CONTRIBUTIONS OF GPS OCCULTATIONS TO ANTARCTICA ICE SHEET MASS BALANCE STUDIES

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Antarctica is the coldest, and the most remote continent on Earth. Nearly 75% of the world's fresh water is trapped in the Antarctic ice sheets, which could significantly raise the global sea level if the ice sheets would melt. The continental ice sheet mass balance budget remains one of the largest uncertainties in understanding of the causes of global sea level rise. Advanced gravity mapping missions, CHAMP, GRACE and GOCE, are anticipated to provide significant measurements in the form of temporal gravity field to quantify ice sheet mass balance and its contribution to global sea level rise. To fully exploit of the accuracy of GRACE, equivalent of less than several mm-level measurement accuracy of ground water movement over a spatial scale of 200 km monthly at satellite altitude, the knowledge of surface pressure fields over Antarctica is needed at an accuracy of sub-mbar (rms). The current atmospheric general circulation models, ECMWF (operational data product) at 6-hour sampling, and NCEP at 3-hour sampling, and both with 100 km spatial resolutions, are inadequate both in accuracy and resolution to adequately correct GRACE measurements to extract ice sheet mass balance signals. In this paper, we study the use of space borne GPS occultation measurements from CHAMP, SAC-C and GRACE (-1 and 2) to potentially provide an improved atmospheric pressure field for GRACE gravity corrections. The retrieved atmospheric measurements are studied based on assumption that water vapor is scarce over the interior of the Antarctic continent, to compute pressure profiles. Improved pressure fields could also be available by employing 4DVAR assimilation techniques using bending angle and refraction measurements from GPS occultation. In this paper, results will be presented in comparing CHAMP occultation pressure fields with Automatic Weather Stations (AWS) in Antarctica as well as using extreme Southern Ocean sea level data from satellite altimetry.