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Simulation study for the Stratospheric Inferred Wind (SIW) sub-millimeter limb sounder

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The Stratospheric Inferred Wind is a micro satellite mission studied within the Swedish Innosat program. The objective of the Innosat program is to launch a scientific satellite every two years [1]. SIW has been selected together with two other missions as a candidate for the 2nd launch planned in 2020. If realized, SIW will be the first sub-millimetre (SMM) satellite mission designed for measuring horizontal wind between 30-80 km. It has been shown that such systems can provide relevant wind information in this altitude range where other satellite techniques lack sensitivity [2,3]. The other objective of the mission will be to continue the stratospheric monitoring at a time in which the current observing systems will probably be ended.

SIW is equipped with a small payload (40x40x44 cm3, 17 kg and power of 47 W) consisting of a radiometer cooled to 70 K, an auto-correlator spectrometer (8 GHz bandwidth, 1 MHz resolution), and an antenna of 30 cm. The atmospheric limb will be scanned from 10 to ∼80 km at two perpendicular directions in order to reconstruct the horizontal wind vectors from the measured line-of-sight winds. Those are obtained from the small Doppler shift of molecular lines contained in two spectral bands simultaneously measured with the double-side band radiometer. One of the bands is centred at 655 GHz to measure a cluster of strong O_3 lines. It is the best spectral band for wind measurements [4]. The second band is centred near 625 GHz, and together with the first band, it will allow us to measure a large number of molecules relevant for studying the stratospheric dynamics and chemistry (N2O, H_2O, ClO, HCl, BrO, NO, HNO_3,...). The 655 GHz O_3 lines also provide temperature between 10-80 km with similar performances as those obtained if an oxygen line would have been used instead.
In this presentation we will introduce SIW and discuss the measurement performances derived from simulations studies.

[1] http://www.ohb.de/press-releases-details/ohb-sweden-and-aac-microtec-to-develop-the-innosat-platform-and-implement-its-first-mission-named-mats.html
[2] Wu D., et al.: Mesospheric Doppler wind measurements from Aura Microwave Limb Sounder (MLS), Advanced in Space Research, 42, 1246-1252, 2008
[3] Baron P., et al.: Observation of horizontal winds in the middle-atmosphere between 30S and 55N during the northern winter 2009–2010, Atmospheric Chemistry and Physics 13(13), 6049–6064, 2013, doi:10.5194/acp-13-6049-2013
[4] Baron P., et al.: Definition of an uncooled submillimeter/terahertz limb sounder for measuring middle atmospheric winds, Proceedings of ESA Living Planet Symposium, Edinburgh, UK, 9–13 September 2013, (ESA SP-722, December 2013)