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Assessing prospects of sub-daily radar-observations to improve the understanding of soil- and vegetation dynamics.

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The geosynchronous C-band SAR mission Hydroterra (initially called G-CLASS) is one of three candidate missions for ESA's upcoming Earth Explorer 10 programme (scheduled for launch in 2027-2028). While current available satellite-borne C-band radar instruments have a rather long re-visit time (ASCAT METOP A,B,C: daily, Sentinel-1 A,B: 3-6 days), the fact that the Hydroterra satellite would be in a geosynchronous orbit opens the possibility for a C-band radar dataset with much finer temporal resolution. The image-formation process and operations concept incorporated within the Hydroterra system however requires choices of spatial and temporal resolution of the final product.

The presented experiment is intended to highlight potential benefits associated with high temporal sampling of Hydroterra observations for the understanding of daily and sub-daily soil-moisture and vegetation processes. In order to generate a backscatter dataset that simulates observations at high temporal resolution, a parametric first-order radiative transfer model (RT1) [1] is first calibrated with incidence-angle dependent Sentinel-1 C-band backscatter data as well as auxiliary soil-moisture (SM) and leaf-area-index (LAI) timeseries provided by the SURFEX-ISBA [2] land-surface model over south-western France. Once the model-parameters are obtained, a simulated backscatter timeseries at high temporal resolution is generated by performing a forward-simulation using the retrieved model-parametrizations and auxiliary SM and LAI datasets at hourly intervals.

The simulated dataset is then used (in conjunction with the LAI dataset) to simulate a retrieval of SM under a set of possible observation conditions, e.g. varying soil- and vegetation properties (represented via the RT1 model parameters), different temporal resolutions (1,3,6,12 hourly), incidence-angles and noise-levels. In a final step, the obtained SM retrievals from the simulated dataset are used to assess the effects on rainfall estimates obtained via the SM2RAIN [3] algorithm.

The outcome of those simulations is intended to help quantifying the choices of spatial and

temporal resolution for the Hydroterra mission concept from a soil properties applications point of view.

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