EGU2020-5180, updated on 25 Oct 2020
https://doi.org/10.5194/egusphere-egu2020-5180
EGU General Assembly 2020

Global soil water estimates as landslide predictor: the effectiveness of observations, simulations and data assimilation results

Anne Felsberg[1], Gabriëlle De Lannoy[1], Manuela Girotto[2], Jean Poesen[1], Rolf Reichle[3], and Thomas Stanley[3]
[1]KU Leuven, Belgium (anne.felsberg@kuleuven.be)
[2]UC Berkeley, CA, USA
[3]NASA Goddard Space Flight Center, USA

Hydrological triggering of landslides is strongly connected to the water content of the soil. Previous local studies showed that the inclusion of predisposing soil hydrological conditions, such as soil moisture, improved the landslide prediction abilities over using rainfall only as predictor variable. Existing global models that predict landslides however still mostly rely on antecedent rainfall indices as a proxy for soil moisture conditions, because global precipitation data has been more readily available than soil moisture data. Soil moisture data are now available from satellite observations or modeling, or combinations thereof (data assimilation). Our research seeks to quantify to which extent global landslide prediction can benefit from these data products.

To tackle this question, we examined soil hydrological conditions at the times and locations of known landslide occurrences (Global Landslide Catalog, Kirschbaum et al. 2015). More specifically, we investigated soil moisture estimates retrieved from the Soil Moisture Ocean Salinity (SMOS) mission, simulated by the Catchment Land Surface Model (CLSM), or resulting from assimilation of SMOS or Gravity Recovery And Climate Experiment (GRACE) data into CLSM.

A first coarse-scale, univariate global analysis for the years 2011 through mid-2016 indicates that soil moisture and total water storage estimates are adequate alternatives for antecedent rainfall indices to predict landslides. In particular, the assimilation of SMOS or GRACE data into CLSM improves root-zone soil moisture and preferentially increases root-zone soil moisture at landslide events. Whereas both assimilation schemes help to predict landslides based on an increased landslide probability with increased water content, the SMOS or GRACE satellite observations alone (that is, without data assimilation) are too sparse, noisy or coarse to clearly distinguish the different hydrological conditions between landslide and non-landslide events.