IMGI
Institute of Meteorology and Geophysics Innsbruck

FWF Der Wissenschaftsfonds.

On the mean bias of forecasted 2 m air temperature over snow covered complex alpine terrain.

Sascha Bellaire, Mathias W. Rotach & Jürg Schweizer

FWF-Project: SAINT – **S**now cover **A**tmosphere **INT**eractions

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Aim:

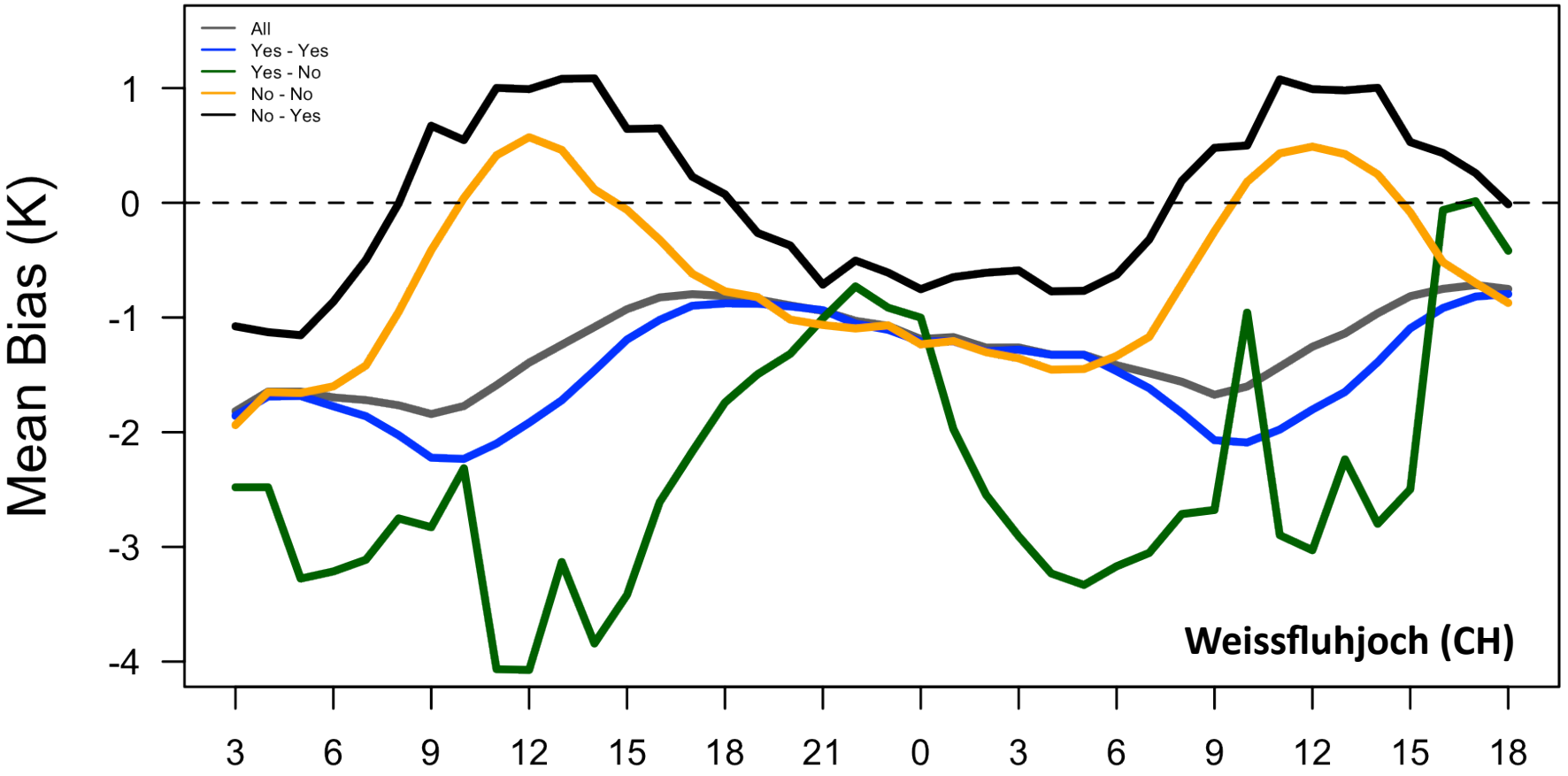
- **Coupling of a complex snow cover model (SNOWPACK) with a high-resolution numerical weather prediction model (COSMO-2).**


Davos, Switzerland
SLF experimental site


Picture: www.slf.ch

Mean Bias of 2 m air temperature (Mod. – Obs.)

