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Combined ionosphere models from different space geodetic techniques

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The ionosphere is the upper part of the Earth's atmosphere which consists of free electrons and ions. The intensity of the ionisation, mainly caused by the solar radiation, varies with time (seasonally and diurnally, sunspot cycles), with geographical location (polar, auroral zones, mid-latitudes, equatorial regions), and with certain solar-related ionospheric disturbances. The ionosphere is a dispersive medium for electromagnetic waves and influences both, their group and phase velocity. Thus, the observables of all space geodetic techniques operating in the microwave band are influenced by the ionosphere. This effect is in first approximation proportional to the so-called Slant Total Electron Content (STEC) along the ray path and can be corrected when the measurements are carried out at two distinct frequencies. This provides also information about the parameters of the ionosphere in terms of TEC values. The following space geodetic techniques are used for this study: GPS, satellite altimetry missions, Very Long Baseline Interferometry (VLBI). Each technique has its specific characteristics influencing the derived ionosphere parameters. The analysis of the differences between the individual ionosphere models allows to draw conclusions about these influences and their effect on the measurements. Final goal is the development of an improved model of the ionosphere, which should make best use of the advantages of each particular space geodetic technique. This can be done by applying a least-squares adjustment (Gauss-Markov Model) on each set of observations and combining the normal equations by adding the relevant matrices. The resulting integrated ionosphere model is expected to be more accurate and reliable than the models derived by the individual methods so far. Comparisons between the results of the different space geodetic techniques will be presented as well as some first attempts in terms of combination.