Monthly climatologies of geopotential height and geostrophic wind from ten years of GPS RO data

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With over ten years of continuous GPS radio occultation (RO) data now available from CHAMP, COSMIC, and other missions, there has been an increasing interest of applying the data for climate trend detection. In this study, we describe our approach towards the generation of global monthly gridded climatologies of geopotential height and geostrophic wind in the upper troposphere and lower stratosphere (UTLS). To interpolate or map the irregularly sampled RO geopotential height data into a 2D grid, the Bayesian method with spherical harmonic basis functions is implemented. Interpolation or mapping coefficients are calculated in such a way that selects the optimal balance between misfit of the data and over-fit of the data. A recent study based on a synthetic dataset generated from ECMWF has shown that CHAMP RO measurements to be best fit with a spherical harmonic basis of 14th degree and COSMIC of 20th degree. Monthly averaging is performed by first binning the RO data into 2 or 4 day bins, calculating spherical harmonic coefficients for geopotential heights of dry pressures 200, 225, 250, 275, and 300 hPa, and then average global maps for all time bins over a month. Geostrophic winds are calculated directly from the mapping coefficients at each time bin without the need to perform finite differencing, and the monthly averaging is derived in the same way as the geopotential height. We will describe the uncertainty associated with the monthly gridded data and present comparisons with weather analyses and climate models.