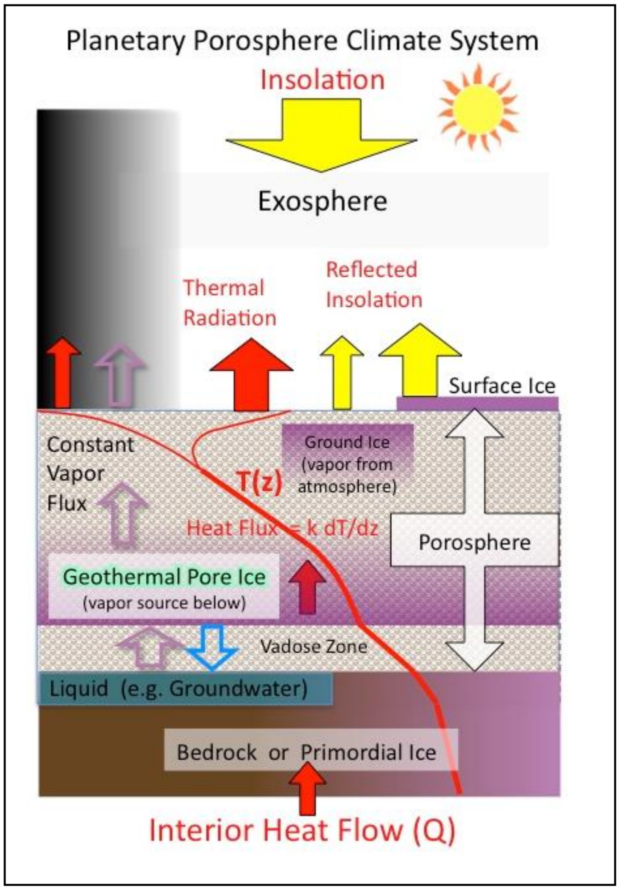
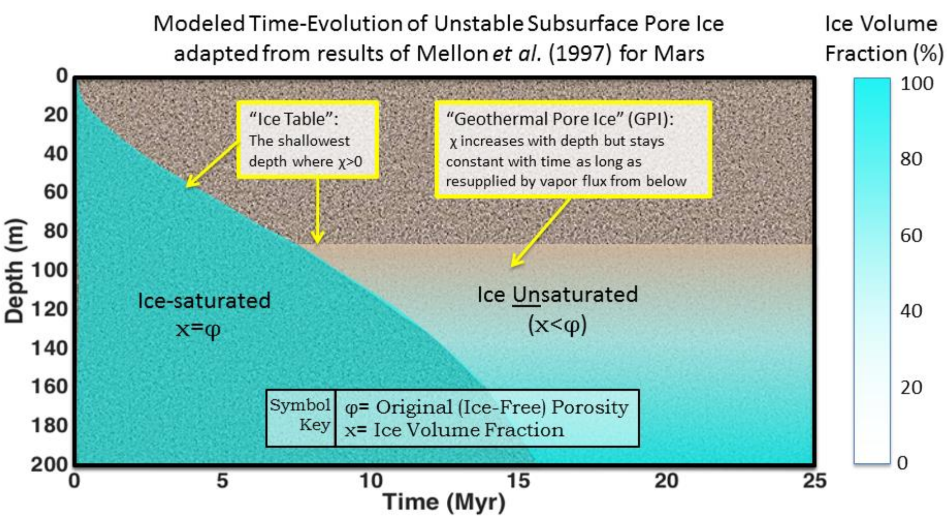
**GEOTHERMAL PORE ICE ON AIRLESS BODIES.** Stephen E. Wood, Dept. of Earth and Space Sciences, University of Washington, Box 351310, Seattle, WA, 98195-1310, sew2@uw.edu.

**Introduction:** Recent observations of the asteroid Ceres made in the far infrared indicate that the body is outgassing water vapor at a rate of approximately 6 kg/s [1]. We find that a model for the flux of vapor from a partially ice-saturated regolith on Ceres, driven outward by the geothermal gradient for an assumed heat flux of ~1 mW/m$^2$ , can produce a comparable global flux of $H_2O$ vapor. The same model applied to the flux of $CO_2$ vapor from the regolith of Callisto [2] (assuming a water ice regolith partially saturated with $CO_2$ ice) produces a global flux approximately equal to the estimated source flux required to maintain the observed $CO_2$ exosphere against known loss processes (0.3 kg/s) [3].

Our model is based on previous theoretical work related to deep equatorial ground ice on Mars [4] that demonstrated how an assumed initially pore-filling subsurface ice layer would retreat when near-surface conditions made the ground ice no longer stable. Mellon [4], and Clifford [5], pointed out that once the ice table (the shallowest depth with a non-zero volume fraction of pore ice) retreated below a certain depth, the linear gradient of vapor density established by diffusion of vapor to the surface would necessarily go through the supersaturated regime of its phase diagram and therefore recondense as pore ice, an effect not considered in previous work [6]. Once this occurs, a steady-state profile of ice volume fraction, f_ice(z), develops, with net mass loss only occurring from the retreating pore-filling ice layer. The rate of vapor flux to the surface is then determined only by the vapor density and temperature gradient at the ice table depth (z0). We use an analytic physical model for regolith thermal conductivity [7,8] and a range of assumed values for the crustal heat flux to calculate the temperature gradient at z0, then integrate over all latitudes where surface ice is unstable to estimate the resulting global volatile vapor flux on Ceres, Callisto, Iapetus, and other "airless" icy bodies.




**References:** [1] Küppers et al. (2014), *Nature*, *505* (7484), 525-527. [2] Wood et al. (2012), LPSC Abstract 43, 2901. [3] [4] Mellon et al. (1997), *JGR*, *102*, 19357-69. [5] Clifford (1993), *JGR*, *98*, 10973-11016. [6] Fanale and Salvail (1989) Icarus 82, 97-110. [7] Wood (2013) *LPSC Abstracts*, *44*, 3077 [E--poster]. [8] Wood (2015), in preparation.