

# Introduction to snow research in the Numerical Weather Prediction Group

Timo Vihma

## 1. Surface energy balance over snow and ice

Field experiments and data analyses:

Antarctic: snow on sea ice (2004-2005), particular focus on albedo, snow-covered glacier and blue ice (2006-2008), in collaboration with MER

Arctic sea ice: Tara and Vagabond expeditions in 2007-2009 (with Uni Tartu)

Svalbard: coastal snow in 2009 (with Uni Tartu)

## 2. Snow properties

Field experiments and data analyses:

Spatial and temporal variations in snow density and temperature in the Antarctic (with SYKE and MER)

Snow grain size and structure in the Antarctic (with MER) and Sodankylä (with UHA)

### **3. Modelling of the snow pack**

Development of the vegetation-snow-ground and snow-on-sea-ice schemes and snow analyses in HIRLAM and AROME

Radiative transfer and albedo (with ILM and MER)

Snow thermodynamics over sea ice (with MER)

### **4. Climatology of snow in the Arctic**

Factors controlling inter-annual variability in the spring onset of snow melt over sea ice (with UPMC, Paris)

Snow fall in the Arctic and its links to atmospheric moisture budget (with Uni Tartu)

## Some examples of recent results

**Surface energy balance over snow in Antarctic sea ice (ISPOL & McMurdo) and Arctic sea ice (SHEBA) in summer (Vihma, Johansson, Launiainen, 2009, JGR in press)**

