

EPS-SG/3MI Polarimeter - Instrument and Level-1 Performances

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3MI is a new mission launched in August 2025 on board of the EPS-SG A satellite [1]. The instrument is designed to provide multi-spectral, multi-polarisation, and multi-angular images of the Earth TOA outgoing radiance with the goal to characterise the microphysical properties of the atmosphere.

The design consists of two detectors (SWIR and VNIR) and a rotating filter and polariser wheel [1]. The instrument acquires images under 12 spectral bands: 9 bands from 410 nm to 910 nm in VNIR, 3 bands from 1370nm to 2130 nm in. Nine of the 12 bands (6 in VNIR, all 3 in SWIR) acquire polarised images at 60°, 0° and -60°. The three components of the Stokes vector (I, Q, U) are derived from the triplet of polariser acquisitions. The multi-view aspect is achieved by several successive overlapping acquisitions of the same Earth-Atmosphere target under 14 different angles, thanks to the large FOV of 3MI.

At L1, 3MI provides the three (I, Q, U) components as two different products to users: L1B, which correspond to the native geometry, as the satellite orbits the Earth; and L1C, which contain, for each point on the surface, the multiple angles under which it is observed, resampled on a common grid.

Following the launch and after completion of the SIOV phase, the instrument underwent a very thorough commissioning phase. The requirements both at radiometric and geometric level are extremely demanding, especially in what refers to polarisation. The amount of polarised light from observations is normally very low, except for certain very favourable Sun-Satellite geometric conditions such as the Sun glint. Therefore, the signal has to be very precisely adjusted and corrected for radiometric artifacts. Furthermore, the highest precision in the handling of the geometry is essential, as any small misregistration issue, particularly between polarisers, generates anomalies in the polarisation signal.

The commissioning campaign was carried out in cooperation with CNES, who provided expertise in analysis and support for the commissioning tools, as well as access to the Muscle-Neo intercalibration system. Here we will present the results of the commissioning activities for 3MI in both the radiometric and geometric aspects covering: geometric and radiometric behaviour at L1B and L1C over inter-calibration sites, channel cross-calibration, instrument behaviour, special manoeuvres such as Moon rolls and Deep Space roll, etc. We will also discuss lessons learned with respect to the ground calibration and future plans.

The first assessment of the 3MI performance at L1 in both the radiometric and geometric aspects will be presented, and, briefly, the potential for the L2 aerosol and cloud products.

References

- [1] Fougnie, B. et al., 2018: The multi-viewing multi-channel multi-polarisation imager –Overview of the 3MI polarimetric mission for aerosol and cloud characterization. *Journal of Quantitative Spectroscopy & Radiative Transfer* 219 (2018) 23–32.

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