CHARACTERISING PERCOLATION AND WET-SNOW FACIES VARIABILITY ON
DEVON ISLAND ICE CAP, NUNAVUT, CANADA

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ABSTRACT: As the Earth’s coldest regions undergo marked changes due to atmospheric warming, so
will the surface facies configurations of its glaciers and ice sheets. Their percolation and wet snow zones
will expand upwards and occupy more area. The inherent stratigraphic complexity of these zones will
then impart greater uncertainty in glacier and ice sheet mass balance estimates derived from traditional
stake and pit methods. Using impulse and FM-CW Ground Penetrating Radars, borehole neutron
scattering and manual snow stratigraphy measurements, our goal is to better describe the spatial and
temporal variability of the percolation and wet-snow facies. Our measurements consider sub-meter to
kilometre to inter-facies scale variability.

Improved knowledge of such variability has practical significance. First, uncertainties in glacier and ice
sheet mass balances remain largely unquantified – unsatisfactory as it concerns documenting relatively
small changes over large areas. Second, the retrieval of wide-area mass balance change using elevation
changes from repeat airborne and orbital altimetry (e.g., ALTM, ICESat, CryoSat) will require information
on snow density, densification and the spatial scale of variability over the altimeter footprint. We suggest
that there is a need for continual in situ validation studies over the lifetime of altimeter-based glacier and
ice sheet change detection campaigns.

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