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Lightning activity in Saturn's Great White Spot of 2010/2011

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In this presentation we will summarize the main findings about Saturn's Great White Spot of 2010/2011 gained by analyzing data from the Cassini RPWS (Radio and Plasma Wave Science) instrument in combination with images from the Cassini cameras.

Great White Spots (GWS) are planetary-scale disturbances in Saturn's atmosphere that usually happen once per Saturn year (29.5 Earth years). The last GWS of 2010/2011 occurred earlier than expected, and the Cassini RPWS instrument measured radio emissions caused by lightning discharges thereby identifying the GWS as a giant thunderstorm. Lightning radio emissions were measured for almost 9 months, from 5 December 2010 until 28 August 2011, with typical flash rates of more than 10 per second. Many images of the GWS were taken with the Cassini ISS (Imaging Science Subsystem) and by Earth-based telescopes which captured the storm's birth, evolution and demise. The GWS developed an elongated eastward tail due to Saturn's zonal winds, and this tail wrapped around the whole planet by February 2011.

RPWS data indicated that the storm's head was the main center of lightning activity, but the region of active thunderstorm cells also extented eastward into the tail. This was confirmed by the first optical observation of lightning flashes on Saturn's dayside located eastward of the head. The head region periodically spawned anticyclonic vortices, and the optical flashes appeared in the cyclonic gaps between them where the atmosphere looked clear down to the level of deep clouds. The largest anticyclonic vortex in the tail drifted with a rate that was 2 deg/day slower than the head. Hence, after about half a year one caught up with the other, and it came to a head-vortex collision in mid-June 2011. This led to a significant decrease of lightning and convective activity, which became intermittent and finally ended in late August 2011.