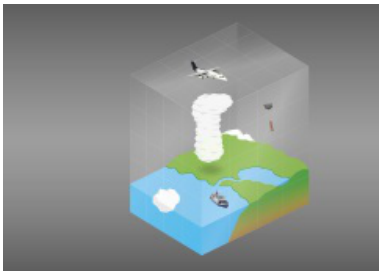

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Potential Contributions of Airborne Radio Occultation Observations in Field Campaigns to Forecast Improvement of Hurricanes and Atmospheric Rivers

Because of its high vertical resolution and global sampling, spaceborne GNSS radio occultation has had a large impact on operational numerical weather prediction. Implementation of this technology on aircraft greatly increases the density of this type of observations for use in field campaigns and provides the capability to target observations in sensitive regions where the forecast can potentially be improved. Airborne radio occultation (ARO) measures signal propagation delay from rising and setting GNSS satellites below the local horizon that sample the atmosphere in the region up to 600 km to the sides of the aircraft. The derived profiles are thus complementary to dropsondes released directly below the aircraft. The benefits of this strategy were demonstrated during research flights which were forced to avoid convective towers in the genesis region of hurricane Karl. ARO observations were made through these regions that were impossible to fly over, thus expanding greatly the capabilities of the aircraft during the field campaign. The observations helped to show in data assimilation experiments that the flow of mid-level dry or moist air affected the hurricane development. Several variations of the original GNSS Instrument System for Multistatic and Occultation Sensing (GISMOS) have flown subsequently in field campaigns targeting atmospheric rivers, where both ensemble and adjoint methods were used to determine sensitive areas for potential rapid uncertainty/error growth. With multiple measurement objectives, ie quantifying integrated vapor transport in the pre-frontal low-level jet as well as reducing uncertainties in the dynamics of the system, we show how ARO contributes to realizing these multiple objectives by easily expanding the region of the atmosphere sampled during each flight. We also show how using true GNSS (GPS plus Galileo) expands that area still further, and increases confidence in observation errors assigned to the data type in data assimilation.

Primary authors: Dr HAASE, Jennifer S. (Scripps Institution of Oceanography, UCSD); Dr MURPHY, Michael J. (Scripps Institution of Oceanography, UCSD); Dr CAO, Bing (Scripps Institution of Oceanography, UCSD); Prof. CHEN, Shu-Hua (University of California, Davis); Dr ZHENG, Minghua (Center for Western Weather and Water Extremes, SIO, UCSD); Dr RALPH, F. Martin (Center for Western Weather and Water Extremes, SIO, UCSD); Dr MURPHY, Brian J. (Edison State); Dr CHEN , Xue-Meng (University of California, Davis); Dr WANG, Eric Kuo-Nung (Scripps Institution of Oceanography, UCSD); Dr CHEN, Shu-Ya (National Central University); Prof. HUANG, C. Y. (Central Taiwan University); Prof. GARRISON, James L. (Purdue University)

Presenter: Dr HAASE, Jennifer S. (Scripps Institution of Oceanography, UCSD)

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