Geophysical Research Abstracts
Vol. 16, EGU2014-12561, 2014
EGU General Assembly 2014

Upgrade of MARSCHALS Observation Capabilities for StratoClim 2015

Daniel Gerber, Brian Moyna, Matthew Oldfield, Simon Rea, Brian Ellison, Richard Siddans, Gareth Thomas, and Brian Kerridge

STFC Rutherford Appleton Laboratory, RAL Space, Chilton, United Kingdom (d.gerber@rl.ac.uk)

MARSCHALS (Millimetre-wave Airborne Receivers for Spectroscopic CHaracterisation in Atmospheric Limb-Sounding) is a Remote Sensing radiometer deployed from the Russian high altitude aircraft M55 Geophysica. MARSCHALS will participate in the aircraft campaign of the FP7 project StratoClim in 2015, where the composition and dynamics of the Upper Troposphere - Lower Stratosphere (UTLS) over the Asian Monsoon region will be sampled by a uniquely comprehensive detector suite. We report on the latest set of instrument upgrades to MARSCHALS, which will significantly improve its observation capabilities for StratoClim.

MARSCHALS was developed and built at RAL Space on ESA contract. The scientific rationale of MARSCHALS was A) illustrate the merits of submillimetre-wave limb-sounding of the UTLS as demonstrator for the PREMIER mission - a former ESA Earth Explorer 7 (EE7) candidate mission - and B) the measurement of trace gases in the UTLS region in conjunction with the infrared limb sounding instruments co-deployed on the Geophysica platform (these currently consist of the infrared limb-sounder MIPAS-Str and the infrared limb-imager GLORIA-AB). In its original form, MARSCHALS consisted of three spectral bands at 293.86 GHz - 305.46 GHz (Band B), 313.48 GHz - 325.48 GHz (Band C) and 342.2 GHz - 348.8 GHz (Band D). These bands are implemented by three heterodyne receivers employing ambient Schottky mixers and sharing a common channeliser spectrometer of 200 MHz resolution. This is a low-cost compromise of the original PREMIER observation capabilities, which foresees subharmonic image rejection mixers (SHIRM) and consequentially a simultaneous, high-resolution detection of the two sidebands at 324 GHz - 336 GHz and 343.25 GHZ - 355.25 GHz.

SHIRM technology is being actively developed at RAL Space under national funding. Similarly, wide-band, high-resolution spectrometers (WBS) are developed at STAR-Dundee, UK. For StratoClim we will replace the existing MARSCHALS Band D with a new receiver using a RAL SHIRM mixer in conjunction with four WBS from STAR-Dundee, therefore closely replicating the PREMIER observation capabilities of EE7 Phase A. This upgrade will significantly increase the measurement quality of the principal targeted gases H_2O, O_3 and HNO_3, but also adds a number of new species of strong scientific interest, especially in the context of StratoClim. In addition to its principal targeted gases, the upgraded MARSCHALS will have improved sensitivity to CO and will observe other trace gases for the first time; notably HCN and CH3CN elevated from biomass burning, OCS, CH3Cl and, in event of volcanic eruption, SO_2. These mm-wave observations will be made in the presence of cirrus or high aerosol loading which obscure ir observations

A prototype of the upgraded receiver is to be deployed in a test campaign from the High-Alpine Research Station Jungfraujoch in Switzerland in February 2014, of which some first results will be presented as well.

Other instrument upgrades currently under consideration are the addition of a novel, miniature Fourier Transform Spectrometer developed at RAL Space with the prospect to contribute cloud and aerosol information where the current optical cloud monitor only reports cloud top heights.