Energetic neutral atom response to solar wind dynamic pressure enhancements

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We have investigated the response of the ring current to solar wind dynamic pressure (Pdyn) enhancement impacts on the magnetosphere by using ENA images obtained by the High Energy Neutral Atom imager on board the IMAGE spacecraft. In this work, we present several events by distinguishing between pressure events where only the pure compression effects exist (without substorm effects) and those where the substorm is triggered by the Pdyn enhancement, and find notable differences between two types of events. First, for the pure compression events, we present four events where the Pdyn increases by ~100% to ~450% under northward IMF conditions. The Pdyn enhancement results in weak-to-modest ENA emission increases in both the hydrogen and oxygen channels. This ENA enhancement is due to ions adiabatically energized by the compression. The increased ENA emission rate drops as Pdyn decreases, implying the ENA responses are directly caused by the adiabatic compression and decompression process. Also the pure compression events lead to overall global, quasi-simultaneous, increases of ENA in contrast to pure substorm-induced ENA enhancements that are initially localized in the night side region followed by the drift effect. Next we present two events where the Pdyn enhancement was ~100 to 400 % under strongly southward IMF conditions and triggered a substorm. For both events, the ENA emission increase is far more significant than that for the pure compression events, and is primarily due to energetic ions generated by the triggered substorm although the compression effect itself still exists. Also the ENA enhancement appears to be not as global in MLT as for the pure compression events because of the predominant substorm effect that starts near midnight and spreads in MLT.