



Snow Analysis - Status

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18.11.2020

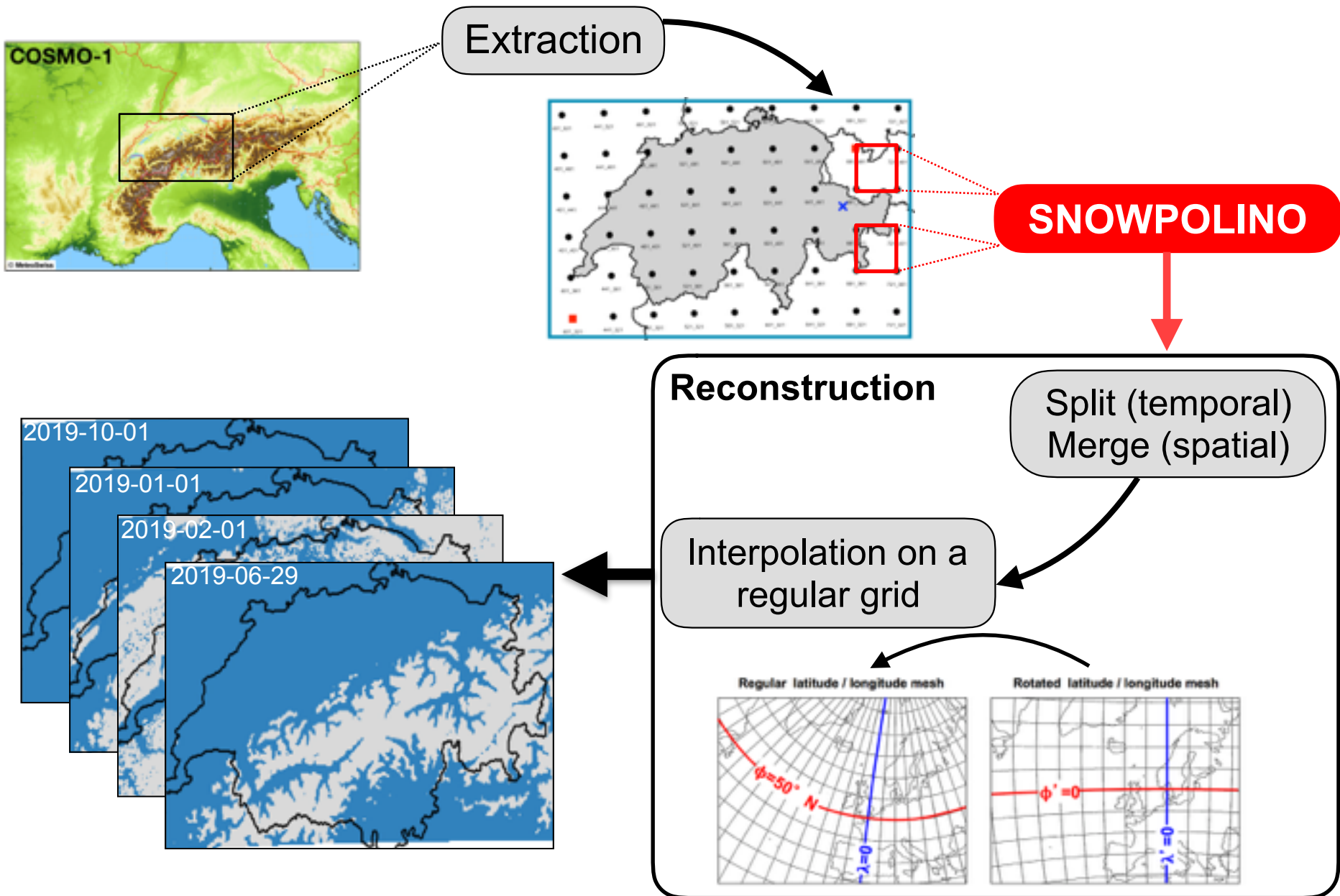


Implementation of two tool chains :

