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A Remarkable Event in Solar Wind Dynamic Pressure and its Effects on Magnetospheric Currents

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On March 14, 2016, the solar wind proton density was enhanced for about 2.5 hr and reached 85 cm^-3, enough to halve the size of the magnetosphere. As impressive as this number is, the temporal behavior of the density change was also remarkable, resembling a house with two walls and a sloping roof. We hypothesize that close to the Sun, reconnection allowed the solar wind to annihilate the magnetic field, causing the plasma density to increase as the magnetic plus plasma pressure of the surrounding solar wind compressed the region in which the field annihilation had occurred. The remarkable appearance of the 'house' enabled its dynamic pressure signature to be distinguished throughout the magnetosphere and across the surface of the Earth, showing where the solar wind dynamic pressure influences the magnetic field and where it is of minimum influence. The 'house' was also seen in electron plasma frequency oscillations on Wind, and in second harmonic type II radio waves produced about 1 hour later at the Earth's bow shock and that propagated back to Wind.
On the surface of the Earth, a survey of 138 stations shows that the signature is seen everywhere at low latitudes but more strongly at noon than midnight. At midlatitudes, the signal is still present but weaker. At high latitudes, the 'house' disappears and the response is largest at midnight than at noon. While these behaviors are not unexpected, this unusually severe event is a good illustration of magnetospheric response to strong solar wind dynamic pressure.