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GPS Radio Occultation: Principles and NWP use

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GPS radio occultation (GPS-RO) measurements are a relatively recent addition to the global observing system. GPS-RO is an active measurement technique with a limb geometry. The GPS-RO measurements complement the information provided by satellite radiances, because they have good vertical resolution, and they can be assimilated without bias correction to the NWP model. This means they "anchor" the bias correction of the radiances.

This lecture explains the physical basis of the GPS-RO technique, and outlines the main preprocessing steps required to map from the raw measurements to quantities used in NWP. Information content studies are used to demonstrate that the measurements provide excellent temperature information in the upper-troposphere and lower/middle stratosphere. The approach used at ECMWF to asimilate the GPS-RO measurements is described. We show how the assimilation of GPS-RO was able to correct a long-standing ECMWF temperature analysis problem in the polar regions, and explain the "null-space" of the measurements. The ability of GPS-RO to constrain the surface pressure field, and the retrieval planetary boundary layer height information from GPS-RO, are discussed briefly.

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