Radio Occultation (ROC) Instrument for Strateole-2

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Deep tropical convection influences transport of mass and momentum from the upper troposphere into the lower stratosphere through generation of gravity waves at a range of scales. We propose to investigate the link between convection and gravity waves through unique GPS measurements during the equatorial Strateole-2 super-pressure balloon campaign. GPS measurements can help quantify gravity wave activity in two ways: by providing precise estimates of balloon velocity and height perturbations due to gravity waves and by providing refractivity profiles that are sensitive to vertical temperature fluctuations caused by gravity waves. We illustrate the capabilities of balloon-borne GPS observations from the 2010 Concordiasi campaign.

The GPS radio occultation (ROC) instrument was deployed on two balloons during the Antarctic Concordiasi campaign. It recorded over 700 profiles during the 99 flight days of observations, more than 30% descended within 4km of the surface. This was achieved with a small low power instrument package containing off the shelf GPS receiver OEM cards. Precise post-processing of the radio occultation data showed a reasonable level of agreement with nearby dropsonde measurements. The dual frequency GPS observations were also post-processed using a precise positioning technique to achieve 20 cm accuracy. This resulted in the discovery of several systematic errors in the single frequency autonomous positioning that was available for preliminary estimates of gravity wave motion.

Improvements for the Strateole-2 campaign will include greater data recovery rate enabled by the Iridium communication system at the equator to provide a much larger dataset. Continuing with the low-cost off the shelf receiver limits the penetration in the moist troposphere but profiles are expected to be retrieved from 17 km to 8 km altitude. The scientific objectives include correlating deep convection observed with other methods (for example, cloud top height in GEOS imagery) with the gravity wave signals observed by the ROC to demonstrate the link with deep tropical convection.