IRS2012-135-1
International Radiation Symposium 2012
Dahlem Cube, Berlin, Germany, 06 – 10 August 2012

Operational hyper-spectral infra-red sounding by EUMETSAT

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Hyper-spectral infra-red sounding has become a backbone of the operational meteorological satellites. The Infra-red Atmospheric Sounding Interferometer (IASI), being flown as part of the EUMETSAT Polar System (EPS) on the Metop-A satellite, provides unprecedented temperature and humidity soundings from space that have demonstrated to be of tremendous impact in numerical weather prediction. IASI also provides information on a number of atmospheric trace gases, the most important ones being ozone, carbon monoxide, and methane. Furthermore, the instrument measures cloud parameters, surface temperature and surface emissivity with high spectral resolution. Two more IASI instruments will be flown on the Metop-B and -C satellites, covering the period until 2020. In parallel, new missions employing hyper-spectral infra-red soundings will be developed. IASI-NG (New Generation), which will follow IASI as part of the EPS-SG (Second Generation), aims at outperforming IASI in two dimensions. Doubling the radiometric performance will benefit the numerical weather prediction through provision of 75% more information on atmospheric temperature profiles, particularly in the planetary boundary layer, and the provision of 30% more information of water vapour profiles. Doubling of the spectral resolution (0.25 cm^{-1}) will allow for quantifying amounts of trace gases which are only detected by IASI and for vertically resolving trace gas measurements where IASI observes only total columns. The second mission under development is the Infra-Red Sounding (IRS), to be embarked on the geostationary Meteosat Third Generation (MTG) sounding satellite. The IRS will provide moderate high spectral resolution (0.625 cm^{-1}) in two broad spectral bands. The main mission objective is to provide small scale frequent observation of water vapour and temperature at high spatial (4 km) and temporal (30 min repeat cycle over Europe). This will enable the monitoring of dynamical information (3D moisture flow) and atmospheric instability in support of regional weather forecast. Frequent information from MTG-IRS on ozone and carbon monoxide can also be used to support emerging atmospheric chemistry applications, particularly air quality monitoring and forecasting.