Recent achievements from the Swarm mission on the low latitude space environment and combinations with other satellite missions

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The Swarm three-satellite constellation mission provides high resolution and high-quality observations of the Earth's magnetic field and of multiple parameters of the ionosphere, which lead to new knowledge on the Earth's interior and space environment and help to investigate space weather effects on space technology. Several findings would otherwise not have been possible and demonstrate that missions like Swarm are indispensable for Earth and space exploration. In addition, aspects of longterm variations or enhanced understanding in temporal and spatial resolution on regional scales could be gained in combination with other missions. This presentation focuses on recent achievements on the low latitude ionosphere. Examples include an empirical model of the occurrence of post-sunset equatorial plasma irregularities derived in combination with ten years of CHAMP geomagnetic data, an enhanced description of the Swarm irregularity observations together with regional maps of the South Atlantic ionosphere from GOLD, and the identification of differing GPS scintillation characteristics evoked by the irregularities in comparison with the lower orbit GOCE data. Equatorial electrojet and plasma data from Swarm also helped to empirically prove that Antarctic sudden stratospheric warming events, such as in September 2019, couple to the low latitude ionosphere through modified planetary waves.