The White Arctic: A Snow Impacts Synthesis for the Terrestrial Arctic

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Arctic Snow Cover

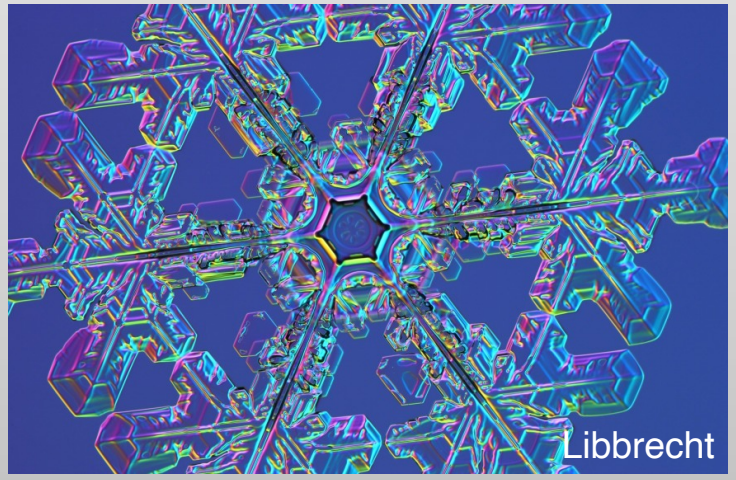
Depth

Duration

Layers

Surface Properties

Physical Properties of Snow



Energy

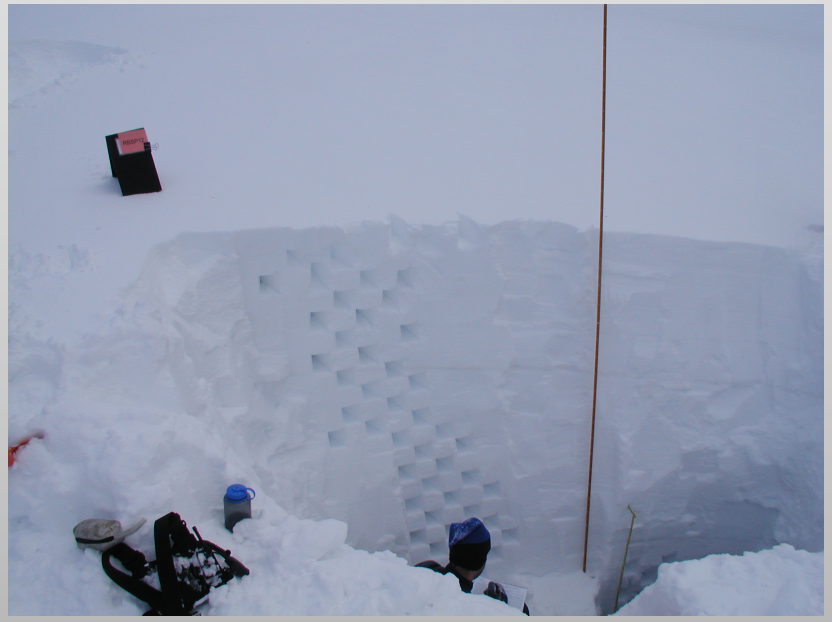
Radiation

Insulator

It moves

Water

Snow Influences



Water Budget

Energy Budget

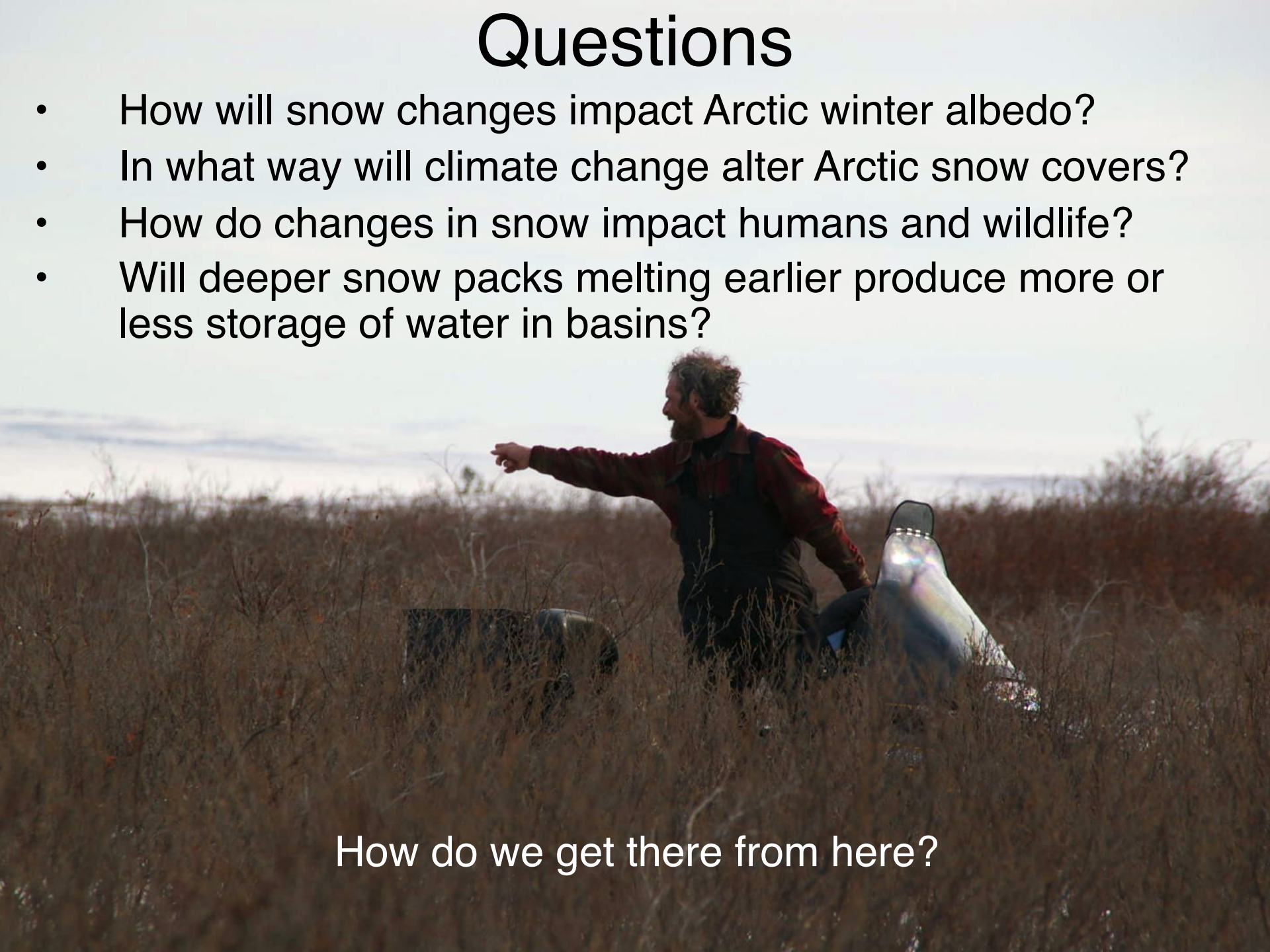
Challenge of Arctic Snow

Focus

- As the arctic climate changes, in addition to changes in snow depth and water equivalent, *the mechanical, thermal, and optical properties of the snow cover will also change, and all of these changes (and their spatial-temporal distributions) will produce a complex set of interlinked ramifications best understood by undertaking a snow-centric analysis.*

Questions

- How will snow changes impact Arctic winter albedo?
- In what way will climate change alter Arctic snow covers?
- How do changes in snow impact humans and wildlife?
- Will deeper snow packs melting earlier produce more or less storage of water in basins?



How do we get there from here?

SnowModel: A Spatially Distributed Snow-Evolution Modeling System (Liston and Elder 2006a).

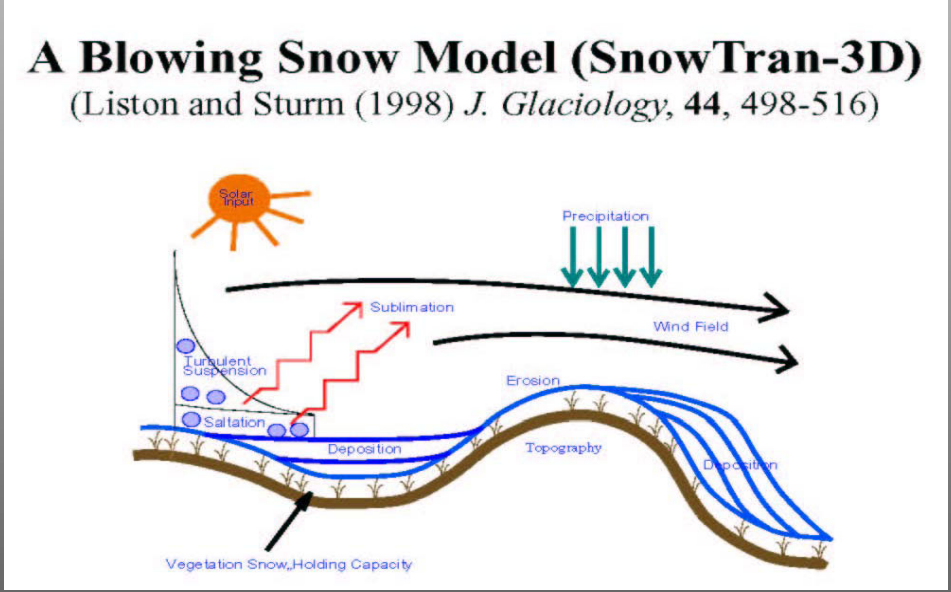
MicroMet – Micro-Meteorological Distribution Model (Liston and Elder 2006b)

