

THE ACE+ MISSION: AN ATMOSPHERE AND CLIMATE EXPLORER BASED ON GPS, GALILEO, AND LEO-LEO RADIO OCCULTATION

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The European Space Agency (ESA) has recently, in May 2002, selected the Atmosphere and Climate Explorer (ACE+) radio occultation (RO) mission (1) as its top priority out of 25 proposed Earth Explorer Opportunity Missions, which had addressed all areas of Earth system science. The ACE+ constellation of 4 Low Earth Orbit (LEO) satellites utilizes GPS, GALILEO, and LEO-LEO signals for RO sounding of fundamental atmospheric variables such as humidity and temperature. ACE+ will acquire about 5000 GPS/GALILEO RO soundings per day and demonstrate the novel LEO-LEO concept by about 230 LEO-crosslink soundings per day. Following confirmation after phase A study in 2002/03 (firmly expected), ACE+ development is scheduled to last until 2007, with launches 2007/08 followed by a 5 years operational phase.

The primary ACE+ mission goals are focused on climate and include:

- to monitor climatic variations and trends at different vertical levels and throughout all seasons. This to improve our understanding of the climate system as well as to detect the different fingerprints of global warming;
- to improve the understanding of climatic feedbacks defining the magnitude and characteristics of climate changes in response to given forcings;
- to validate the simulated mean climate and its variability in global climate models;
- to improve and tune - via data assimilation - the parameterization of unresolved processes in climate models and to detect variations in external forcing of climate.

Additional very important goals relate to numerical weather prediction, atmospheric processes research, and space weather (details in (1)).

The key innovation compared to similar (earlier) missions (e.g., COSMIC) is the novel use of GALILEO and LEO-LEO signals. Especially the LEO-LEO signals placed at 3 frequencies within 10-23 GHz, from center to wing of the 22 GHz water vapor absorption line, will for the first time allow RO measurements of humidity without temperature-humidity ambiguity and up through the full troposphere. For example, the LEO-LEO data have potential to provide much needed upper troposphere humidity profiles with an unprecedented accuracy of better than 5% in specific humidity.

The presentation will provide an introduction to the ACE+ mission along the lines above, with a particular emphasis on the scientific rationale and the novel LEO-LEO capability.

(1) Hoeg, P., and G. Kirchengast, ACE+ - Atmosphere and Climate Explorer based on GPS, GALILEO, and LEO-LEO Radio Occultation (ESA Earth Explorer Opportunity Mission Proposal), Wissenschaftl. Ber. No. 14, 121 pp., IGAM/University of Graz, Austria, 2002.