

# Observations of contemporaneous lightning storms in Saturn's atmosphere

G. Fischer (1), U.A. Dyudina (2), M. Delcroix (3), and J.A. Pagan (1)

(1) Space Research Institute, Austrian Academy of Sciences, Graz, Austria ([georg.fischer@oeaw.ac.at](mailto:georg.fischer@oeaw.ac.at))

(2) Division of Geological and Planetary Sciences, Caltech, Pasadena, USA

(3) Commission des observations planétaires, Société Astronomique de France

## Abstract

In contrast to Jupiter, where multiple lightning storms take place at various latitudes at the same time [1], the situation at Saturn seems more restricted. First, so far Saturnian lightning storms have only been observed at the equator, and at the planetocentric latitudes of  $35^\circ$  and  $50^\circ$  in both hemispheres. Second, the typical situation at Saturn is that there is only one months-long lightning storm at one time since their occurrence probability is lower than at Jupiter.

However, in this presentation we will show the details of three situations where multiple storms were also present at Saturn. The most recent one was in early 2011, when a 2000-km sized storm at  $50^\circ$  north was initially overlooked due to the spectacular presence of the 2010/2011 Great White Spot around  $35^\circ$  north [2]. The second case was in spring 2008, when a single lightning storm at  $35^\circ$  south split into two distinct thunderstorm cells that resided at the same latitude but separated by about  $30^\circ$  in longitude. The third case can be inferred from the irregular occurrence of SEDs (Saturn Electrostatic Discharges, radio emissions from Saturn lightning) during the Voyager 2 encounter in 1981 [3]. The almost permanent presence of SEDs during the whole flyby suggests the contemporaneous existence of multiple storms, most likely located at  $35^\circ$  north and/or the equator.

In general, the giant Great White Spots raging at Saturn usually only once per Saturn year [4], must consist of multiple thunderstorm cells at adjacent latitudes. It is likely that the presence of a strong thunderstorm cell can trigger the development of others around the same latitude on Saturn. Similar to observations at Earth, the triggering mechanism

could be the propagation of convectively generated atmospheric gravity waves [5].

## Acknowledgement

G.F. and J.A.P. are supported by the Austrian Science Fund FWF (project P24325-N16).

## References

- [1] Little, B. et al.: Galileo images of lightning on Jupiter, *Icarus*, 142, 306-323, 1999.
- [2] Fischer, G. et al.: A giant thunderstorm on Saturn, *Nature*, 475, 75-77, 2011.
- [3] Zarka, P., and Pedersen, B.M.: Statistical study of Saturn Electrostatic Discharges, *J. Geophys. Res.*, 88, A11, 9007-9018, 1983.
- [4] Sanchez-Lavega, A. et al.: The Great White Spot and disturbances in Saturn's equatorial atmosphere during 1990, *Nature*, 353, 397-401, 1991.
- [5] Balachandran, N.K.: Gravity waves from thunderstorms, *Monthly Weather Review*, 108, 804-816, 1980.