1. Snowpolino driven by COSMO-1 atmospheric analysis
2. Snowpolino driven by in-situ measurements

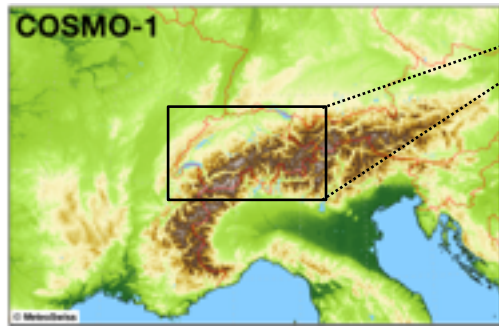


1. Snowpolino driven by COSMO-1 atmospheric analysis

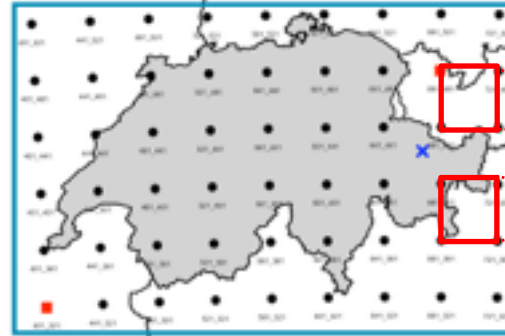




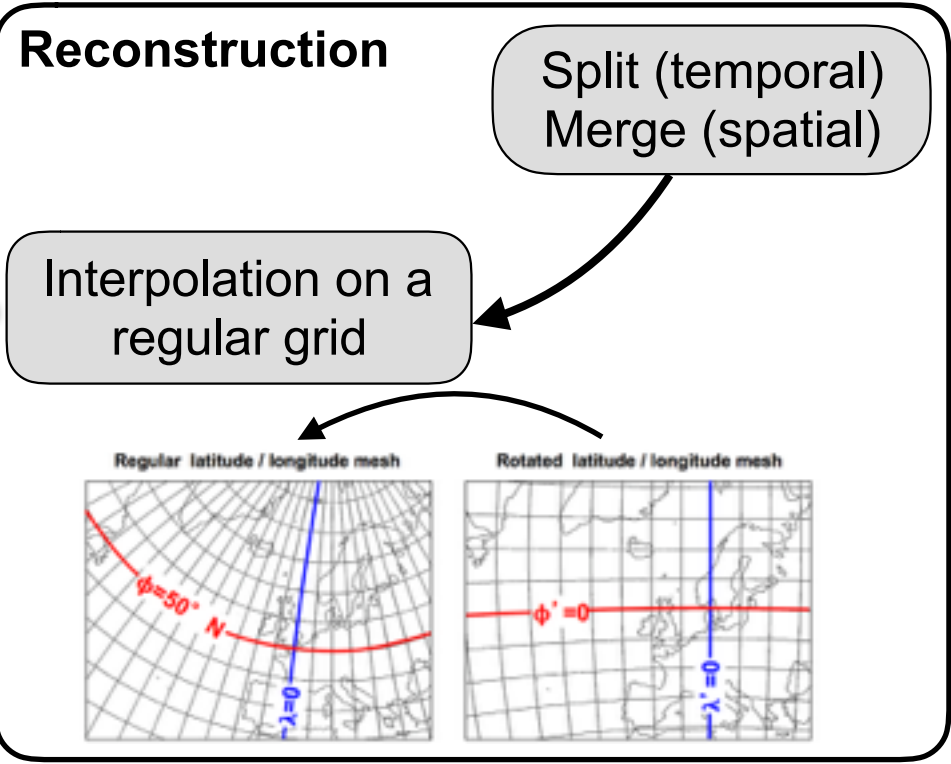
1. Snowpolino driven by COSMO-1 atmospheric analysis



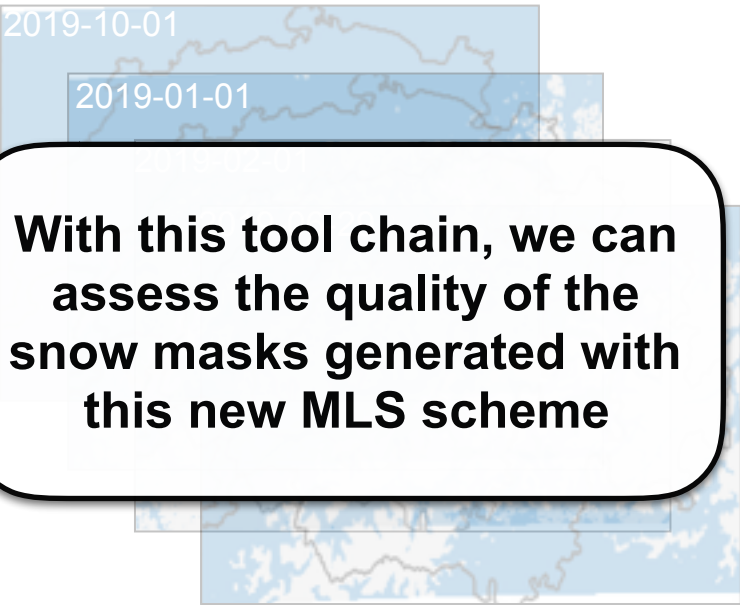
Extraction



SNOWPOLINO



With this tool chain, we can assess the quality of the snow masks generated with this new MLS scheme





