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Solar and solar wind sources of geomagnetic activity during grand solar maximum

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We have studied solar activity for over entire grand solar maximum from solar cycle 12 to 23. We have analyzed different solar activity proxies in detail and furthermore the solar originated disturbances and their geomagnetic effects. We compared the occurrence rate of the coronal mass ejections, high-speed streams and co-rotating interaction regions and the occurrence of geomagnetic storms and substorms. We identified and analyzed solar wind ULF waves in details. ULF fluctuations were identified from the solar wind using the Fourier method developed in this work. The solar wind ULFs were identified from ACE and Wind data and ground-based ULFs from Oulujärvi, Kilpisjärvi and Kevo magnetic observations. We found out that solar wind ULF occurrence peaks during the declining solar cycle phase in a same solar cycle phase where high-speed streams and substorms are found to peak. Our analysis furthermore shows that the trend of ULF waves detected from ground-based instruments is similar to the trend of solar wind ULFs.