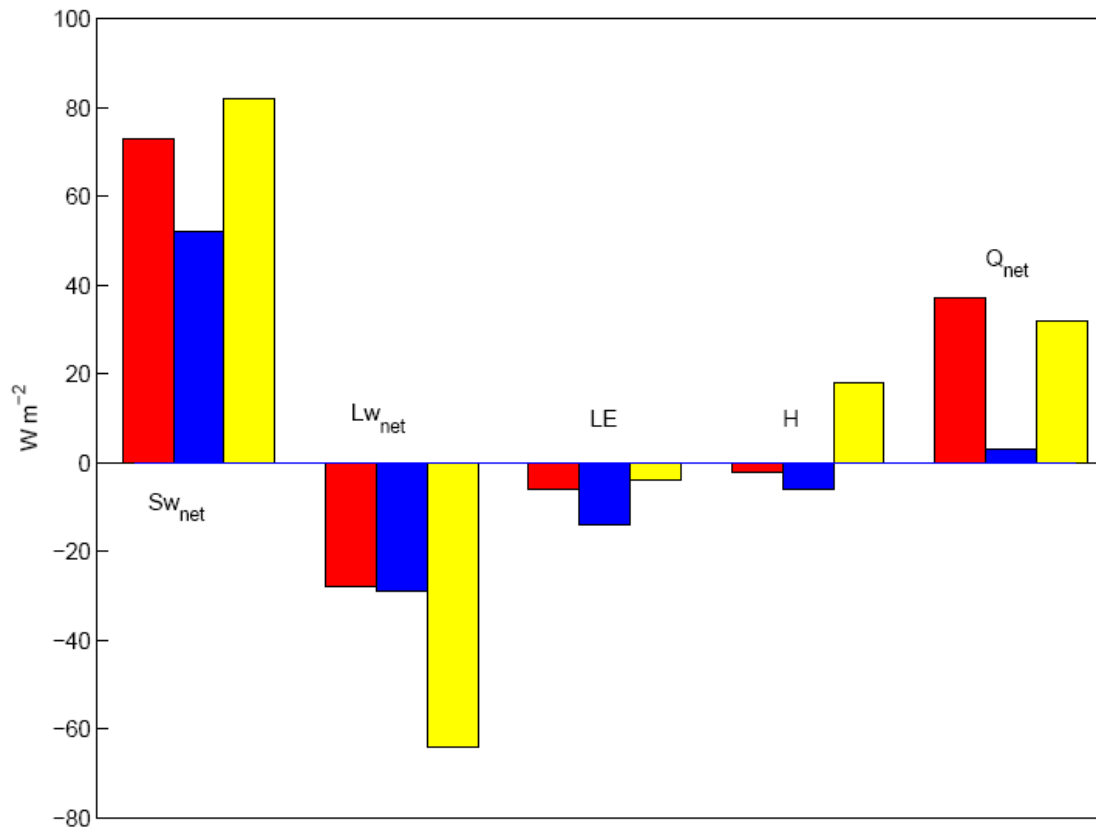
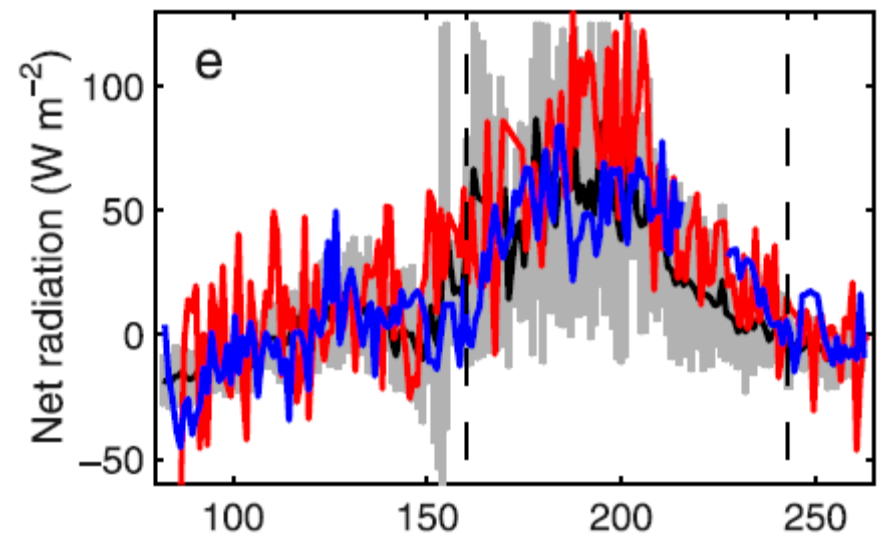
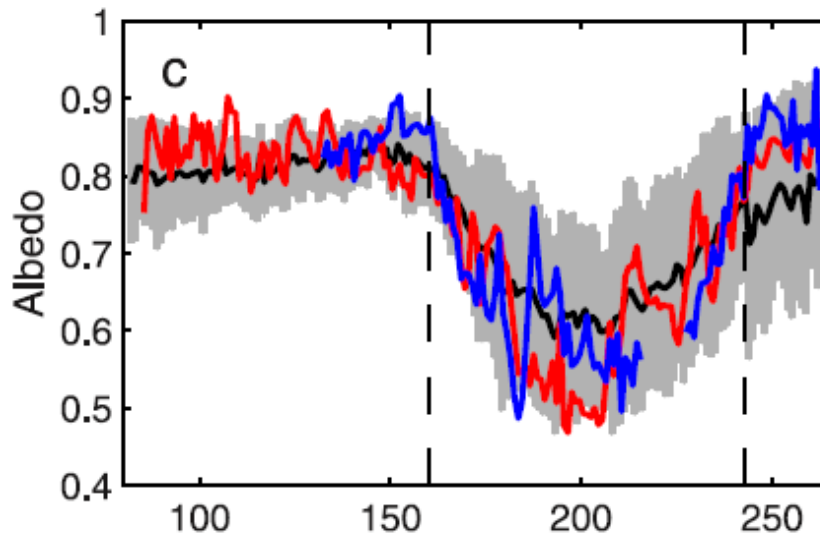