1. Snowpolino driven by COSMO-1 atmospheric analysis

Snow mask inter comparison - Different products

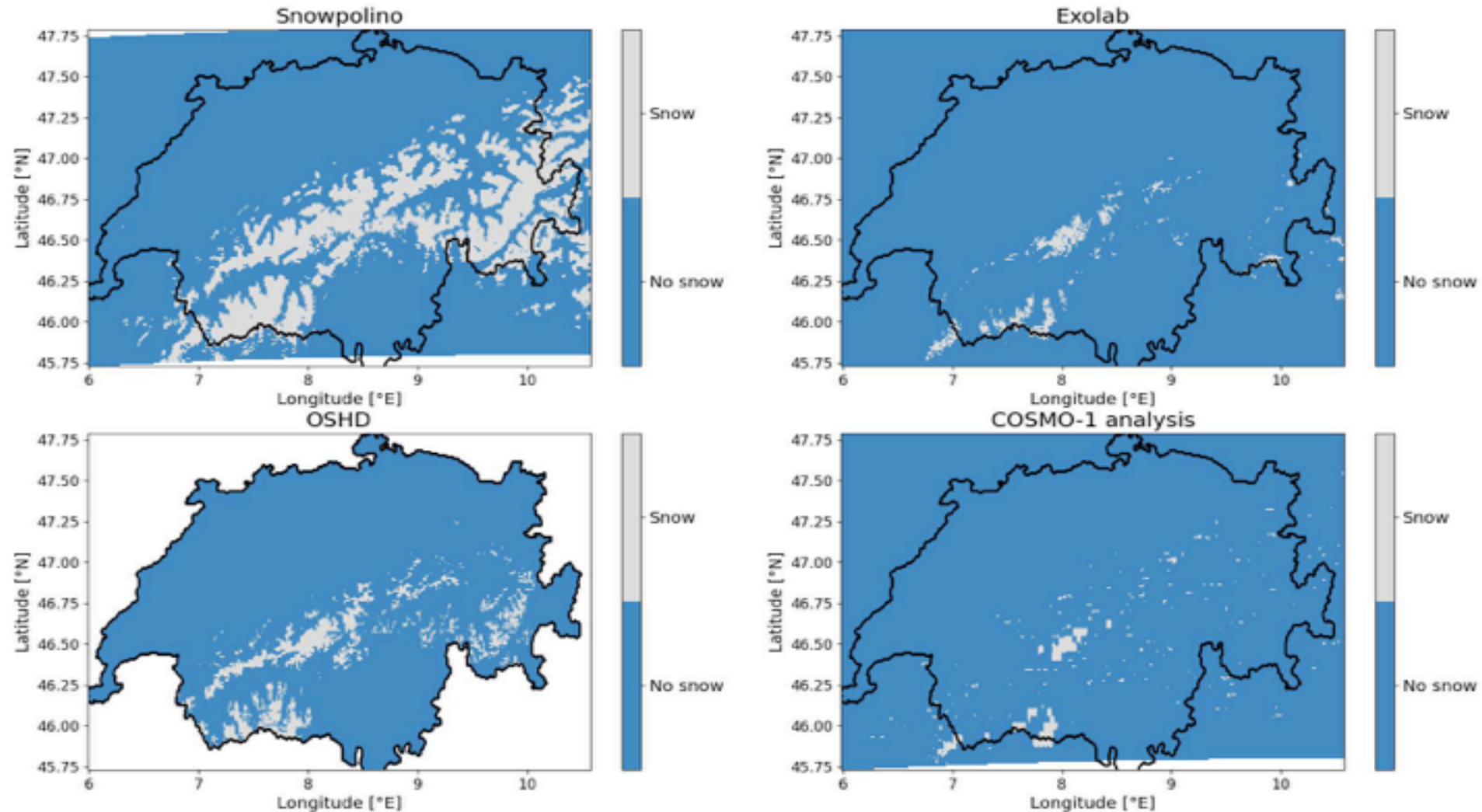
		Snowpolino	OSHD (SLF)	Exolab	COSMO-1 analysis
Based on		Snow-hydrological model	Snow-hydrological model + Data assimilation (from IMIS measuring network)	Polar orbiting satellites	Meteosat (geostationary satellites)
Resolution		1 km	1 km	20 m	4 km
Provided quantity		Snow depth (HS)	Snow depth (HS)	Snow cover probability (P) <small>0 = confidently snow free 255 = confidently snow covered</small>	Snow depth (HS)
Snow mask	Snow	HS > 0	HS > 0	P > 127	HS > 0
	No snow	HS <=0	HS <=0	P <=127	HS <=0



