Overview of the EPS-SG/3MI Mission – Instrument, Level-1, and their Performances to Support Operational Atmospheric Characterisation

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The purpose of the 3MI mission is to provide multi-spectral, multi-polarisation, and multi-angular images of the Earth TOA outgoing radiance in order to characterise the microphysical properties of the atmosphere. 3MI is a new mission without any link to previous EPS instruments that inherits from the mature technology developed for the POLDER/PARASOL missions. It is scheduled for launch in 2025. The design consists on two detectors (SWIR and VNIR) and behind a rotating filter and polariser wheel. There are a total of 12 spectral bands from 410 nm to 2130 nm, 9 of which acquire polarised images at 60°, 0° and -60°. The multi-view is achieved by several successive overlapping acquisitions of the same Earth-Atmosphere target under 14 different angles, thanks to the large FOV of 3MI [1].

EUMETSAT will deliver two 3MI Level 1 products to users: L1B and L1C [2]. Both products are corrected for different aspects of image acquisition (smearing, dark current, straylight, noise, etc.) but they respond to different user needs. L1B provides the user with the native acquisition of Earth scenes as the satellite flies over it, with sections of the scenes overlapping, each scene under the same pixel-dependent observation geometry. L1C is the result of the projection of all observations on a geo-located Earth grid, providing the user with the different viewing angles, spectral bands and polarisation into a single geo-located pixel.

Extensive effort has been made these last 2 years to perform the on-ground characterization of 3MI. All the aspects needed to meet the requirements in terms of radiometric and geometric performance have been addressed, and among them, very challenging ones such as the straylight or polarization characterizations. The on-ground calibration parameters will feed the Level-1 processing in order to derive products with the state-of-the-art performance. Once in orbit, the performance will be checked, and if needed adjusted, based on vicarious calibration and comparison to reference sensors, especially METimage. These aspects will be summarized with respect to the expected performance.

The Level-2 products derived from 3MI and its extensive information content include a large suite of parameters for aerosol as well as cloud characterization. These products and approaches will be overviewed.

References

[1] Fougnie, B., T. Marbach, A. Lacan, R. Lang, P. Schlüssel, G. Poli, R. Munro, and A. B. Couto, "The Multi-Viewing Multi-Channel Multi-Polarisation Imager – Overview of the 3MI polarimetric mission for aerosol and cloud characterization," *J. Quant. Spectrosc. Rad. Transf*., APOLO special issue, No. 219, pp. 23-32, 2018.

[2] Lang. R., G. Poli, B. Fougnie, A. Lacan, T. Marbach, J. Riédi, P. Schluessel, A. B. Couto, and R. Munro, "The 3MI Level-1C Geo-projected Product – Definition and Processing Description", *J. Quant. Spectrosc. Rad. Transf*., APOLO special issue, No. 225, pp. 91-109, 2019.

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