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Ice contamination on satellite IR sensors: the MIPAS case

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MIPAS on board the ENVISAT platform is a Michelson Interferometer measuring the atmospheric limb emission in the mid-infrared (IR), from 4.15 μm to 14.5 μm [1]. The calibrated MIPAS measurements are radiance spectra as a function of wavenumber. The radiometric and spectral calibrations of the raw data are part of the Level 1 processing in the Ground Segment [2]. The accuracy of the radiometric calibration is essential in order to ensure precise temperature and trace gas retrieval in the Level 2 processing. This calibration process requires a set of cold space measurements and a series of measurements of a black body source to determine the radiometric gain function and to correct for instrument self-emission. The deep space measurements are repeated every four limb scanning sequences with the purpose of compensating the variation of instrument's temperature along the orbit. The radiometric gain function is updated every week to correct for a degraded transmission at the detector due to ice contamination. The ice contamination leads to a decrease of the signal, mainly due to ice absorption of the incoming IR radiation. This paper presents an analysis of the effect of ice contamination during the MIPAS mission; in particular we will study its impact on the radiometric accuracy and on the Level 2 retrieval precision. We will highlight the importance of the ice monitoring for the MIPAS mission and we will show that this type of monitoring allows improving the stability and the overall performances of the MIPAS instrument. The effect of ice in other ENVISAT instruments will be also mentioned (e.g., AATSR). The lessons learned during the mission about ice contamination are very important, especially for IR sensors that are the most affected by this type of problem. These lessons will be useful in order to improve the in-flight operations of present and future satellite missions.

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