It is well-known that space-geodetic observation techniques are well suited for studying long-periodic meteorological phenomena, mainly variations of the water vapor distribution within the atmospheric boundary layer. Due to the sensitivity of microwave-based observation techniques to atmospheric effects such as attenuation, scintillation and delay not only the long-periodic effects but also high-frequency variations of refractivity can be detected. Especially high-frequency carrier phase variations can be used for turbulence studies which are in particular useful for meteorological applications.

Atmospheric turbulence can be analysed in various measurement and analysis steps such as in intermediate frequency signals (IF data), prefit residuals ('observed minus computed' values) of carrier phase observations or estimated tropospheric delays.

This presentation shows how atmospheric turbulence can be determined from real GPS carrier phase data. Two different GPS networks are used to analyse the temporal and spatial structure of atmospheric turbulence in terms of the power-law behaviour of tropospheric delay structure functions. The first network consists of six equally equipped GPS stations located along a 16 km straight line. It is found that the estimated zenith tropospheric delay parameters follow the theoretically predicted 5/3 power-law behaviour for the first 2000 s and a 2/3 spatial power-law behaviour indicating two-dimensional turbulence processes. Another short baseline network consists of two identical GPS-receivers connected to a common H-Maser. The effect of the common frequency standard on both prefit residuals and tropospheric delays is evaluated and the benefits for the separation of clock parameters and tropospheric delays are discussed.