



## **Gravity wave activity in the thermosphere inferred from GOCE data, and its dependence on solar flux conditions.**

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This study is focused on the effect of solar flux conditions on the dynamics of Gravity Waves (GW) in thermosphere. Air density and cross-wind in situ estimates from the Gravity Field and Steady-State Ocean Circulation Explorer (GOCE) accelerometers are analyzed for the whole mission duration. The analysis was performed in the Fourier spectral domain averaging spectral results over periods of 2 months close to solstices. First the Amplitude Spectral Density (ASD) and the Magnitude Squared Coherence (MSC) of physical parameters are linked to local gravity waves. Then, a new GW marker (called  $C_f^3$ ) was introduced here to constrain GWs activity under Low, Medium and High solar flux conditions, showing a clear solar dumping effect on GW activity. Most of GW signal has been found in a spectral range above 8 mHz in GOCE data, meaning a maximum horizontal wavelength around 1000 km. The level GW activity at GOCE altitude is strongly decreasing with increasing solar flux. Furthermore, a shift in the dominant frequency with solar flux conditions has been noted, leading to a larger horizontal wavelengths (from 200 to 500 km) during high solar flux conditions. The influence of correlated error sources, between air density and cross-winds, is discussed. Consistency of the spectral domain results has been verified in time-domain with a global mapping of high frequency perturbations along GOCE orbit. This analysis shows a clear dependence with geomagnetic latitude with strong perturbations at magnetic poles, and an extension to lower latitudes favoured by low solar activity conditions. Various possible causes of this spatial trend are discussed.