All



Yes - Yes

Yes - No

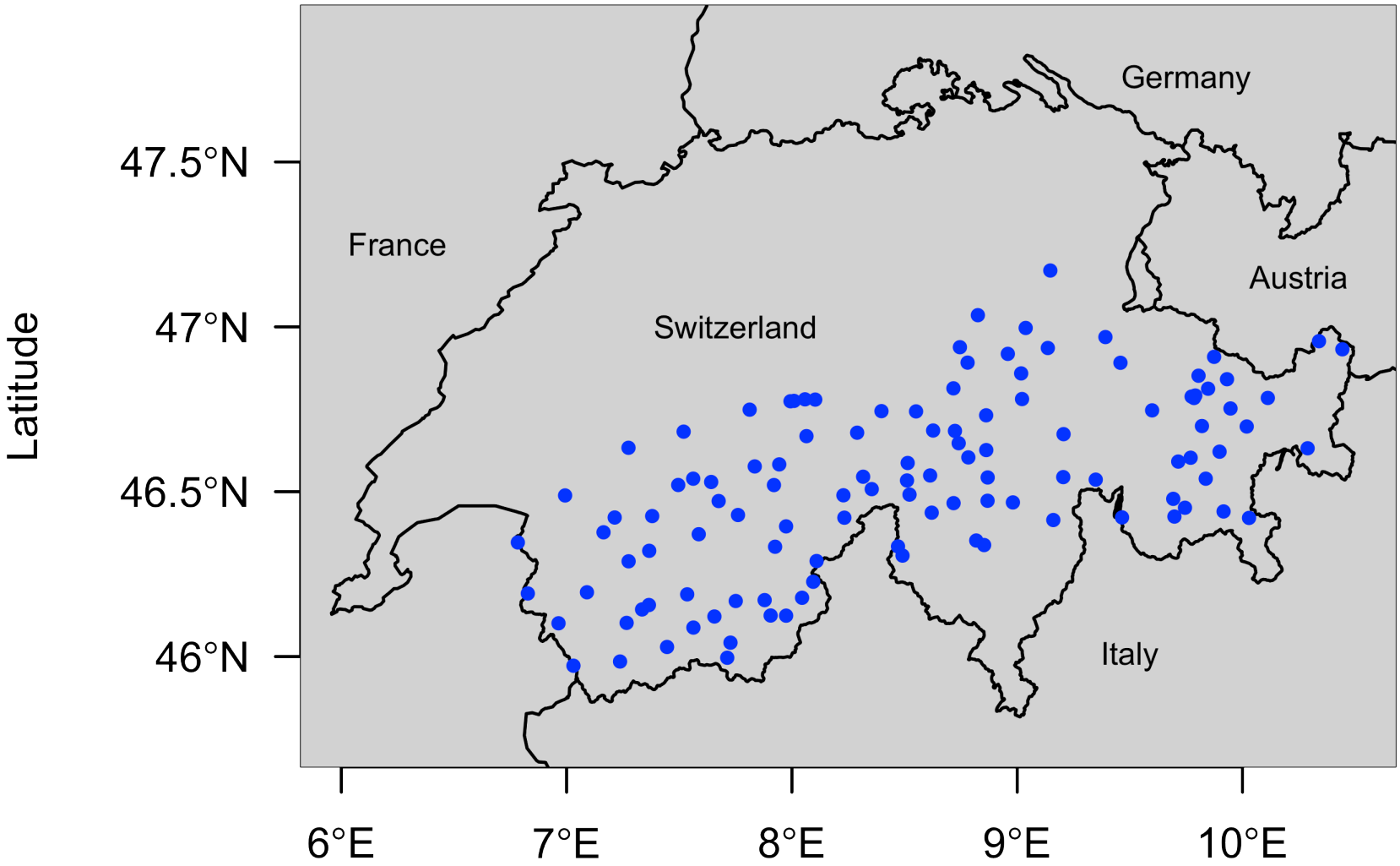
No - Yes

No - No

Intercantonal Measurement and Information System (IMIS)

