Geophysical Research Abstracts
Vol. 21, EGU2019-14304, 2019
EGU General Assembly 2019


# The FORUM ESA candidate mission, a new light on the infrared Earth emission

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More than 50% of the outgoing longwave radiation (OLR) of the Earth occurs in the Far InfraRed (FIR) spectral region from 100 to 667 $cm^{-1}$ (100–15 $\mu$m). Despite that, this spectral region has never been spectrally observed from space. This lack of spectral measurements introduces important errors in the modelling of climate system because of the uncertainties still present in the climate variables that show relevant spectral features in the FIR, such as the upper tropospheric water vapour, cirrus clouds, and high latitude ice surface emissivity.

The Far-infrared-Outgoing-Radiation Understanding and Monitoring (FORUM) mission has been design to cover this long-standing gap in the FIR spectral observations from space by measuring for the first time the most relevant spectral region of the OLR, including the FIR, from 100 to 1600 $cm^{-1}$ (100-6.25 $\mu$m), with a nominal resolution of 0.4 $cm^{-1}$, benchmarked against international standards with an absolute accuracy of 0.1 K in Top Of Atmosphere (TOA) brightness temperature.

The satellite hosting FORUM will fly in convoy with Metop-SG to complement the mid-infrared (645-2760 $cm^{-1}$) spectral measurements made by IASI-NG. In this way FORUM will contribute to establish a new dataset of the Earth's entire emission spectrum from 100 to 2760 $cm^{-1}$ (3.62–100 $\mu$m), which will shed a new light on our capability to model the links between key underlying physical processes driving climate change, their spectral signatures and the Earth's Radiation Budget (ERB).

Mission objectives include:

- Derivation of the FIR optical properties of cirrus clouds

- Measurement of FIR surface emissivity in Polar regions

- Measurement of the upper tropospheric water vapour and associated FIR spectral signatures

- Derivation of FIR spectral fluxes (spectral greenhouse effect; spectral cloud forcing; climate model diagnostics)

- Measurement of a FIR TOA radiance "benchmark"

- Improvement in water vapour and carbon dioxide spectroscopy

- Reference intercalibration of broadband ERB sensors

Here we present the current status of the FORUM mission preparatory studies for the ESA Earth Explorer 9 mission programme. The studies aim at finalising the measurement requirements and improving the scientific readiness level of the new mission.