

Expected impact of IASI-NG on CH₄ retrieval

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ABSTRACT

IASI has been providing high resolution spectra in the thermal infrared, with a global coverage of the earth twice a day since 2006. The channels around the 7.7 μm band, sensitive to CH₄, are used with co-localized observations from the Advanced Microwave Sounding Unit (AMSU) to retrieve an integrated content of methane over the mid and upper troposphere. The three in-flight IASI instruments are expected to be gradually flowed-on as of 2026 by the next generation: IASI-NG. This instrument will cover the same spectral band to allow the continuity of observations but also promises a technological leap with a doubling of its spectral resolution and a significant reduction in instrumental noise.

In this work, we will use various scenarios for spectral and radiometric characteristics of IASI-NG to assess the expected impact of the gains in spectrometric performance on the precision of future methane retrieval by IASI-NG. We will present results based on the simulation of clear sky brightness temperature spectra on the TIGR climatology database with the fast radiative transfer model 4A/OP, for both IASI and IASI-NG and:

- characterize the gain in sensitivity to methane of IASI-NG channels, in comparison to equivalent IASI channels.
- determine the typical signal to interference ratio of the two instruments with respect to methane, thanks to the characterization of the sensitivity to other interfering variables and the knowledge of the instrument's radiative noise; we will show both an improved value and an increasing number of channels that present a high ratio, and are therefore exploitable for inversion purposes.
- show marginal gains in degree of freedom and significant ones in the information content, as obtained from the study of the information content of measurements in the framework of optimal estimation,
- determine the expected precision gain of these retrievals obtained through an adaptation of existing neural-network based inversion algorithms to IASI-NG and trained it on the calculated spectra, for a selection of channels of interest.