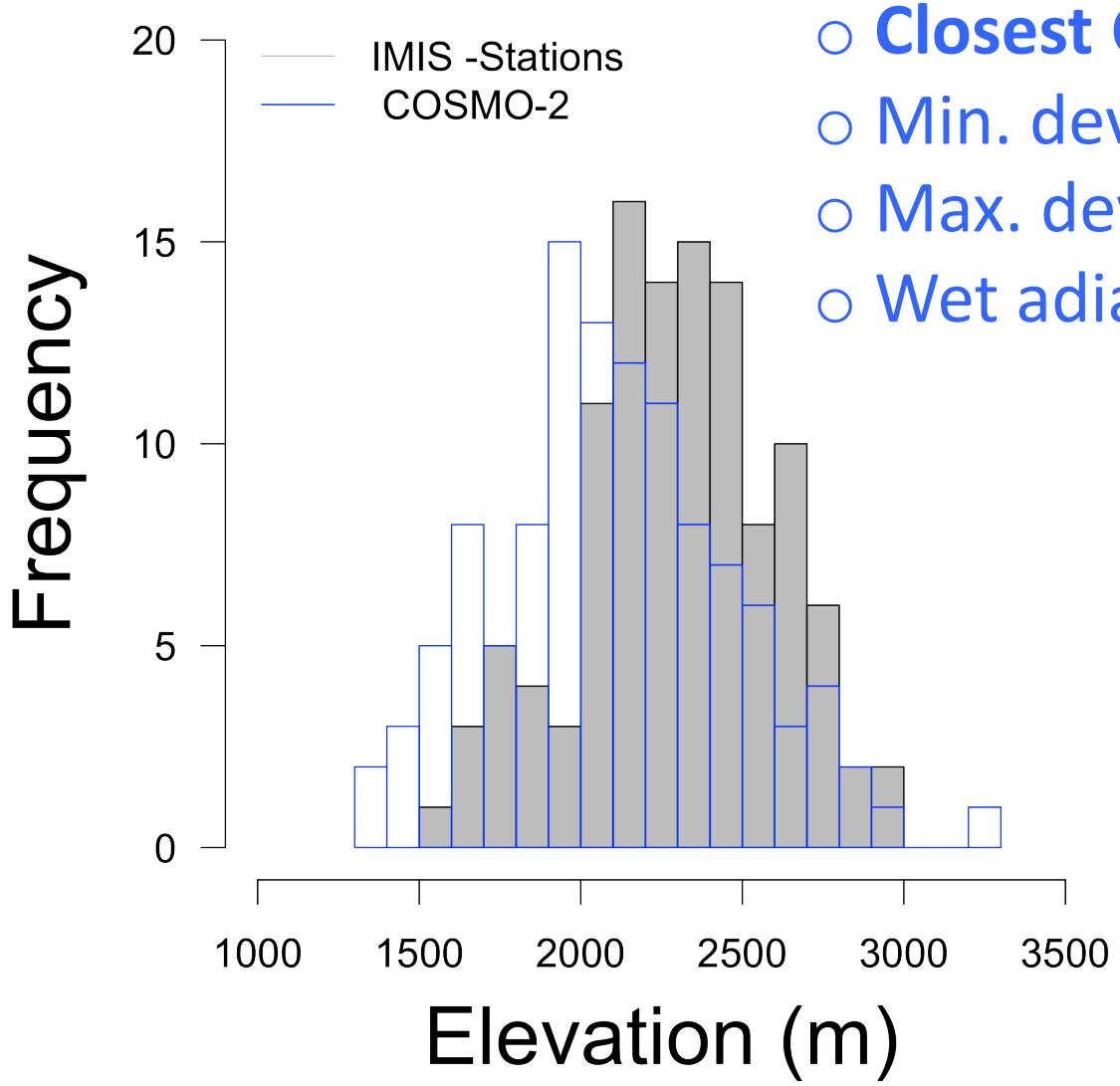
- **102 IMIS Stations**
- Air temperature **NOT ventilated**
- **Alpine terrain** between **1560 m and 2972 m**

Intercantonal Measurement and Information System (IMIS)



