

Nadir observations of sprites from the International space Station

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The experiment LSO (Lightning and Sprite Observations) on board of the International Space Station is the first experiment dedicated to sprite observations at the nadir. Such observations are difficult because the luminous emissions of sprites and lightning can be superimposed when they are observed from space at the nadir. Such observations are however needed for measuring simultaneously all possible emissions (radio, X - γ , high energy electrons) associated with sprites for a better understanding of the implied mechanisms. They are possible in specific spectral lines where sprites are differentiated from lightning. Absorption bands of the atmosphere are well adapted for this differentiation because the light emissions from sprites occurring in the middle and upper atmosphere are less absorbed in these bands than lightning emissions occurring more deeply in the atmosphere. The most intense spectral emission band of the sprites, corresponding to the N₂ 1P band at 761 nm, partly superimposed with the oxygen absorption A band of the atmosphere, is used by the LSO experiment. The experiment is composed of two micro-cameras, one in the visible and near infra red, the other equipped with an adapted filter. Only sprites, halos and superbolts, which correspond to a class of rare very intense lightning, are transmitted through the filter. Sprites, halos and superbolts are identified by the ratio of the intensities received through the filter and in the whole spectrum. This ratio is lower for superbolts than for sprites and halos. The response of the sprites is also more complex and variable than the response of superbolts which is very flat and comparable from an event to another. Finally, LSO observed 17 sprites, 3 halos and 9 superbolts. Several examples of differentiation of sprite and superbolts are given. The results of a first global statistical study are also presented.