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Potential Distribution of high-grade buried water ice at low- to mid-latitudes of Mars

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Data measured using the Mars Odyssey Neutron Spectrometer (MONS) were reanalyzed to reduce counting-rate variances on a 0.5 deg latitude-longitude cylindrical spatial grid. This task was accomplished by filtering the data measured between Feb, 2002 and Sept. 2009 ($\sim$ 4 Mars year) for times when the gains of the MONS photomultiplier tubes were sufficiently high to allow a clean definition of the background beneath the 10B(n,alpha)7Li peaks in singles counting-rate spectra. The filtered epithermal time-series data set was reduced from the original by about 25% and that of the thermal data set by 50%. Nevertheless, the volume of data remaining was sufficiently large that statistics was not a problem. Frost-free data were then smoothed using a 2 deg - HWHM Gaussian function and mapped onto a 1deg cylindrical grid. Subsequently, thermal and epithermal counting rates were converted to a Water-Equivalent-Hydrogen (WEH) abundance of a lower layer, Wdn, buried at a depth, D, beneath an upper layer containing 1% WEH by mass and a chemical composition compatible with that of Mars Exploration Rovers outputs. These data were then searched for a signature of buried WEH ranging between Wdn = 30% and 100% by mass at depths larger than 60 g/cm2 (corresponding to 40 cm at a density of 1.5 g/cm3). The pattern of data found in the neighborhood of the five recent small craters showing almost pure water ice using HiRISE data [Byrne et al., Science, 3325, 2009] was used for our selection of potential buried-ice locations. This task was accomplished using scans within a +/-75 deg latitude zone applied at a constant longitude grid with 10 deg spacing (the actual spatial resolution of the MONS is a 10 deg circle). Most locations found lay within the northern mid latitudes just north of the dichotomy boundary. They also cluster around terrain marked by late Hesperian and Amazonian extensive lava flows as well as the Chryse out-flow channels. The distribution of these locations does not match precipitation patterns during the recent past but could possibly match plumes of rising brine driven by enhanced geothermal temperature gradients [Travis, Feldman, Maurice, A mechanism for bringing ice and brines to the near-surface of Mars, Geophys. Res. Letters, submitted, 2010].