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Effect of SNR-based weighting on the results of GNSS phase observations

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In most GNSS software products a simplified observation weight model, which is merely based on satellite elevation angle and gained under the assumption of azimuthal symmetry, is widely used. Normally the quality of GNSS signals is highly correlated with the satellite elevation angle, but this simple weight model is not appropriate if observations are included which are affected by multipath effects or by signal diffraction under non-ideal observation conditions. Furthermore, due to manufacturing-dependent characteristics of the GNSS equipment the behaviour of the signal quality on L1 and L2 may be different. Under these circumstances an improved weighting is necessary related to the original information concerning the signal quality.

In addition to pseudorange and carrier phase observations, a geodetic GNSS receiver also records signal-to-noise ratio (SNR) measurements. SNR is a ratio of the signal power to the noise level of the GNSS observations; in most current GNSS applications it serves as a criterion for signal tracking ability and provides the possibility to compare the signal strength between channels and satellites. In this paper an improved weight model based on SNR values is presented which allows a frequency-related weighting of each phase observation. Subsequently linear combinations of individually weighted L1 and L2 observations are formed for data processing. This approach is implemented in the Bernese GPS software version 5.0. Using this weight model in regional networks, an enhancement of accuracy of estimated station specific neutrospheric parameters and an improvement in ambiguity resolution will be shown. The model represented is a further step towards a more realistic GNSS weighting model which in particular is more suitable for processing of low elevation data.