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Global neutral gas distribution at Saturn derived from ENA images

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Energetic Neutral Atoms (ENAs) result from charge exchange collisions between fast ions trapped in planetary magnetic fields and residual neutral gases resident in the magnetosphere. ENAs thus escape and can be detected and imaged by the INCA (Ion and Neutral CAmera) camera on board Cassini to produce a picture of the population in the entire magnetosphere. Using all available INCA images in the time period 183/2004 to 200/2008 and selecting those times during which the INCA imager was looking at Saturn's magnetosphere from approximately the same vantage position, we were able to produce average images of the neutral gas cloud that correspond to 4.6 Saturn rotations. In the present study, we demonstrate a technique to retrieve the global neutral gas distribution in Saturn's magnetosphere using these average ENA images. The neutral gas distribution at Saturn is retrieved by simulating INCA images using ion distributions of combined CHEMS, LEMMS and INCA in-situ ion measurements that cover several passes from SOI (183/2004) to day 100/2007, at various local times over the dipole L range 5<L<20 Rs. A parameterized neutral gas distribution is then changed until agreement between the simulated and average INCA image is obtained. Our preliminary results on the neutral cloud density distribution and composition up to $\sim$10 Rs are consistent with the neutral gas model by Jurac and Richardson [2005], while the calculated total O content is in agreement with the Esposito et al., [2005] results. The OH vertical distribution was found to be more extended than previously thought [e.g. Richardson, 1998].