Oct. 2012 – Sept. 2013

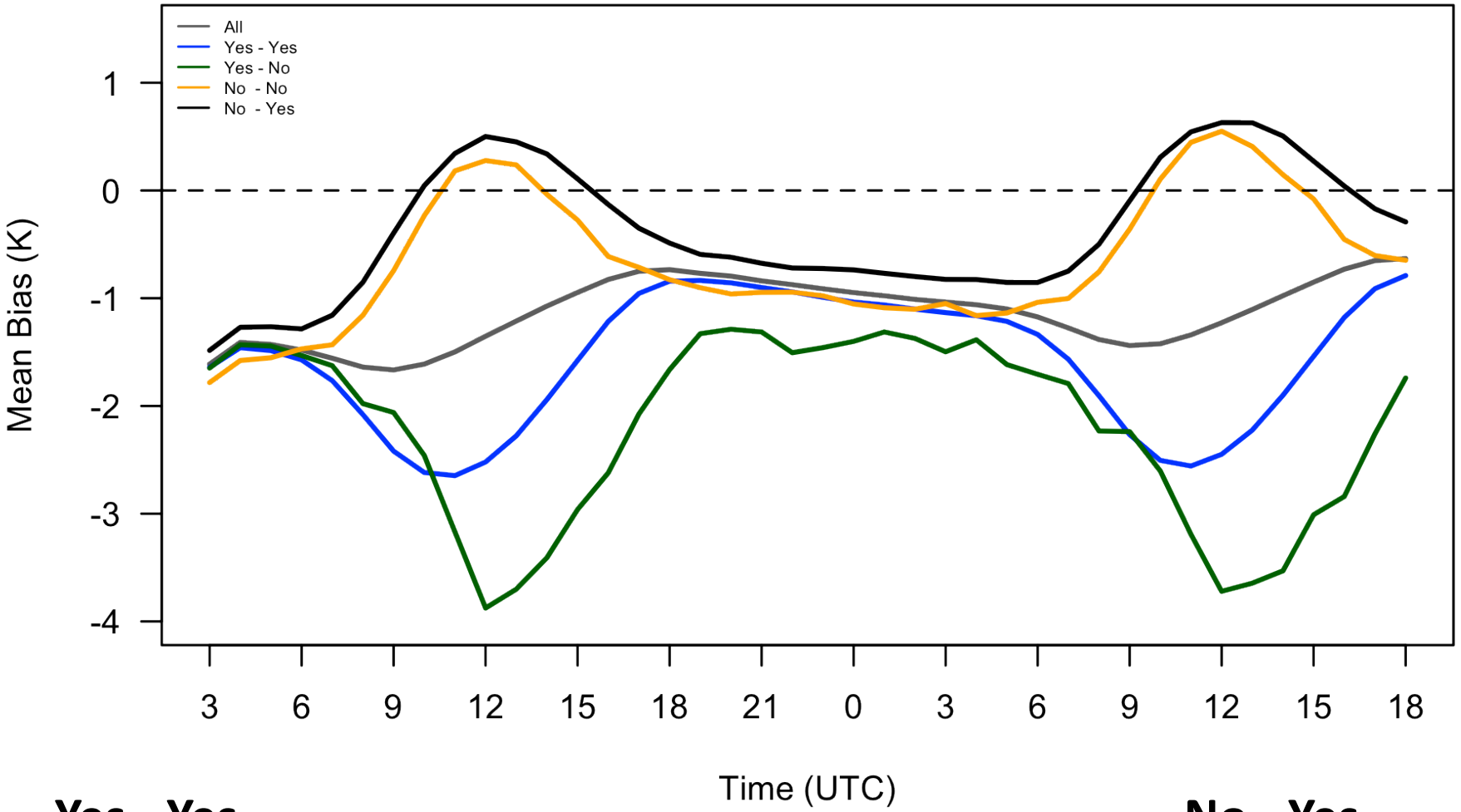
Elevation difference - COSMO-2 vs. IMIS



- **Closest** COSMO-2 **grid point**
- Min. deviation **1 m**
- Max. deviation **728 m**
- Wet adiabatic lapse rate **0.65 °C**

Mean Bias of 2 m air temperature (102 IMIS-Stations)

