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Resolving the Daily Water Cycle over Land with a Geosynchronous C-band Radar Satellite

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Observing and understanding processes of the daily water cycle (DWC) over land with a high spatial resolution is one of the outstanding grand challenges in Earth Observation (EO). This challenge has been taken up by the G-Glass mission, which is a geosynchronous C-band radar satellite that was recently selected by ESA as one of the candidate mission for its 10th Earth Explorer. Among other variables, G-Class will observe soil moisture and precipitation, which are key to understand the DWC. Both variables can be retrieved from spaceborne radar observations in a sequential manner: Firstly, soil moisture can be estimated by inverting a backscatter model that describes the interaction of the microwave pulses with the vegetation and soil surface. Secondly, precipitation can be derived from the soil moisture data by inverting a soil water balance model. Research has already demonstrated the feasibility of this approach, and a number of operational services do exist (for soil moisture) or are about to be introduced soon (for precipitation). However, existing services do not properly resolve the DWC as they rest on polar-orbiting radar satellites that capture soil moisture at best twice a day at their ascending and descending passes respectively. Even though daily rainfall can be estimated from such data, estimates remain rather noisy. To more densely sample soil moisture across one day, and to reduce the noise in the daily rainfall estimates it is essential to collect several backscatter measurements per day. This may be achieved, as proposed by G-Class, by a geosynchronous satellite that observes the same land surface areas every few hours (1-3 hours). In this presentation the current planning for C-Glass will be reviewed. Furthermore, we will discuss expected strengths and limitations of G-Class based on results obtained with METOP ASCAT and Sentinel-1 that measure, like G-Class, backscatter at C-band.