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Modeling ionospheric outflows with the Space Weather Modeling Framework

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Ionospheric outflows are an important source of heavy ions in the magnetosphere. Ambipolar electric fields, Field Aligned Currents (FACs), Joule heating, centrifugal acceleration, wave-particle interactions, and other physical phenomenon accelerate plasma and can lead to mass flow from the ionosphere to the magnetosphere. Most Magnetosphere-Ionosphere Coupling (MIC) models ignore these processes instead relying on pressure gradient terms to draw plasma off the inner boundary of the magnetosphere. We present preliminary results of new efforts to model the "gap" region in the Space Weather Modeling Framework (SWMF). In particular, we use the Polar Wind Outflow Model (PWOM), a field-aligned multi-fluid polar wind code, and describe efforts to couple it to the Upper Atmosphere (UA), Ionosphere Electrodynamics (IE), and Global Magnetosphere (GM) components of the SWMF. We present our methodology for the MIC, as well as several controlled numerical experiments demonstrating the importance of different physical processes.