



SLAINTE: A sub-daily (In)SAR mission idea to study vegetation water, health and carbon

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Changes in sub-daily vegetation water content capture the pulse of the Earth's ecosystems. They reflect the interplay between plant function, evaporation, and soil moisture, and underpin land-atmosphere exchange of water and carbon from leaf to global scales. Current and planned microwave missions provide a snapshot every few days. These are adequate to observe inter- and intra-annual variations of above ground biomass (AGB), the slow response in water status over weeks and months, and to map (a-posteriori) biomass loss due to deforestation or mortality. However, they are not sufficient to capture the sub-daily, or even daily, dynamics needed to study ecosystem health.

The SLAINTE (Irish for *health*) mission aims to fill this critical observation gap at sub-daily scales enabling us to “zoom in” on the fast dynamics associated with water status. Sub-daily observations of VWC are needed to study the vegetation response to the daily cycle in vapour pressure deficit (VPD), the impact of stomatal regulation, and the rate at which vegetation is able to recharge VWC lost during the day. They reveal how ecosystems respond to biotic and abiotic stress (e.g. changing temperature and vapour pressure deficit, soil moisture, insects, disease) and disturbances (e.g. drought, fire). Observing these processes is critical to understand the resilience of terrestrial ecosystems and their water resources in the face of increasing climate variability and extremes, and pressures from human land and water use. The availability of sub-daily SAR data would also

fill a critical gap in Earth system knowledge where observations of rapid changes in SSM are essential. For example, they would allow us to observe short-lived wetting/drydown events associated with irrigation, triggering and evolution of flash floods and shallow landslides and the development of hazardous storms.

SLAINTE comprises a small constellation of monostatic L-band Synthetic Aperture Radars (SAR) that will provide sub-daily, ≤ 1 km scale observations related to ecosystem water status. It has been developed as one of ESA's New Earth Observation Mission Ideas and was recently submitted in response to ESA's call for the 12th Earth Explorer. Here, we will provide an overview of the SLAINTE mission idea, our ambitions, and an overview of preliminary science studies. We hope to stimulate discussion with the wider EGU community on how the provision of routine, sub-daily (In)SAR observations could be exploited to address the scientific challenges across the geosciences.