Impact Analysis of Multiple LRR On-Board Future Copernicus CRISTAL Altimetry Mission

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The Copernicus Expansion CRISTAL mission is a Polar Ice and Snow Topography Altimeter that will carry a Ku/Ka bands dual-frequency radar altimeter with an interferometric capability in Ku-band and a microwave radiometer. One of the primary objectives for this CRISTAL mission is to measure and monitor sea-ice thickness and its overlying snow depth. Planned to be launched in 2027, it will nominally carry GNSS receivers and a Laser Retro Reflector (LRR) to support the Precise Orbit Determination (POD) needed by the altimetry.

It is also considered to incorporate 20 additional LRR, 4 on each side of the satellite except on the nadir pointing, where it is located the geodetic LRR, to support future active space debris removal. The idea is to allow a future space mission to approach CRISTAL making use of laser that will reflect from all sides of the satellite. It is currently foreseen that these additional LRRs would have a field of view of 50° (±25°) and will be mounted with at least 1 metre from each other. Still on-going analysis are being carried out to assess different configurations.

Taking into account the current design, it is quite possible that the routine tracking by the ILRS of this mission will be challenging, as multiple reflections from different LRRs will be received simultaneously. The support from the ILRS community will be more than needed.

The mission and its current design will be described. Then, results of simulations will be provided to show the effect of receiving multiple returns from the satellite, coming from several LRR. This presentation is provided to motivate the discussion with the ILRS on potential issues on the ILRS operations.