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Sandia National Laboratories

UAVs for soil moisture and snow observations

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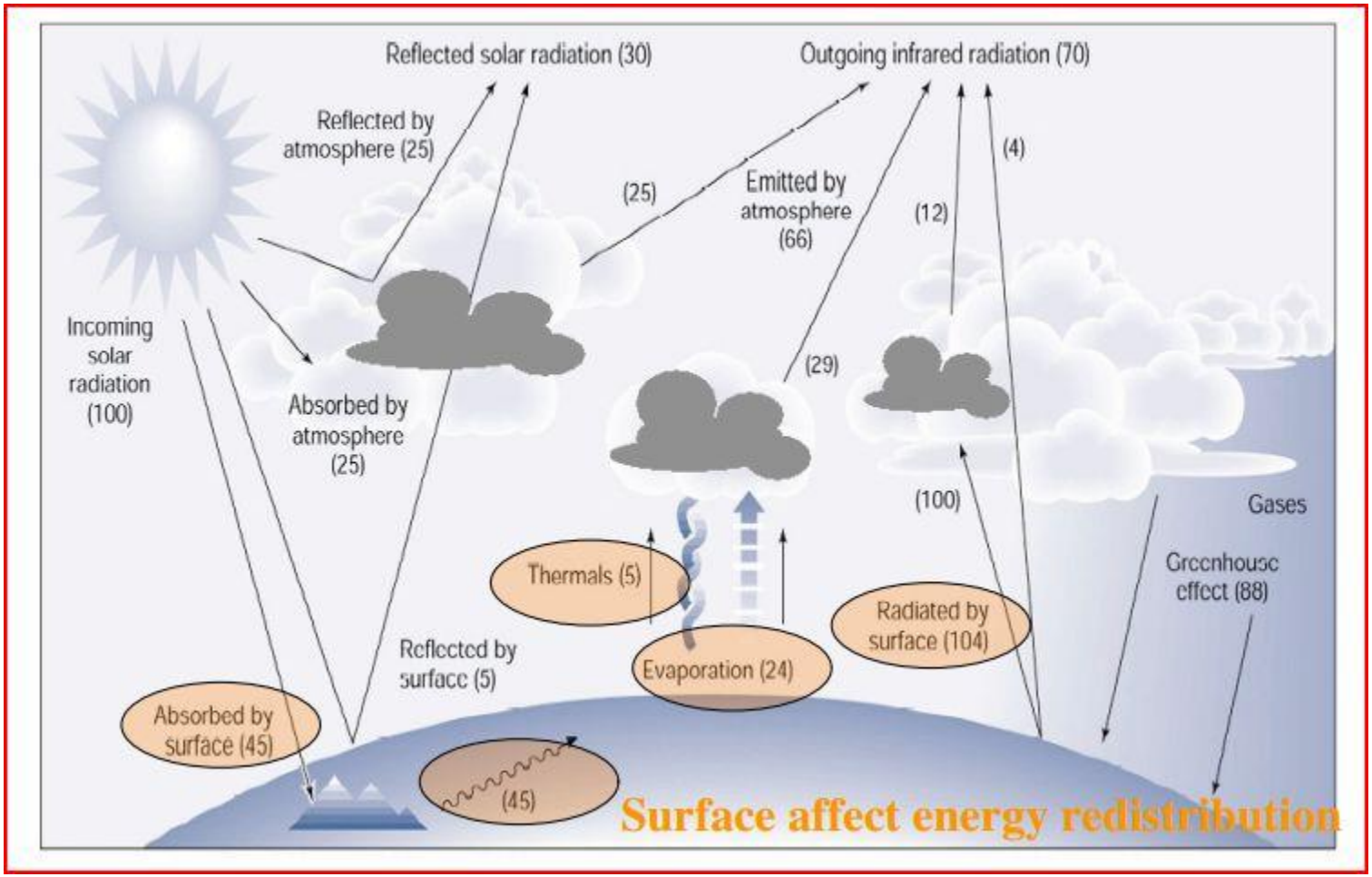
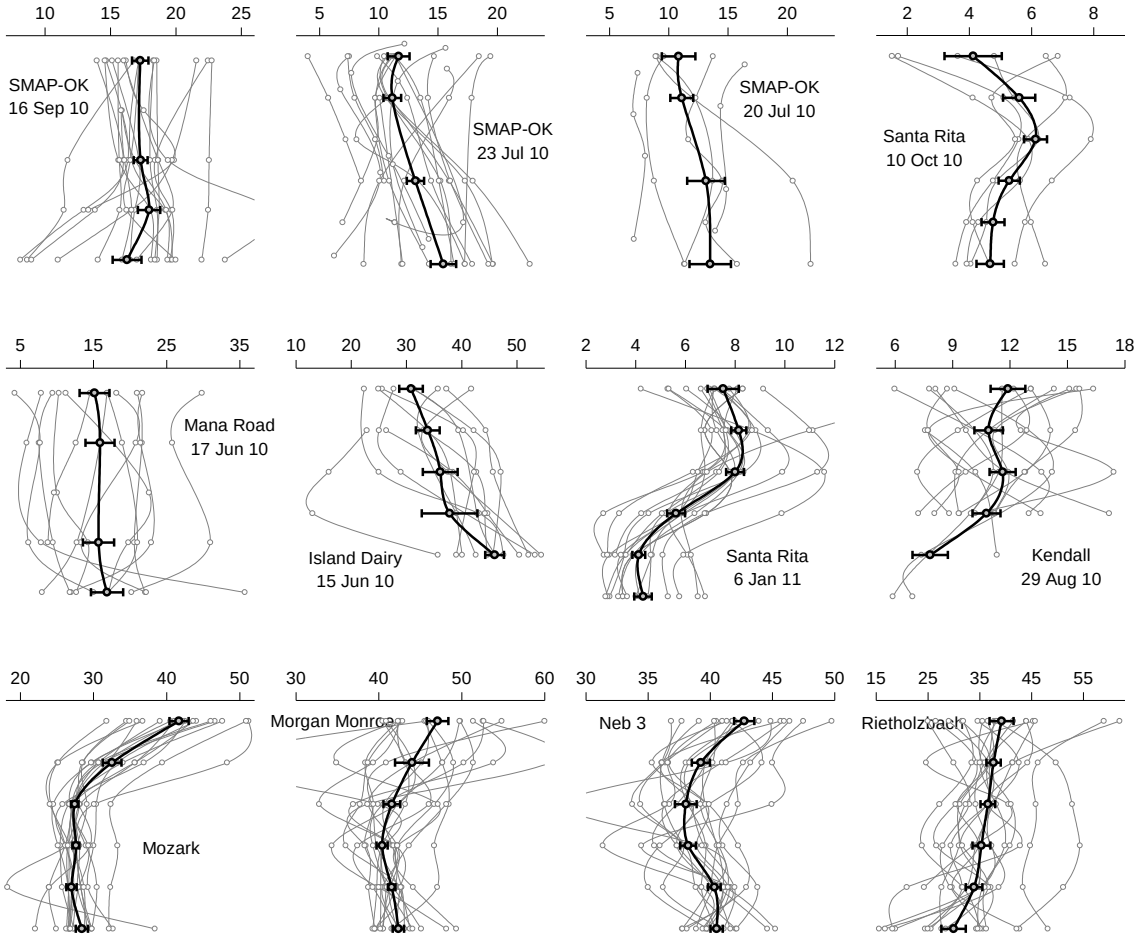
Land surface energy balance