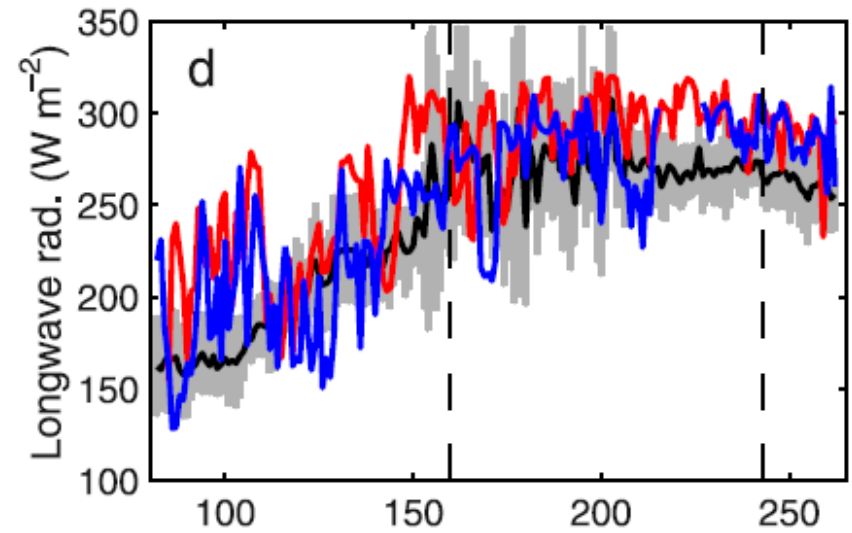
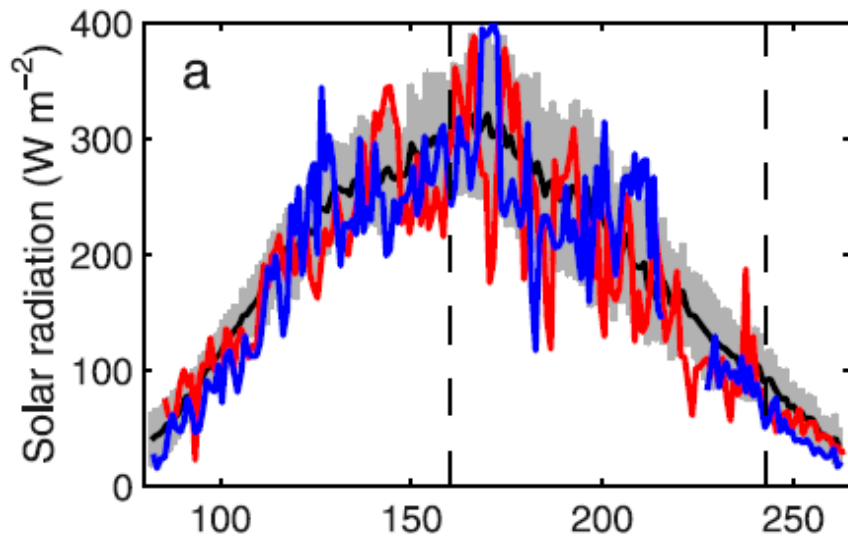


