

30th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)  
Small Earth Observation Missions (4)

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## DEVELOPMENT OF THE HYDROGNSS MISSION, INSTRUMENT AND SCIENCE OBJECTIVES WITHIN THE NEWSPACE ESA SCOUT PROGRAMME

### Abstract

HydroGNSS is a small satellite mission under the ESA Scout Programme tapping into NewSpace, as part of ESA's FutureEO Programme, to be implemented within a budget of 30m and a schedule of three years from mission kick-off to launch. The mission guided by the HydroGNSS Science Advisory Group (SAG) comprises: two satellites using an innovative GNSS Reflectometry (GNSS-R) instrument, a ground segment with Svalbard ground station used for timely download, a Space Operations Centre (SOC), a Mission Operations Centre (MOC) tasking scientific mission planning, and including the Payload Data Ground Segment (PDGS) and a web based data delivery system with free and open data provision to registered users. These areas are discussed and how their combination will be used to deliver valuable science from small satellites. Three innovations of HydroGNSS: acquisition of coherent channel, cross polarization and dual-frequency offer improved L2 products over previous GNSS-R missions.

Kicked Off October 2021, the HydroGNSS mission preparation is well underway. Four major mission reviews have been undertaken, ensuring Technology Readiness Levels (TRL) have been raised for all units, and the assembly, integration and test of the first satellite has commenced, the second satellite will commence build later in the year. Raising the Scientific Readiness Level (SRL) has been achieved via an End-to-End Simulator developed by the science team under the guidance of the HydroGNSS SAG. The E2E simulator interfaces the PDGS Level 1 and Level 2 processors to represent end-to-end dataflow and error modelling. The ride-share launch has been agreed and is allocated to a launch slot in mid to late 2024. After launch, a campaign will be undertaken to calibrate and validate products before they are released as part of the data-delivery service. Subsequently HydroGNSS will generate products that will contribute towards hydrological Essential Climate Variable (ECVs) feeding into better knowledge of the Earth's climate.

GNSS-R is a type of bistatic radar utilising abundant GNSS signals as signals of opportunity, empowering small satellites to provide measurement of the same quality associated with larger satellites. The GNSS-R instrument is used to collect parameters related to the ECVs: soil moisture, inundation, freeze/thaw, biomass, ocean wind speed and sea ice extent.

These measurements assist with the UN Net Zero ambition by monitoring biomass, flooding and providing farmers, scientific researchers amongst others with information about soil moisture, and COP26 'Space Enabled Net-Zero' targets by benefiting from monitoring soil moisture supporting fighting climate change using space-enabled technology.