1. Snowpolino driven by COSMO-1 atmospheric analysis

Snow mask inter comparison - Video

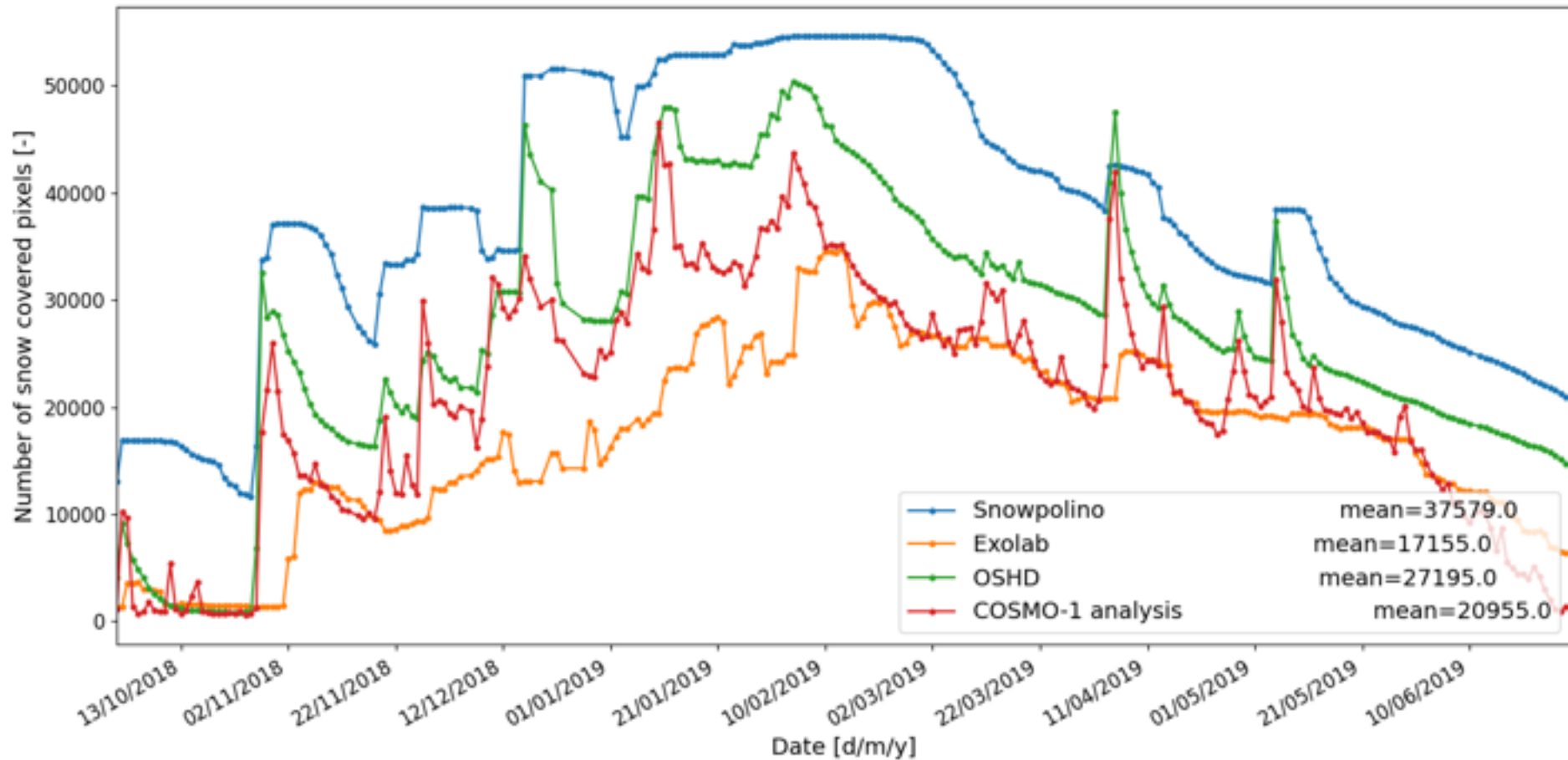
2018-10-01





1. Snowpolino driven by COSMO-1 atmospheric analysis

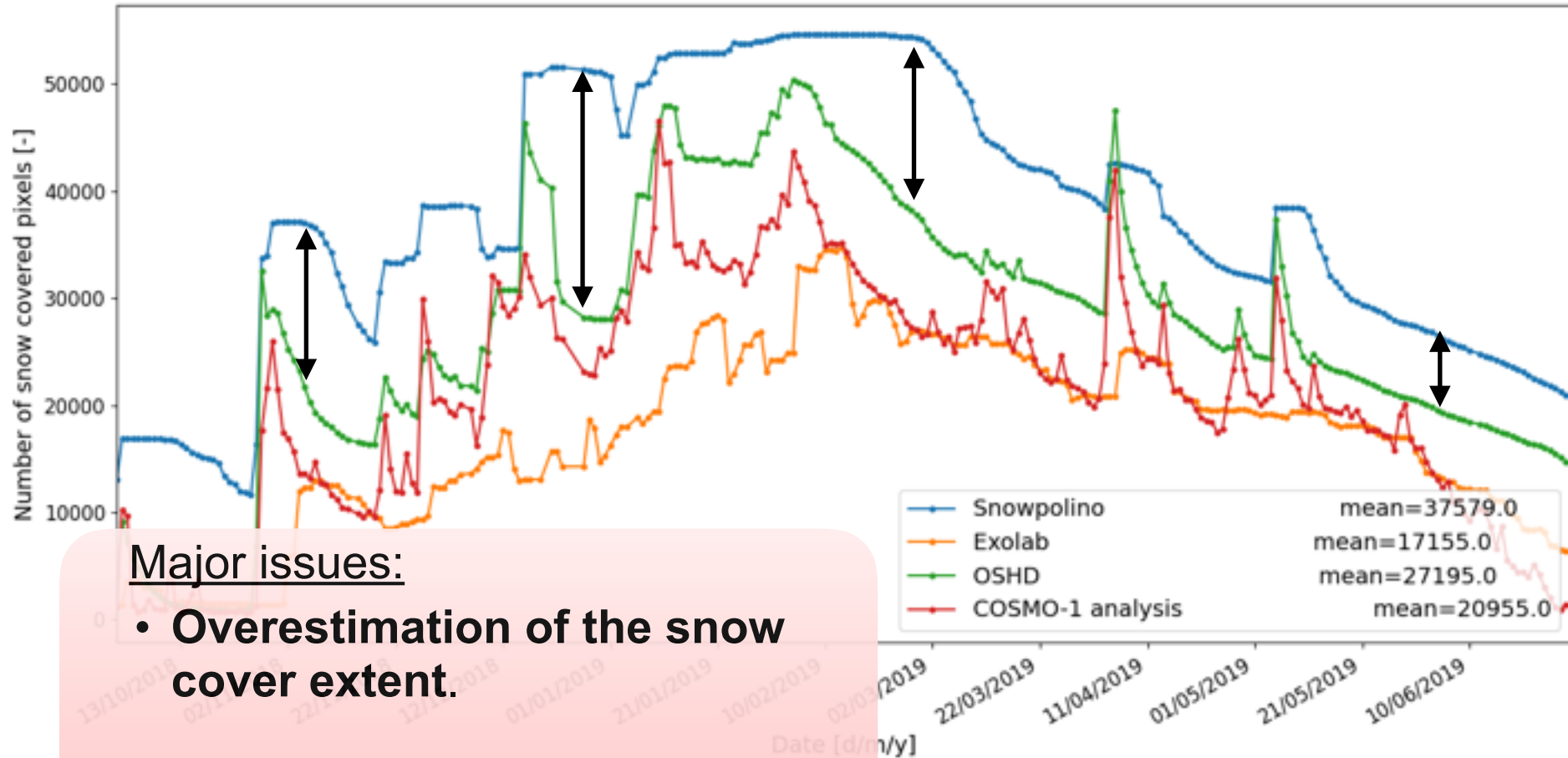
Snow mask inter comparison - number of snow covered px