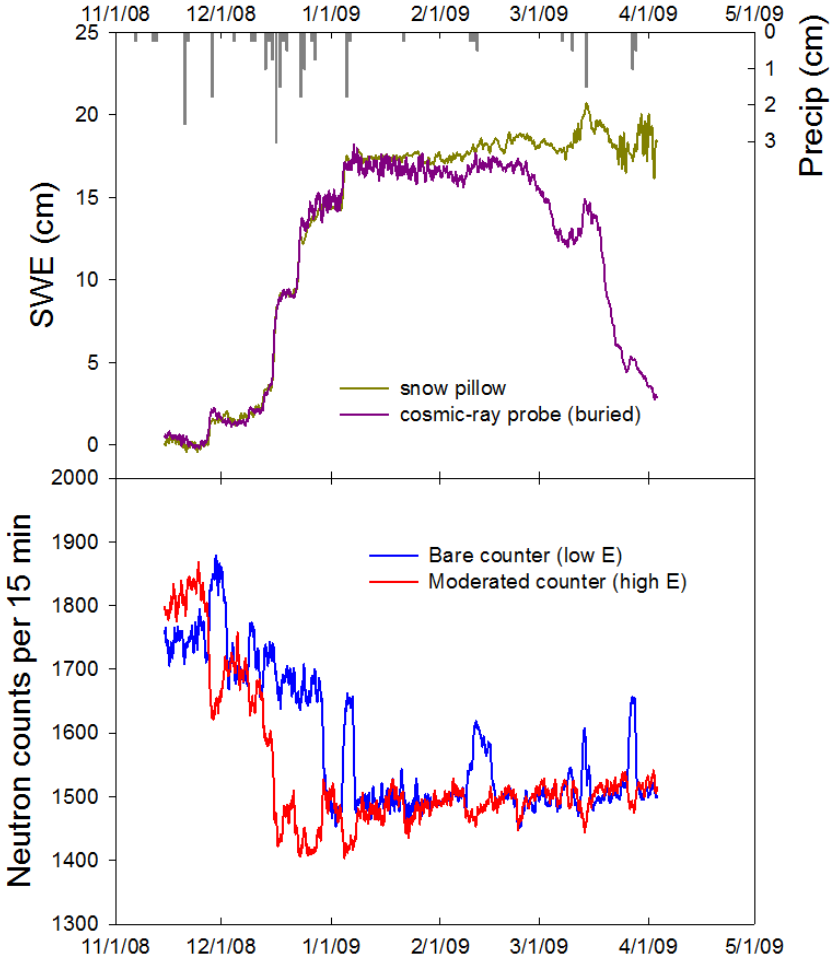
Arctic science applications

- Permafrost covers 20% of Earth's of land mass
- High latitudes are warming several times as fast as low
- Permafrost soils store huge amounts of C (~1600 Pg)
- CO_2 emissions have increased 40% in two decades--where has it gone?
- Questions remain: will arctic become a net carbon source or sink?
- Sparse data in cold regions, so processes not well understood

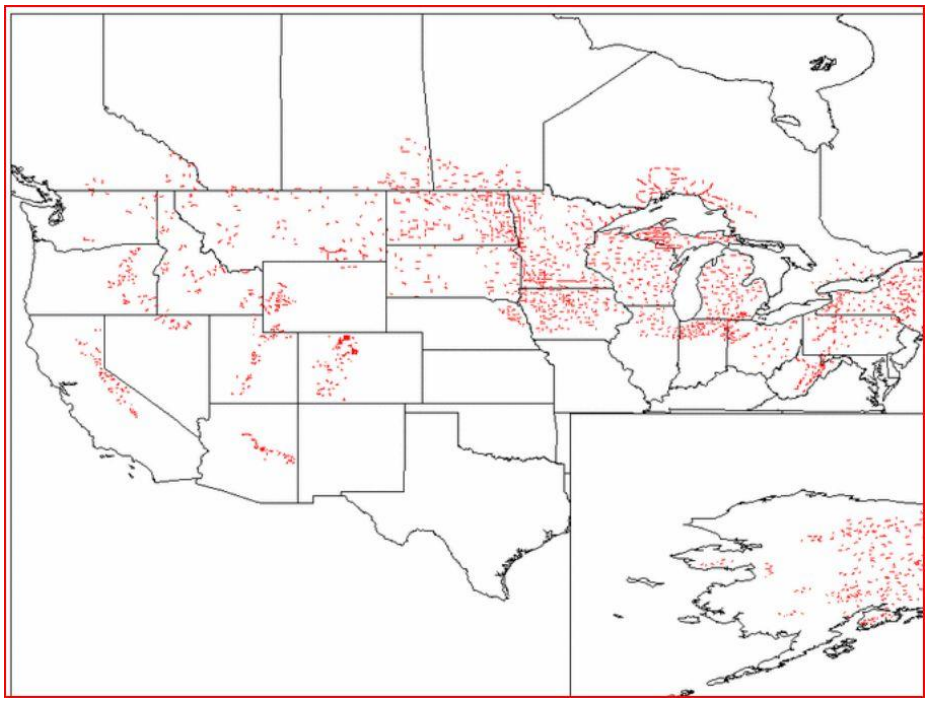
Soil moisture: highly variable in space and time



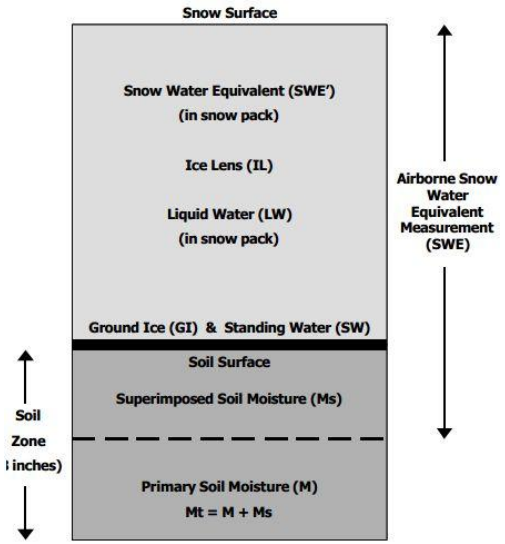
Snow: highly variable in space and time too!



State of the art: snow and soil moisture observations with low-flying aircraft



NOAA NOHRSC Flight lines



Looking to the future

- Aerial gammas surveys require low flying aircraft

- Data are lacking in remote areas such as the Arctic, where conditions are particularly unfavorable for aviation

- UAVs are a highly promising alternative, but existing techniques must be adapted
  - lower weight instrumentation
  - less power consumption
  - fully automated

- New techniques should be developed—e.g. aerial neutrons.

- Soil moisture and snow surveys are promising canidate for regular UAV operations