Geophysical Research Abstracts
Vol. 15, EGU2013-13446, 2013
EGU General Assembly 2013

Wide-Band Airborne Microwave and Millimeter-Wave Radiometers to Provide High-Resolution Wet-Tropospheric Path Delay Corrections for Coastal and Inland Water Altimetry

Steven C. Reising (1), Pekka Kangaslahti (2), Shannon T. Brown (2), Alan B. Tanner (2), Sharmila Padmanabhan (2), Chaitali Parashare (2), Oliver Montes (2), Douglas E. Dawson (2), Todd C. Gaier (2), Behrouz Khayatian (2), Xavier Bosch-Lluis (1), Scott P. Nelson (1), Thaddeus Johnson (1), Victoria Hadel (1), Kyle L. Gilliam (1), and Behzad Razavi (3)

(1) Microwave Systems Laboratory, Colorado State University, Fort Collins, CO 80523-1373 USA (Steven.Reising@ColoState.edu), (2) Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109 USA (Pekka.P.Kangaslahti@jpl.nasa.gov), (3) University of California at Los Angeles, Los Angeles, CA 90095 USA (razavi@ee.ucla.edu)

Current satellite ocean altimeters include nadir-viewing, co-located 18-34 GHz microwave radiometers to measure wet-tropospheric path delay. Due to the area of the surface instantaneous fields of view (IFOV) at these frequencies, the accuracy of wet path retrievals is substantially degraded near coastlines, and retrievals are not provided over land. Retrievals are flagged as not useful about 40 km from the world's coastlines. A viable approach to improve their capability is to add wide-band millimeter-wave window channels at 90 to 170 GHz, yielding finer spatial resolution for a fixed antenna size. In addition, NASA's Surface Water and Ocean Topography (SWOT) mission in formulation (Phase A) is planned for launch in late 2020. The primary objectives of SWOT are to characterize ocean sub-mesoscale processes on 10-km and larger scales in the global oceans, and to measure the global water storage in inland surface water bodies and the flow rate of rivers. Therefore, an important new science objective of SWOT is to transition satellite radar altimetry into the coastal zone.

The addition of millimeter-wave channels near 90, 130 and 166 GHz to current Jason-class radiometers is expected to improve retrievals of wet-tropospheric delay in coastal areas and to enhance the potential for over-land retrievals. The Ocean Surface Topography Science Team Meeting recommended in 2012 to add these millimeter-wave channels to the Jason Continuity of Service (CS) mission.

To reduce the risks associated with wet-tropospheric path delay correction over coastal areas and fresh water bodies, we are developing an airborne radiometer with 18.7, 23.8 and 34.0 GHz microwave channels, as well as millimeter-wave window channels at 90, 130 and 166 GHz, and temperature sounding above 118 as well as water vapor sounding below 183 GHz for validation of wet-path delay. For nadir-viewing space-borne radiometers with no moving parts, two-point internal calibration sources are necessary, and the technology has been recently developed for such sources at 90 to 170 GHz millimeter-wave frequencies. This instrument development and airborne flight demonstration will (1) assess wet-tropospheric path delay variability on 10-km and smaller spatial scales, (2) demonstrate millimeter-wave radiometry using both window and sounding channels to improve both coastal and over-land retrievals of wet-tropospheric path delay, and (3) provide an instrument for calibration and validation in support of the SWOT mission. We will describe on-going instrument development, as well as our plans for initial remote sensing test flights aboard a Twin Otter aircraft.