Figure 11. Mean surface fluxes at SHEBA in June 1998 (red), at ISPOL (blue), and at McMurdo Sound on 28-31 December 2000 (yellow; from Table III of Wendler et al., 2005).

# Radiative fluxes over snow-covered sea ice in the Arctic Ocean in 2007 (Vihma et al., 2008, GRL)



# Arctic moisture budget on the basis of ERA-40 (Jakobson and Vihma, 2009, submitted to Int. J. Climatol.)

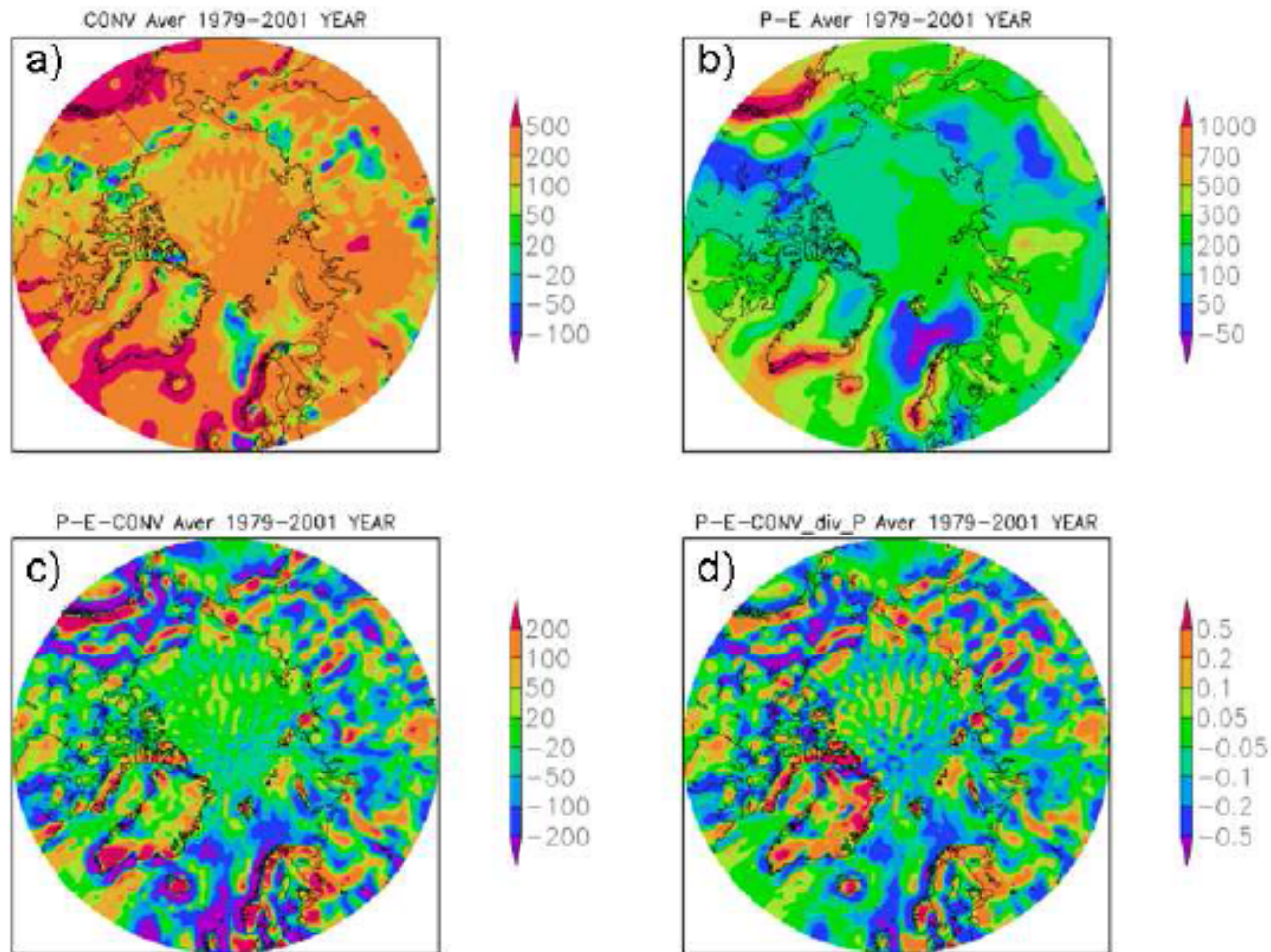
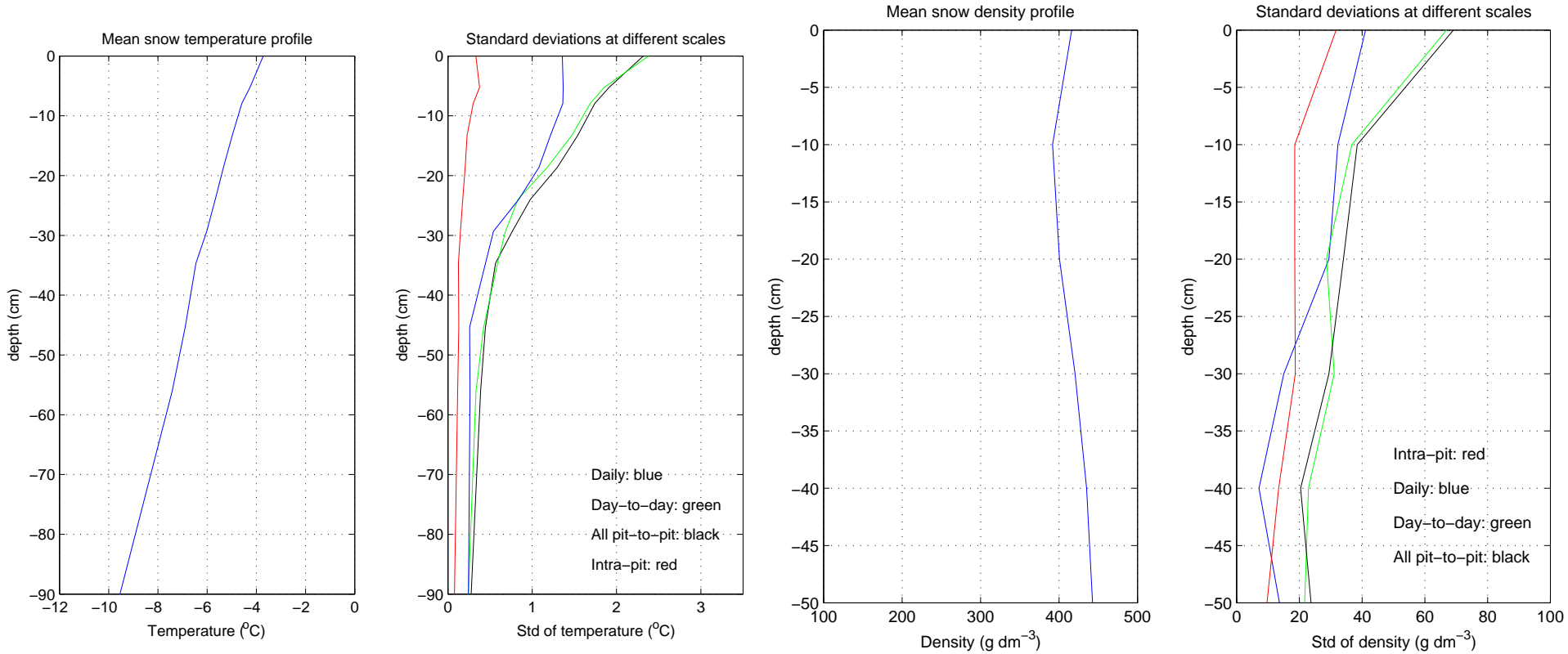
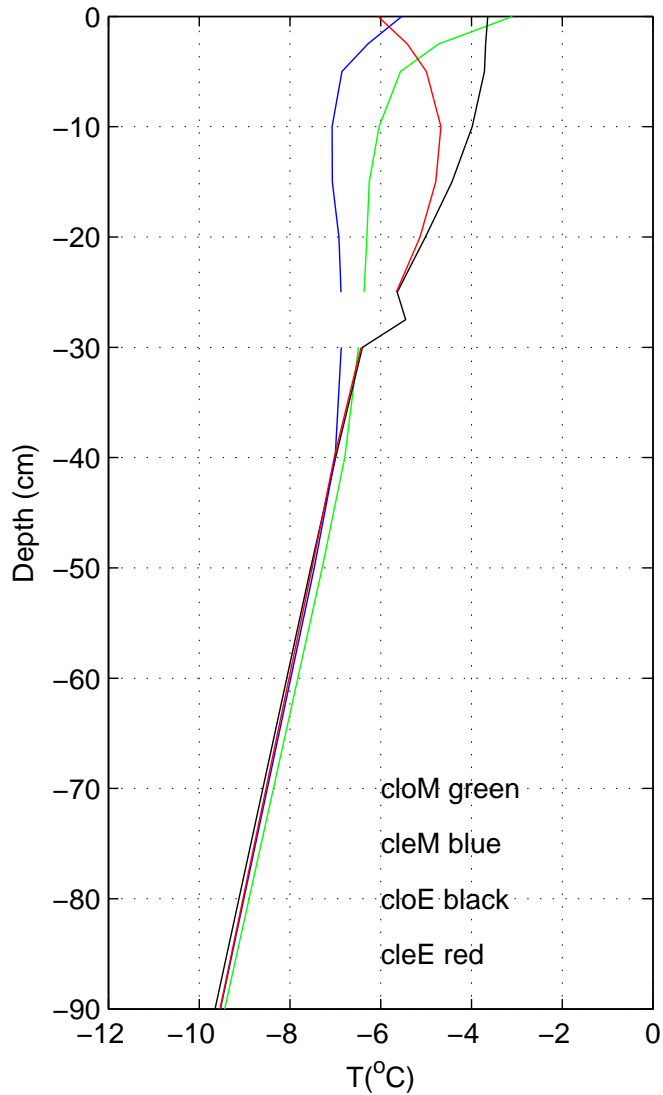


Figure 10. Annual means in 1979-2001 of (a) water vapour flux convergence (mm yr<sup>-1</sup>), (b) net precipitation (mm yr<sup>-1</sup> water equivalent), (c) difference between flux convergence and net precipitation (mm yr<sup>-1</sup>), and (d) difference between flux convergence and net precipitation divided by precipitation.

# Variability of snow temperature and density on Antarctic glacier in summer



Mean profiles in cloudy & clear mor & eve



Day-to-day std in cloudy & clear mor & eve