All



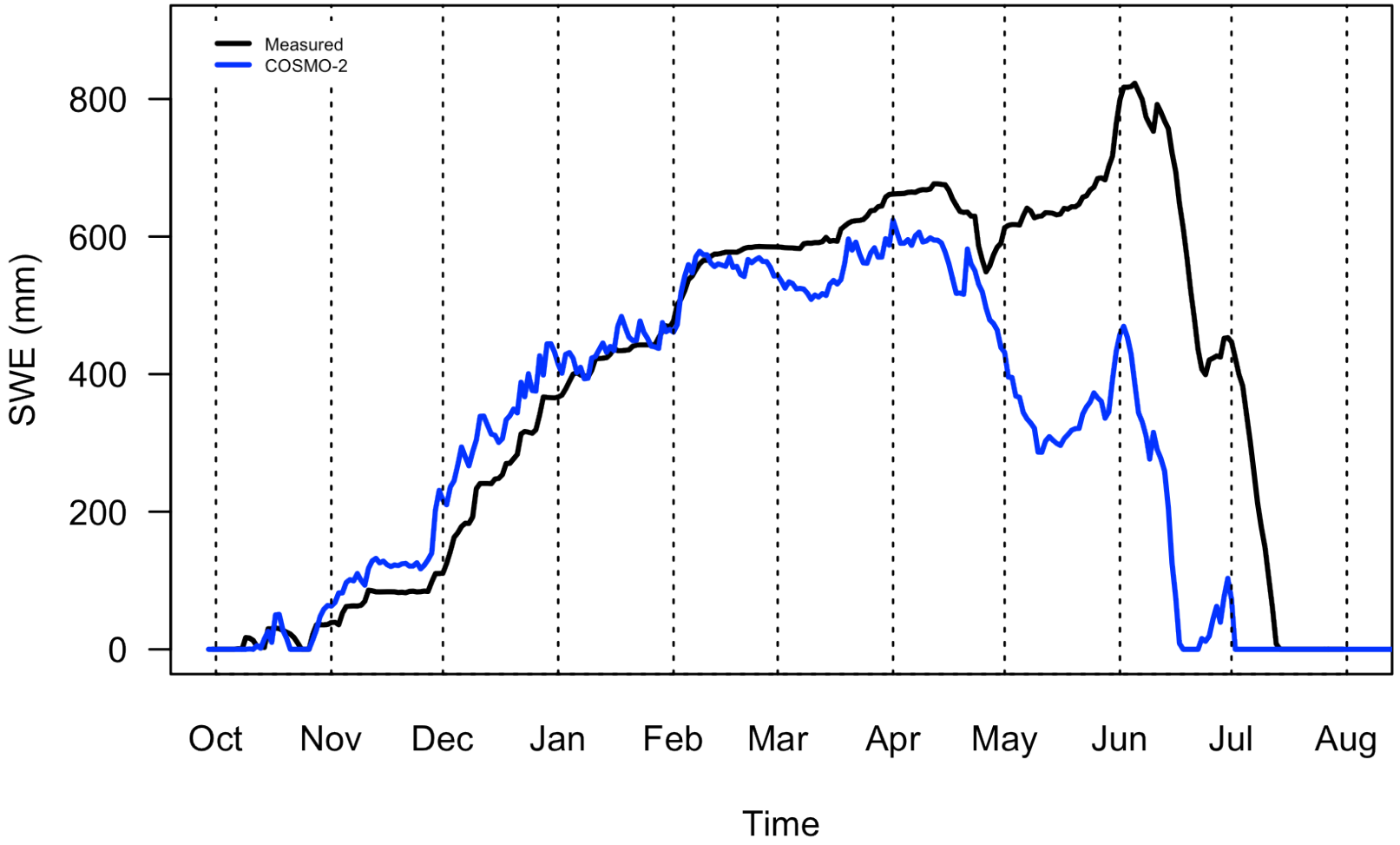
Yes - Yes

Yes - No

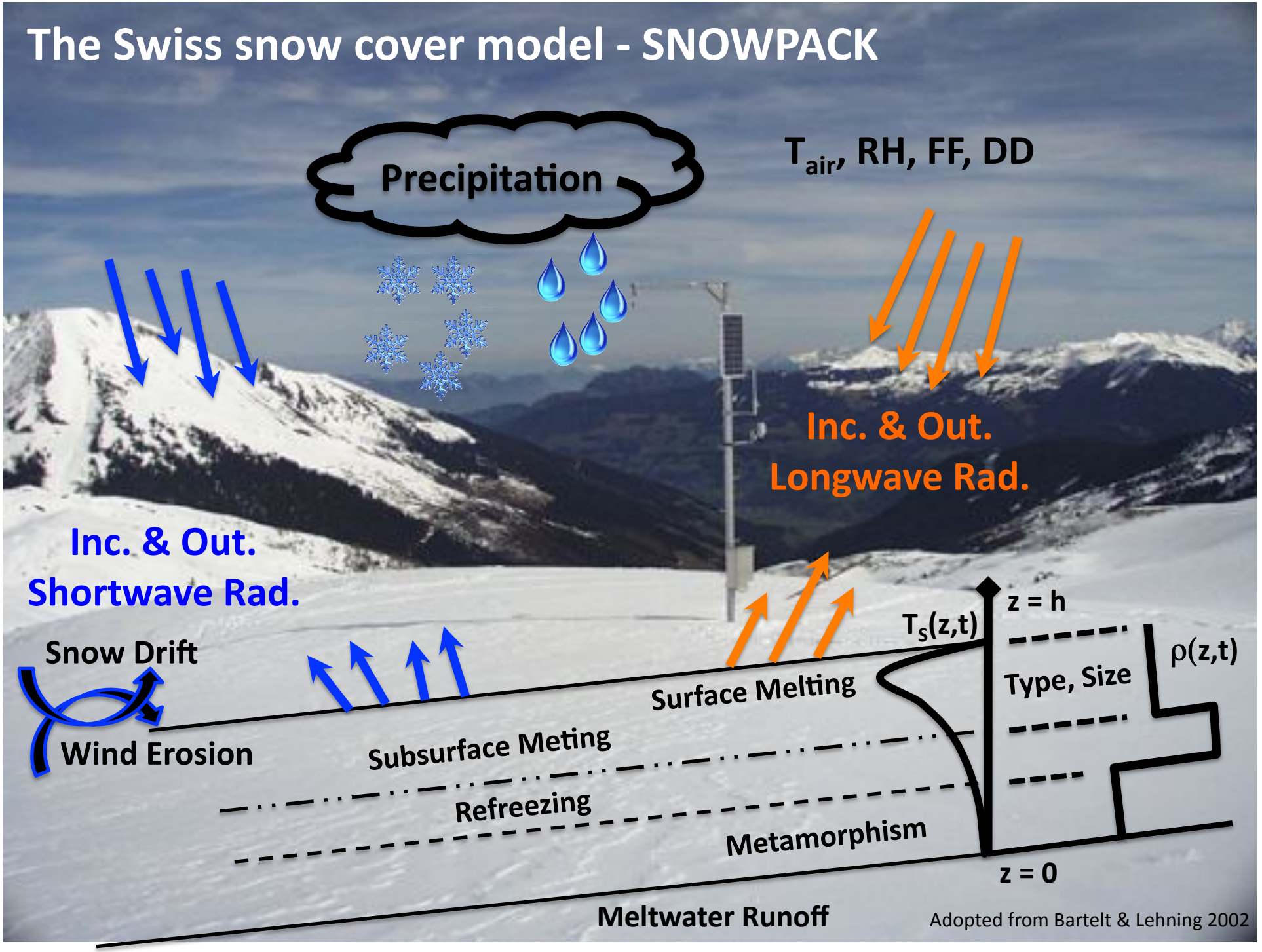
No - Yes

No - No

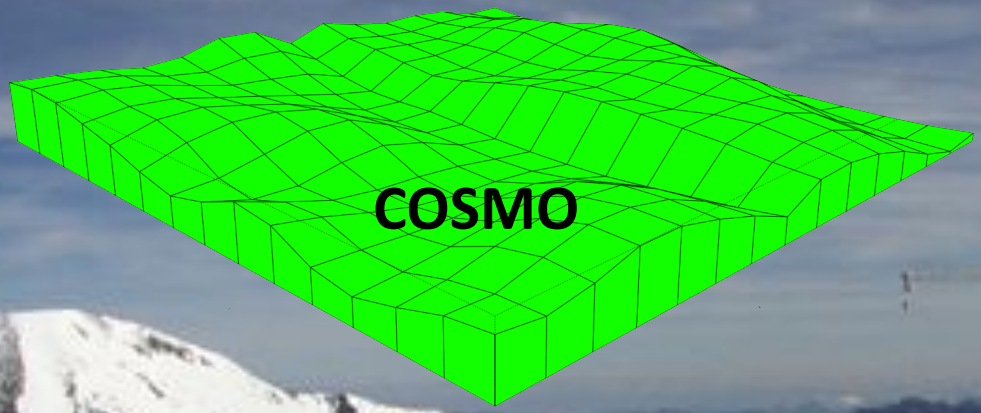
