecht, the Netherlands, (3) Colorado School of MInes, (4) NASA Goddard Institure for Space Studies, New York, U.S.A., (5) Columbia University, New York, U.S.A., (6) Princeton University, Civil and Environmental Engineering , Princenton N.Y., U.S.A.

Although limited, the contribution of terrestrial water storage (TWS) change to sea-level change is significant enough to be taken into account in sea-level attribution studies. Thus, after being absent in a previous report, TWS was again one of the components taken into account in IPCC assessment report 5. TWS can be effectively observed by analysing gravity anomalies from the GRACE mission or by observing individual components with lidar (surface water level), geodetic surveys (groundwater) and space borne passive and active microwave sensors (soil moisture, snow water equivalent). However, these observation only yield time series of limited length making it difficult to estimate long term trends in TWS as multi-decadal variations. We present the results of a century-long (1900-2014) simulation of TWS change with PCR-GLOBWB 2.0 that is fully coupled with a global two-layer groundwater model. In this simulation we include the effects of land cover change, the building of reservoirs and human water use (abstraction from surface and groundwater, water consumption and return flows). The effects of wetland drainage and siltation of reservoirs is corrected for afterwards. We validate TWS estimates for the period 2003-2010 with GRACE estimates. Trends of TWS and its effects on sea-level change are estimated and the main contributions (humans and climate)identified. Similarly, we examine multi-year variability in TWS and sea-level change in relation to climate variability. Our results show a significant positive trend in TWS due to a trend in precipitation over the first half of the 20th century. In the second part of the 20th century trends in TWS due to dam impoundment and groundwater depletion are evident. Finally, large anomalies, in the order of 5 cm sea-level equivalent, can be seen as a result of interannual climate variability.