EnBal – Surface Energy Balance/Melt Model (Liston et al. 1999)

SnowPack – 1-D, Single-Layer Snowpack Model (Liston and Hall 1995)

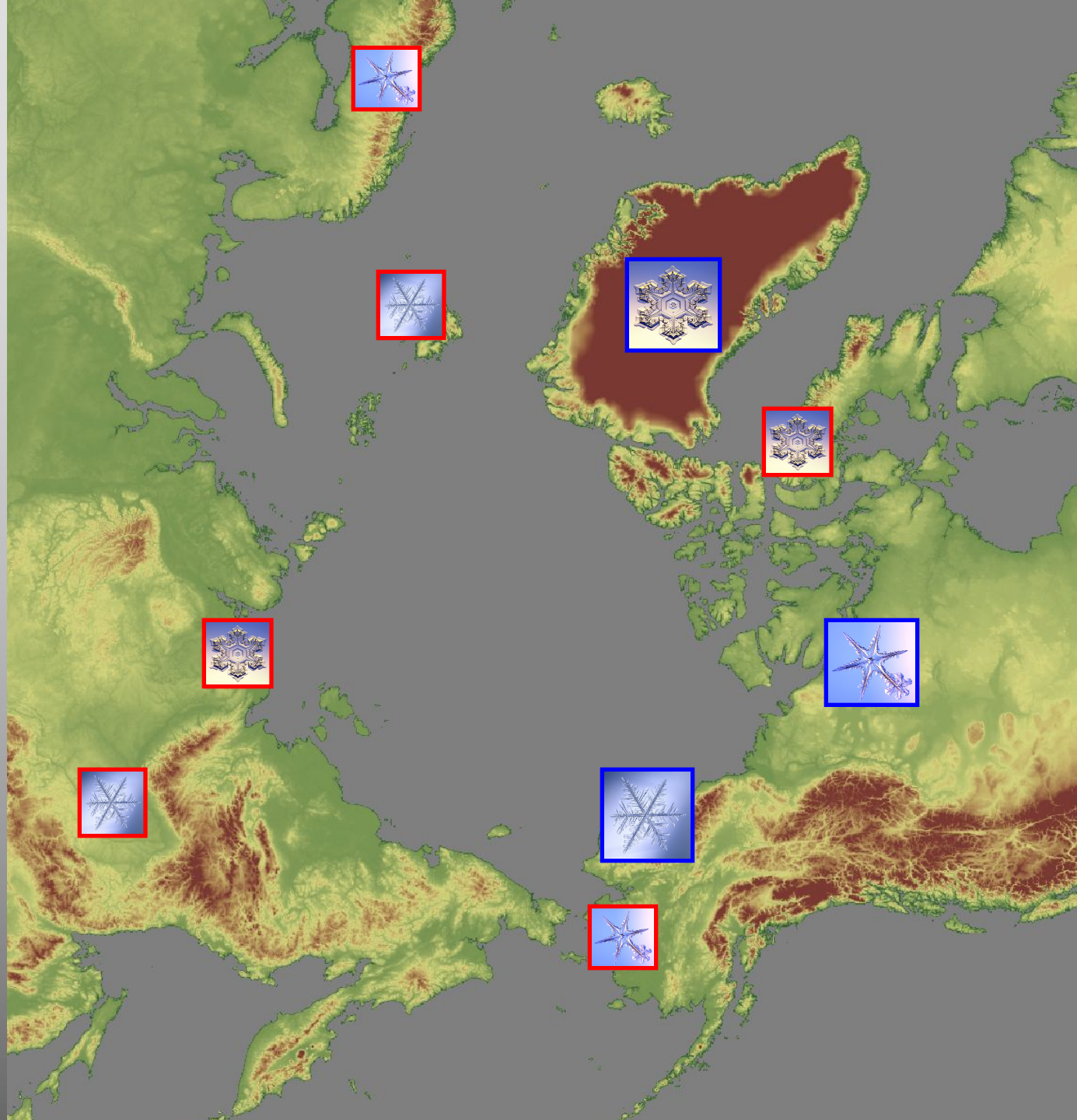
SnowTran-3D – Blowing and Drifting Snow Model (Liston and Sturm 1998; Liston et al. 2007)

SnowAssim – Snow Data Assimilation Model (Liston and Hiemstra 2007)



Our collection of area-specific simulations will be used to guide Pan-Arctic model simulations.

The red boxes indicate previous simulation efforts; the blue boxes indicate current efforts.



Example Spatially Distributed Products

Winter Optical Properties: Landscape albedo, Protruding vegetation fraction, Dry and wet transition timing

Snow Thermal Properties: Snow depth and density, Soil temperature, Winter soil biological productivity index

Snow Mechanical Properties: Ice-crust formation, Blowing-snow event frequency, Snow trafficability index

Hydrologic Characteristics: SWE, Snowmelt timing, Snow-free season length, Meltwater partitioning

Snow Geeks