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GPS radio occultation with CHAMP and GRACE: A first look at a new and promising satellite configuration for global atmospheric sounding

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Atmospheric scientists look forward to the potential, a multi-satellite radio occultation mission can offer for sounding of the Earth's atmosphere on a global scale. The unique combination of global coverage, high vertical resolution, long-term stability and all-weather capability of the radio occultation measurements are excellent characteristics for the improvement of numerical weather prediction and detection of climate trends. Constellations, consisting of several satellites, will multiply this potential.

CHAMP (CHAllenging Minisatellite Payload) and GRACE (Gravity Recovery And Climate Experiment) formed a small multi-satellite configuration for precise atmospheric sounding during the first activation of the GPS (Global Positioning System) radio occultation experiment aboard GRACE on July 28 and 29, 2004. 338 occultations were recorded aboard both satellites, providing globally distributed vertical profiles of refractivity, temperature and specific humidity. The combined set of CHAMP and GRACE profiles shows excellent agreement with meteorological analysis. Almost no refractivity bias is observed between 5 and 30 km, the standard deviation is between 1 and 2% within the entire altitude interval. The improved stability of the GRACE satellite clock in relation to CHAMP allows for the application of a zero difference technique for precise analysis of the GRACE occultation data.