Snow Water Equivalent (SWE) – Weissfluhjoch (2340 m)



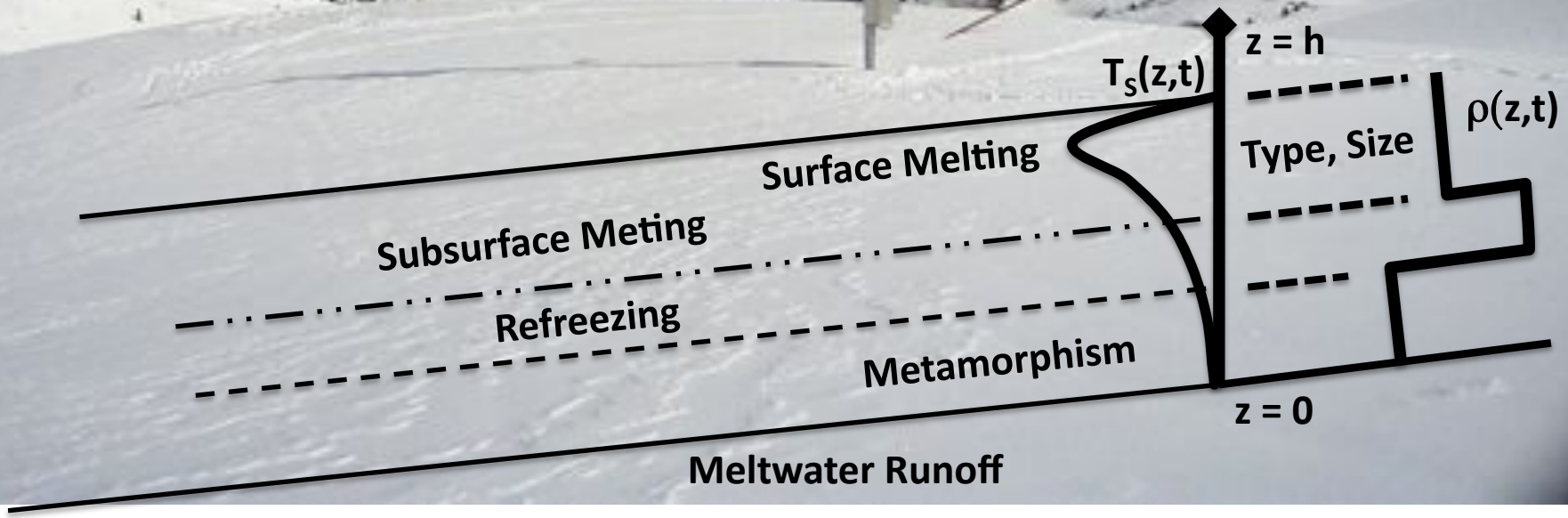
Winter 2012 - 2013


The Swiss snow cover model - SNOWPACK
Precipitation
T_{air}, RH, FF, DD
Inc. & Out.
Longwave Rad.
Inc. & Out.
Shortwave Rad.
Snow Drift
Wind Erosion
Surface Melting
Subsurface Meting
Refreezing
Metamorphism
Meltwater Runoff
$T_S(z,t)$
z = h
z = 0
Type, Size
ρ(z,t)
Adopted from Bartelt & Lehning 2002

