Geophysical Research Abstracts
Vol. 21, EGU2019-10475, 2019
EGU General Assembly 2019

How much global flood risk increase can be expected from soil subsidence?

Hessel Winsemius (1,2), Gilles Erkens (2,3), Philip Ward (4), Edwin Sutanudjaja (3), Marc Bierkens (3), Timothy Tiggeloven (4), Dirk Eilander (2,4), Eskedar Gebremedhin (2), Charles Iceland (5), and Tianyi Luo (5)

(1) TU Delft, Faculty of Civil Engineering and Geosciences, Water Resources Management, Delft, Netherlands (h.c.winsemius@tudelft.nl), (2) Deltares, Delft, The Netherlands, (3) Utrecht University, Utrecht, The Netherlands, (4) VU Amsterdam, Institute for Environmental Studies, Amsterdam, The Netherlands, (5) World Resources Institute, Washington D.C., United States

Over the last few years, global coastal flood risk assessments have been conducted using a combination of weather reanalyses, coastal tide and surge models, sea level rise scenarios, inundation and impact models. Soil subsidence has not received much attention in these scenarios, even though subsidence rates are expected to be high in many urban zones in delta areas, where most of the costs of flooding are expected.

In this contribution, we globally assess how much, and where soil subsidence due to groundwater abstractions contributes significantly to increases in flood risk expressed as urban damage, and how this compares against other drivers of this increase, including sea level rise and socio-economic growth. To establish subsidence rates, we computed long-term transient simulations of global groundwater heads using the global MODFLOW groundwater model. The groundwater heads were used to force a state-of-the-art global scale subsidence model, schematized within the iMOD SUB-CR code using global lithology datasets, leading to a subsidence rate estimate. We then use global scale inundation maps, derived from the Global Tide and Surge Model, and socio-economic impact modelling to assess present day flood risk, as well as future flood risk under different scenarios. We considered the different risk drivers in isolation, as well as in combination to disentangle their individual and combined contribution to flood risk growth.

Results show that in countries that include low lying urban centers, situated on weak soils, subsidence rates can contribute substantially to a country's flood risk, within the same order of magnitude as sea level rise. As subsidence is caused by local abstractions of groundwater, this implies that these countries may prioritize water resource management interventions to reduce subsidence and consequent increases in flood risk.