1. Snowpolino driven by COSMO-1 atmospheric analysis

Snow mask inter comparison - number of snow covered px



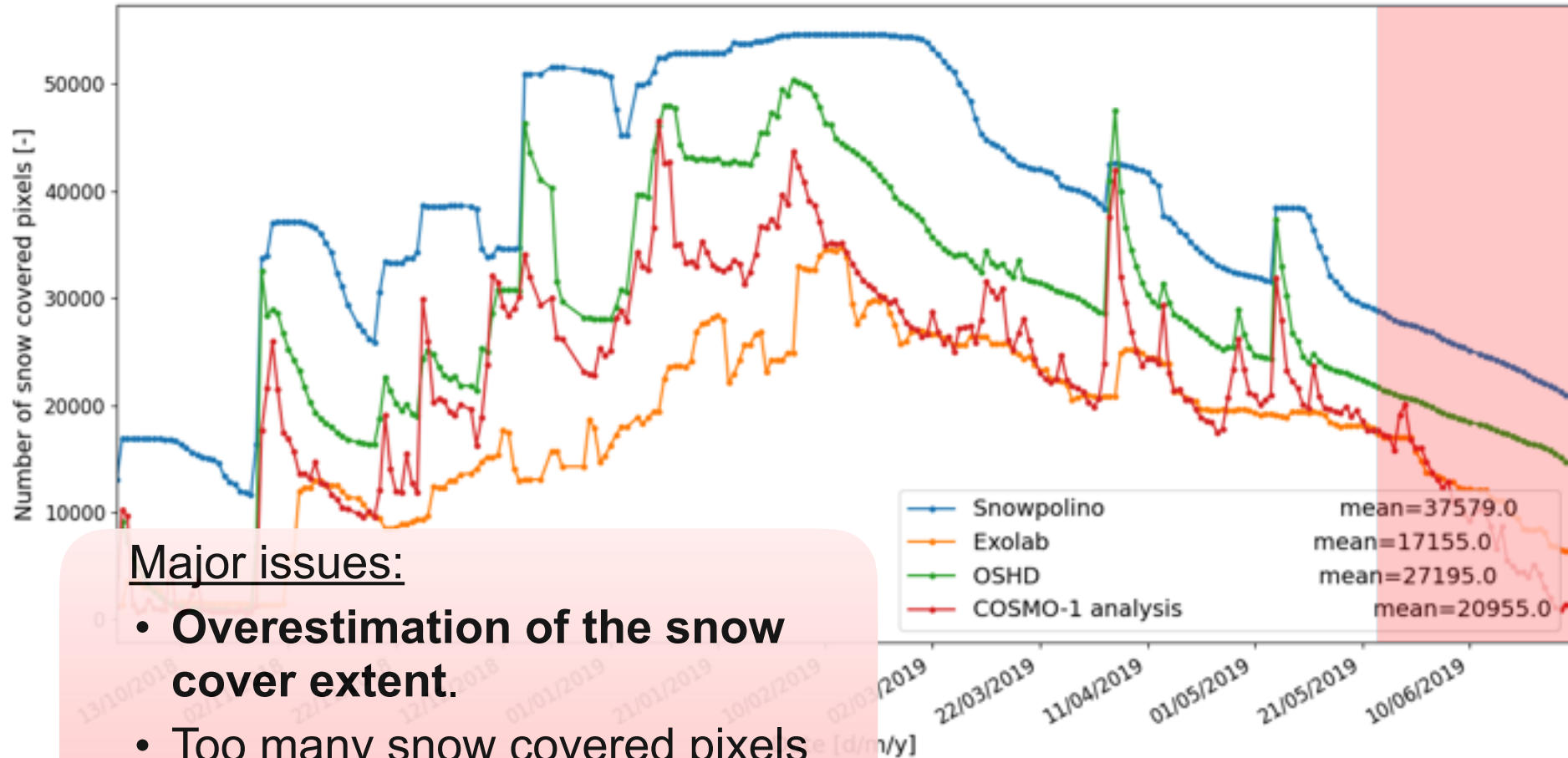
Major issues:

- **Overestimation of the snow cover extent.**



1. Snowpolino driven by COSMO-1 atmospheric analysis

Snow mask inter comparison - number of snow covered px



Major issues:

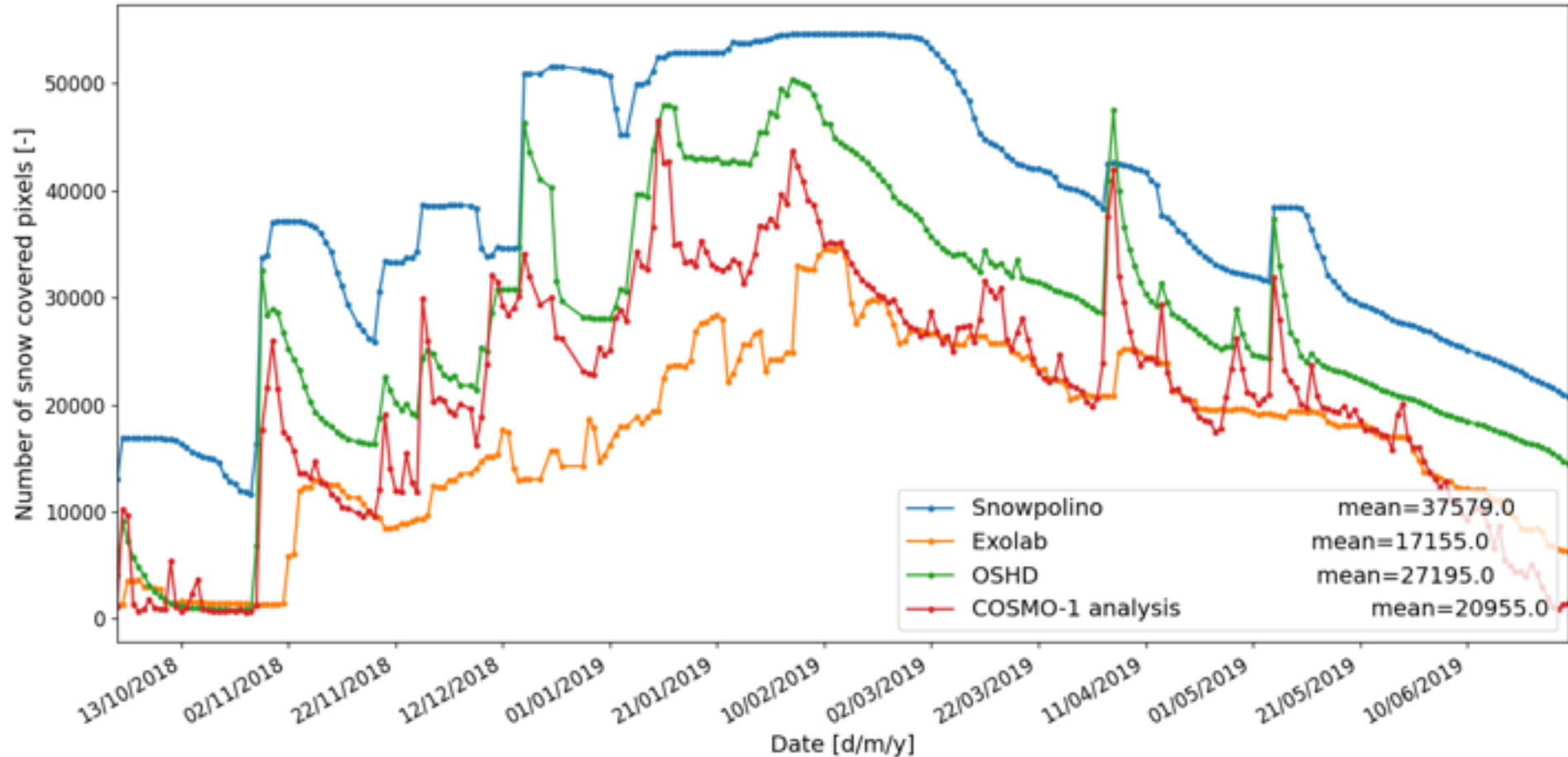
- **Overestimation of the snow cover extent.**
- Too many snow covered pixels toward the end of the season.



