

Surface Chemistry and Physics: Implications for Terrestrial Polar Science and Planetary Science

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Field measurements have only recently unearthed the discovery that the terrestrial polar snowpack is one of the most photochemically active environments on Earth. Due to the strong feedback between the sunlit snowpack and the air over it, such chemistry in the terrestrial polar regions is now recognized to strongly influence the overlying atmospheric boundary layer and potentially the free troposphere due to mixing. It is becoming more accepted that iodine chemistry, intimately linked to NO_x chemistry, plays a major role in controlling ozone concentrations in the overlying boundary layer. In addition, iodine forms aerosols and contributes to the transformation of elemental mercury to its reactive form. Considering that polar tropospheric ozone exhibits a large radiative forcing, iodine forms aerosols, and reactive mercury is detrimental to the polar ecosystems, it is imperative to understand the source of iodine and NO_x . An overview covering laboratory results, which elucidates the properties of ice as a reaction medium, and provides the framework (*i.e.*, the surface chemistry and physics) for the creation of the first multi-phase model for the polar regions, CON-AIR (Condensed Phase to Air Transfer Model) will be presented. This model accounts for the measured iodine and NO_x in the terrestrial polar boundary layer. These model simulations have implications for: 1) being available as a tool for the atmospheric science community to perform additional modeling, laboratory, and field studies relevant to the dynamic interplay of the polar boundary layer and the snowpack; 2) the influence of heterogeneous surface photochemistry on overlying gas phase chemistry of planetary bodies with tenuous atmospheres; and 3) carrying out laboratory and modeling investigations relevant to planetary surfaces (*e.g.*, Mars, Europa, and interstellar clouds) to study the possible formation and chemistry of life forming molecules.