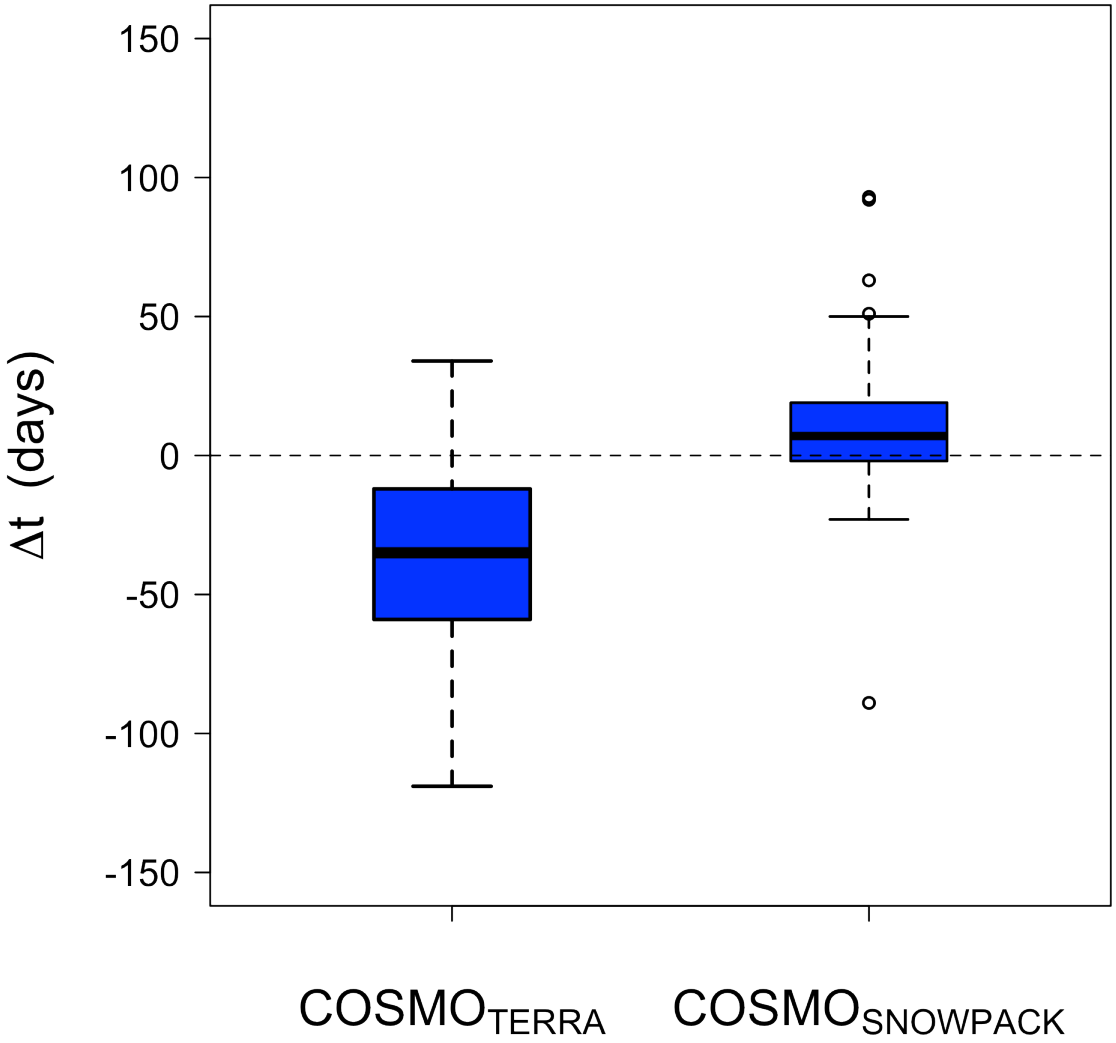
The Swiss snow cover model - SNOWPACK



Used Fields:
TOT_PREC,
T (2 m), RELHUM,
U, V,
GLOB, LW_IN_TG



Snow free for the first time - (Model's – IMIS)



Too late

Too early

Conclusions

Air temperature (2 m)

- Air temperature (2 m) has cold bias during the night.
- During the day amplified cold bias over snow.
- Decreasing cold bias becoming positive during the day without snow.

Snow module (TERRA_ML vs. SNOWPACK)

- COSMO is becoming snow free too early – melting rates.
- Coupled high-resolution model shows better timing – better formulation of snow cover micro-physics.

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Thanks for your attention!
Any questions?

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