1. Snowpolino driven by COSMO-1 atmospheric analysis

Snow mask inter comparison - number of snow covered px

threshold = 0 cm

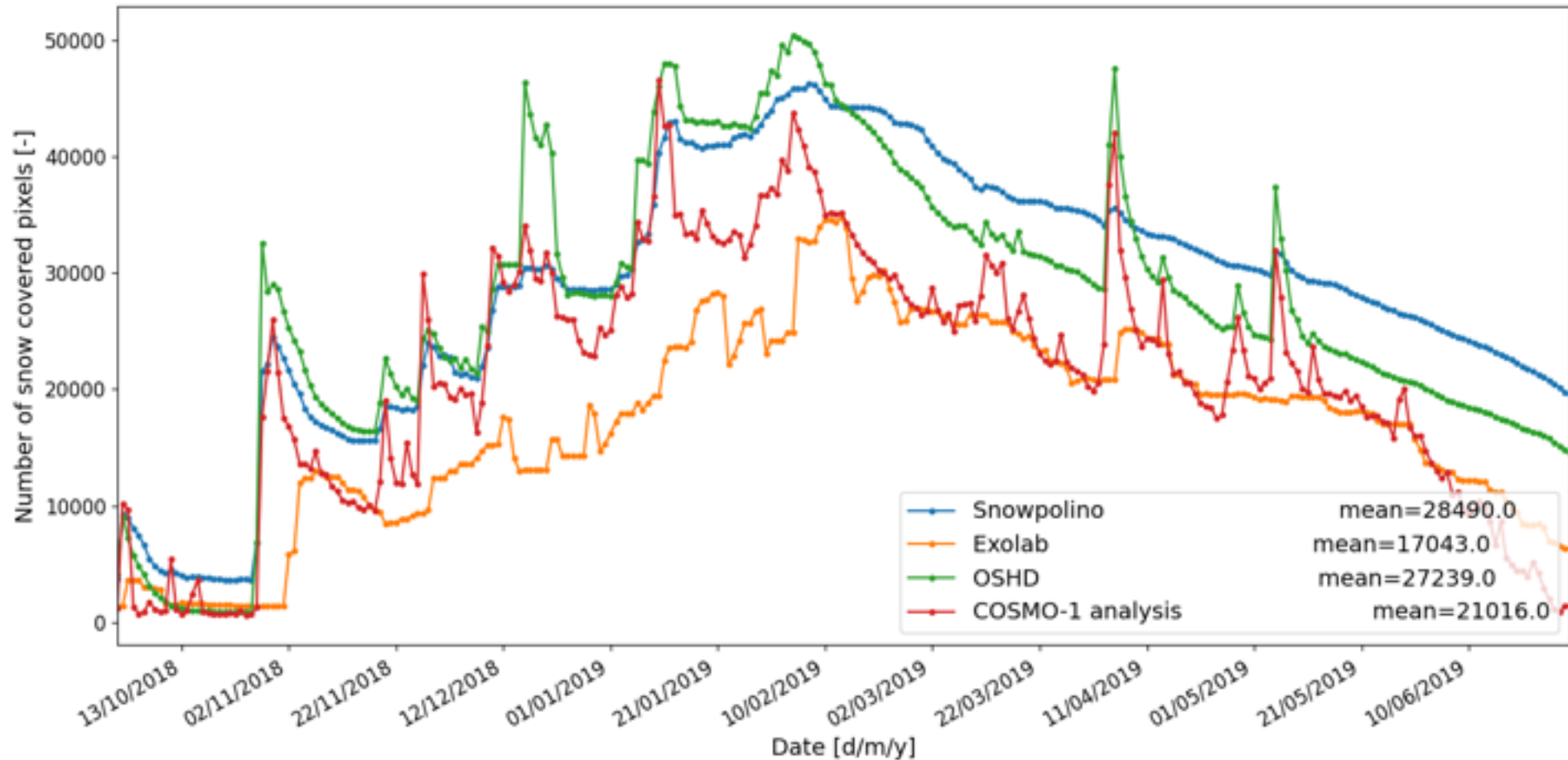




1. Snowpolino driven by COSMO-1 atmospheric analysis

Snow mask inter comparison - number of snow covered px

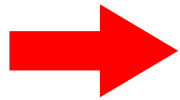
threshold = 5 cm





1. Snowpolino driven by COSMO-1 atmospheric analysis

Snow mask inter comparison - Discussion



How to tune Snowpolino so that the unrealistic shallow snowpack at low altitudes is removed ?

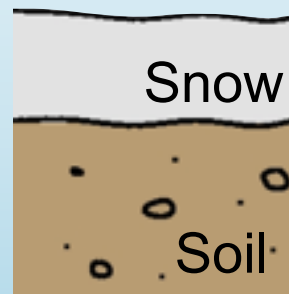
Currently, the Snowpolino standalone version is independent from the soil temperature.

Possible solution: add thermal forcing from the soil in the standalone version.

Hopefully, the shallow snow cover issue will be solved once Snowpolino runs within COSMO as it will be coupled to the land surface model, TERRA. (ie. heat equation solved through the entire snow/soil column)

Snowpolino

TERRA



coupling the 2 standalone versions

... ongoing work (Varun)

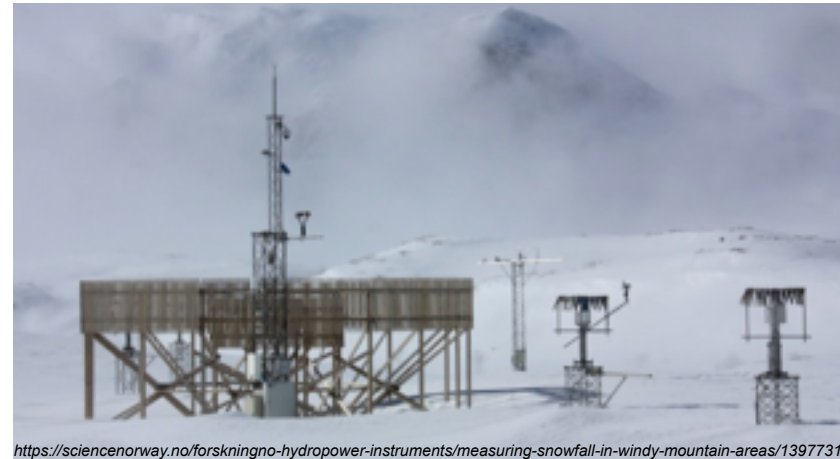
Snow mask inter comparison once again with the coupled model



