# DOCTORAL SCHOOL " MATERIALS, RADIATION AND ENVIRONMENTAL SCIENCES " (ED 104)

**UNIVERSITY :** Lille , 1 – Sciences et Technologies

**Scientific domain :** Optics and Lasers, Chemical Physics, Atmosphere.

**Title of the thesis :** Development of in-flight characterization methods for the Multiviewing, Multichannel and Multipolarisation Imaging (3MI) mission

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**Laboratory** : Laboratoire d'Optique Atmosphérique

**Research project (international/national/regional) : AERIS / International EPS-SG EUMETSAT**


ABSTRACT

The Multiviewing, Multichannel and Multipolarisation Imaging mission (3MI) has been selected by EUMETSAT as part of the European Polar System – Second generation (EPS-SG) and will provide, for the first time from an operationnal missions, unique measurements for characterization for aerosols and clouds.

Leveraging on the POLDER instrumental concept previously developed by CNES, 3MI will bring observation at an enhanced spatial resolution and over an extended spectral range (from 410 nm to 2130 nm). The lack of on-board calibration system will remain a challenge for the 3MI mission regarding both pre-flight characterisation and in-flight monitoring and calibration, in particular concerning the SWIR channels for which very little heritage is available.

The enhanced spatial resolution as well as the new spectral channels might present specific problems that need to be identified and addressed well in advance of the mission launch. Among other potential issues, the interband calibration performed over clouds for visible channel will be complicated by the increased absorption of SWIR radiation by cloud particles. On a different level, the stability of channels located in absorbing bands (763/765 nm for O2-Aband and 910/1370 nm for water vapor) also requires special attention to guarantee long-term stability that is critical for climate applications. Additionally, the potential synergies between 3MI and other instruments on METOP-SG A (in particular the VII imager and UVNS spectroradiometer) motivate the development of new methodologies to provide an enhanced monitoring of 3MI spectral and radiometric performances.

The objectives of this PhD are to study the instrument characteristics of the 3MI and develop the methodologies required to follow those inflight. Methodologies developed for POLDER will be revisited to account for 3MI new specifications and new approaches will be investigated and implemented for 3MI channels, especially the absorbing and SWIR channels. Those methodologies will rely either on standalone 3MI observations or make synergistic use of other METOP-SG A instruments. When deemed useful, methodologies will be tested on the observation provided by the 3MI airborne simulator (OSIRIS) available at LOA.

This thesis work will be performed at LOA in close collaboration with CNES teams supporting EUMETSAT for the characterization and calibration of 3MI.