### Dynamical downscaling of precipitation – Comparison with glaciological and hydrological data

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### Overview of this talk

- Setup of numerical simulations
- Simulated precipitation
- Glaciological data
- Hydrological data

### **Numerical Simulations**

#### - PSU/NCAR MM5 model

Microphysics: Reisner 2

- Horizontal gridpoint spacing: 8km
- 23 vertical levels
- Boundary conditions: ERA40
- Period: 1961-2006

# Dynamical downscaling using MM5 forced with ERA-40 data



#### Domain orography



#### Simulated precipitation



### Effects of unresolved orography



Differences between the MM5 (dx=8km) and LT (dx=0.1km) models

# Comparison with glaciological data

Corrections to take liquid precipitation and/or winter ablation into account have only been made for Hofsjökull



#### Hofsjökull dataseries





Winter

## Drangajökull (NW-Iceland)

WinterNW<br/>Obs[mm]NW<br/>MM5[mm]SE<br/>Obs[mm]SE<br/>MM5[mm]2004/051797 (3 pts.)2090/25542675 (2 pts.)2072/26032005/061833 (3 pts.)2105/25242815 (2 pts.)2127/2604

Observed mean winter balance at altitude > 400m in the NW- and SE-parts of Dyngjujökull. Simulated nine point mean (left – lower values) and nearest neighbour (right – higher values).

The model does not appear to capture the strong observed NW-SE precipitation gradient.

# Comparison with hydrological data

- Output from MM5 used as input to the WaSiM hydrological model for the period 1961-1990 to create a runoff map of Iceland.
  - The WaSiM model was not run with a groundwater module.
  - Instead, precipitation simulated by MM5 was scaled in order to make the simulated water balance fit the measured water balance for individual watersheds.
- Non-scaled MM5 data indicate 1790mm/year
- Scaled MM5 data result in 1750mm/year
- Difference in mean simulated annual precipitation is approximately 2%

## Comparison with hydrological data



Location of watersheds used for direct comparison. The watersheds are not much affected by groundwater flow.

# Direct comparison (unscaled precipitation)

Station #	Q measured	Q calculated	Difference
45	10.3	10.8	5.00%
128	22.4	25.3	13.00%
148	8.2	7.9	-4.00%
198	15.5	15.3	-1.00%
200	39.6	40.3	2.00%
265	19.9	18.4	-8.00%

Note that observation periods differ between stations

# Scaled precipitation – all watershed gauges



#### Difference is general less than 5%

# Summary

- In general, the MM5 model results compare favourably with observed winter balance.
  - Particular for Hofsjökull, where corrections to take liquid precipitation and/or winter ablation into account have been made.
  - Results also compare favourably for the comparatively high altitude outlet glaciers Dyngjujökull and Brúarjökull, where such corrections are relatively unimportant.
- Simulated discharge compares favourably with observed discharge for the majority of observation sites, indicating a satisfactory performance of the model.

Stay tuned – not all sugar and spice!!!