

Name of research institute or organization:

Institute of Applied Physics, University of Bern

Title of project:

Atmospheric Observations with STEAMR/PREMIER receiver prototypes

Project leader and team:

Dr. Axel Murk, project leader
Matthias Renker, Dr. Mark Whale

Project description:

The “Stratosphere-Troposphere Exchange And climate Monitor Radiometer” (STEAMR) is a multi-beam submillimeter wave limb sounder for the next ESA Earth Explorer Mission PREMIER. The Institute of Applied Physics collaborates with Omnisys Instruments (Sweden) and the Rutherford Appleton Laboratory (UK) in the optical design and the receiver development.

The STEAMR receivers operate in a frequency band between 324 and 355 GHz and consist of either double or single sideband mixers, local oscillators, and broadband digital autocorrelation spectrometers. The radiometric performance of these receivers is of vital importance for the PREMIER mission and has been characterized by detailed laboratory tests at our institute. In order to demonstrate the observing capabilities of STEAMR and to compare the laboratory measurements against realistic spectroscopic signatures we integrated the receiver prototypes in a portable breadboard radiometer that we deployed for first light atmospheric observations at the High Altitude Research Station Jungfrauoch during February/March 2012. The high altitude of this site and the dry atmospheric conditions during winter are mandatory for ground-based observations in this frequency range.

Figure 2 gives an example of the observed spectral lines, mostly from stratospheric Ozone, in comparison with model data. The analysis of the differences between measurement and simulation provides important information about the sideband ratio, channel response and the linearity of the receiver.

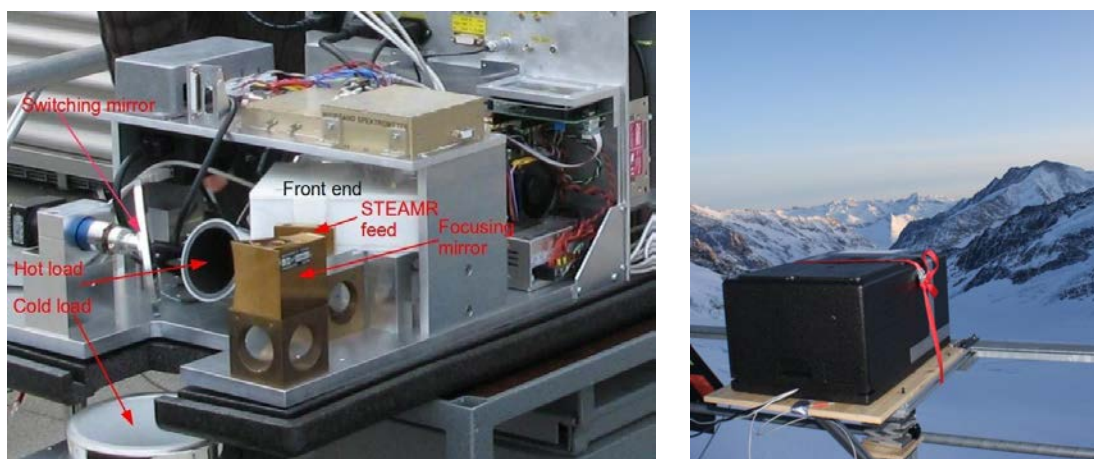


Figure 1. 340GHz radiometer breadboard with the STEAMR receiver prototype, calibration optics and thermal stabilization, installed outdoors on the Jungfrauoch Sphinx terrace.

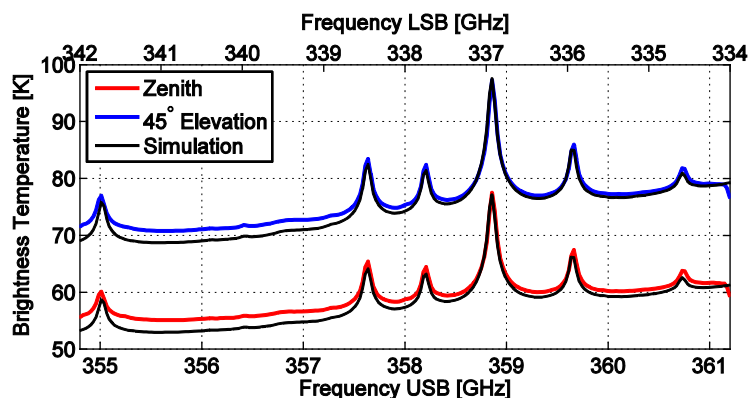


Figure 2. Observed and simulated spectral emission lines with the STEAMR double sideband receiver prototype for two different elevation angles.

The results of the Jungfrauoch observation campaign were so far reported at a conference [1] and in an internal research report [2]. Example results are also included in the ESA Assessment Report for Mission Selection [3]. Further observations and publications are planned in 2013.

Key words:

Microwave remote sensing, submillimeter wave receiver

Internet data bases:

www.iapmw.unibe.ch/research/projects/STEAMR/

Collaborating partners/networks:

Simon Rea, STFC Rutherford Appleton Laboratory, Didcot, Oxfordshire, UK
Andres Emrich, Omnisys Instruments AB, Göteborg, Sweden (www.omnisys.se)

Scientific publications and public outreach 2012:

Conference papers

[1] Rea, S. P., M. Renker, B.P. Moyna, D. Gerber, M. Whale, A. Murk, First-light atmospheric observations with a 340 GHz sideband-separating Schottky diode receiver, 37th International Conference on Infrared, Millimeter, and Terahertz Waves (IRMMW-THz), doi: 10.1109/IRMMW-THz.2012.6380381, September, 2012.

Data books and reports

[2] Renker M., A. Murk, M. Whale, S. Rea, A. Emrich, U. Frisk, Breadboard receiver testing for STEAMR/PREMIER, IAP Research Report, No. 2012-06-MW, Institut für Angewandte Physik, Universität Bern, 2012.

[3] PREMIER: Report for Mission Selection, ESA SP-1324/3, May 2012
http://esamultimedia.esa.int/docs/EarthObservation/SP1324-3_PREMIERr.pdf

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