An Instrument Suite for Neutral and Ion-drifts, Equivalent Temperatures, and Composition

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The exobase lies between 500 - 1000 km, marking the final interface where molecules transition from the collision dominated atmosphere to the ballistic trajectories of the exosphere. With global coverage at 800 km, the second group of 6 FORMOSAT-7/COSMIC-2 satellites is an ideal platform for understanding the seasonal and local time variability of neutral and charged particles in this key region. We propose a new instrument suite that will measure the in-situ non-equilibrium properties of the upper atmosphere and ionosphere in this region. Complementing the primary GPS occultation payload, this instrument suite will allow the FORMOSAT-7/COSMIC-2 constellation to provide unprecedented coverage of space weather in a region of geospace that has traditionally been undersampled.

Combining sensors derived from the FORMOSAT-5 AIP retarding potential analyzer and WINCS concepts, energy analyzers will measure the energy distributions of neutrals and ions while mass spectrometers identify constituent masses uniquely to remove ambiguities regarding their angular and energy distributions. In addition to measuring departure from thermodynamic equilibrium in the exosphere, the suite will provide composition, plus the non-equilibrium bulk velocities – neutral and ion-drifts, plus equivalent temperatures from the particle energy spreads. Detailed simulations of the spectrometer performance will be presented with expected outcomes.