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Evaluation of the infrared signature of auroras from a stratospheric balloon

Frédéric Romand (1), Grégoire Pihan (2), Laurence Croizé (3), Sébastien Payan (1), and Mathieu Barthélémy (4)

(1) LATMOS, UPMC, Paris, France, (2) Insitut d'optique, Palaiseau, France, (3) ONERA, Palaiseau, France, (4) IPAG, Université Grenoble Alpes, France

HALESIS (High-Altitude Luminous Events Studied by Infrared Spectro-imagery) is a future experiment dedicated to the measurement of the atmospheric perturbation induced by transient luminous events in the minutes following their occurrence. The recordings will be done from a stratospheric balloon flying at an altitude of 25 km to 40 km. These electrical and optical events occur above thunderstorms between 20 and 100 km of altitude. As a diversification purpose of the HALESIS experiment, we want to investigate the possibility to observe another kind of atmospheric luminous events: auroras. Auroras are optical phenomena caused by the collision of solar particle with high-atmosphere molecules and ions. They are known for their typical visible emissions, but the excited species could enhance the atmospheric radiances in the short and mid wavelength infrared too. The objective of this work is to evaluate the infrared radiances in the 2000-4000 cm-1 spectral range for typical cases of auroras that should be observed by an instrument located in the stratosphere (HALESIS setup). The vibrational populations of CO_2, NO and NO+ during an aurora are computed together with the resulting infrared radiative emissions. Then, the signal is propagated through the atmosphere to the observer. The computations are done using the code Sharc And MODTRAN Merged, second release (SAMM2, Dothe et al., 2009). We will conclude that the radiance enhancement caused by CO_2 is not significant. Those of NO and NO+ can reach 10-10 W/cm2/sr/cm-1. Due to the very low amplitude of this signature, it will be necessary to use an appropriate strategy of spatial and temporal co-averaging of spectra to detect it. This could be possible considering the large dimension of this phenomena and its long duration. The HALESIS experiment will be done in coordination with ATISE (Auroral Thermospheric and Ionospheric Spectrometer Experiment) ground or balloon demonstration experiment. This will allow coordinating the infrared emissions studies with the visible ones.