2. Snowpolino driven by in-situ measurements

Required meteorological fields to run Snowpolino (need hourly data)

- Air temperature (K)
- Relative humidity (%)
- Wind speed (m/s)
- Incoming short wave radiation (W/m^2)
- Incoming long wave radiation (W/m^2)
- Precipitation sum (kg/m^2)



<https://sciencenorway.no/forskningno-hydropower-instruments/measuring-snowfall-in-windy-mountain-areas/1397731>



<https://www.weather.gov/fgf/March30HeavySnowfall>

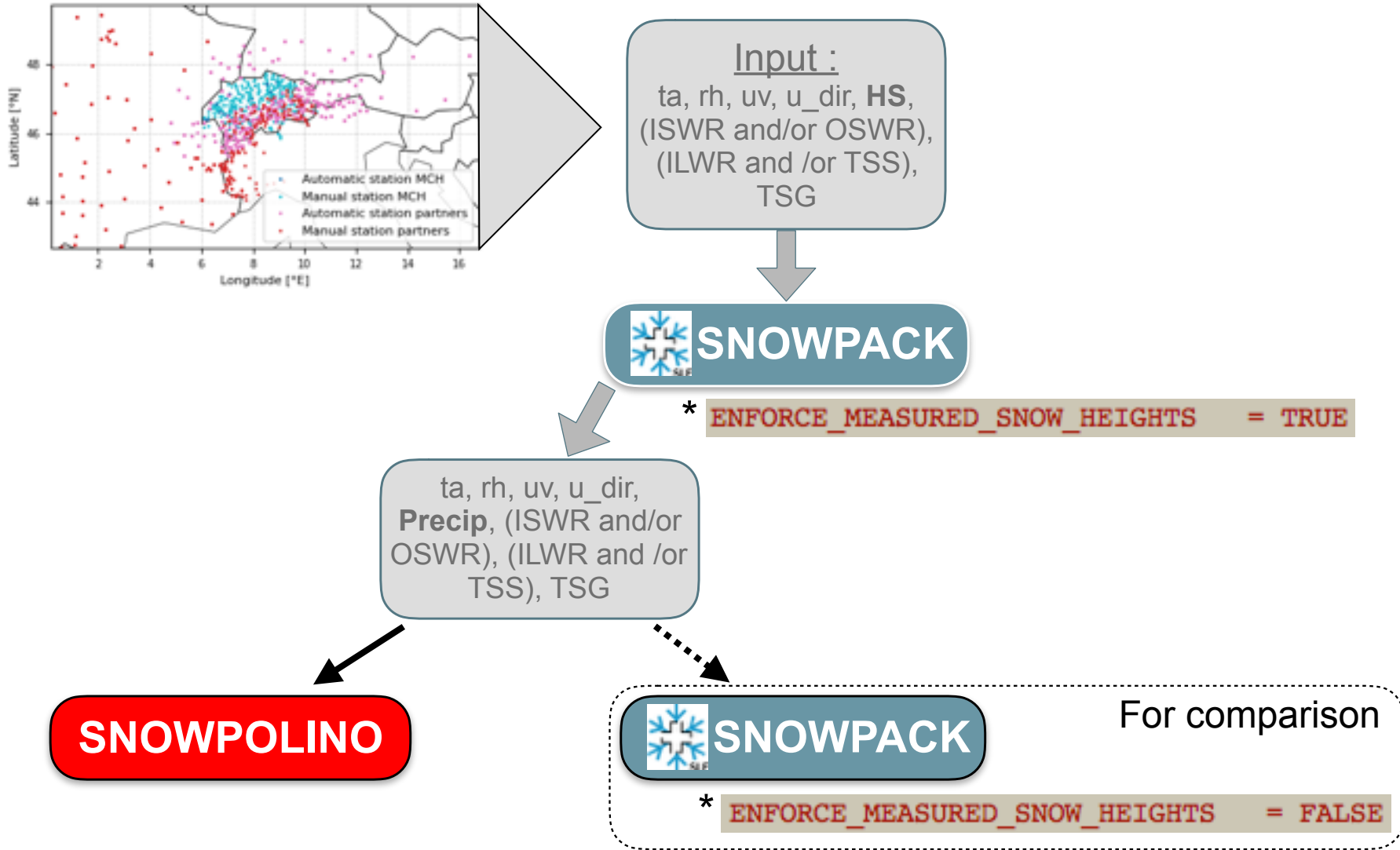


* ENFORCE_MEASURED_SNOW_HEIGHTS = TRUE



2. Snowpolino driven by in-situ measurements

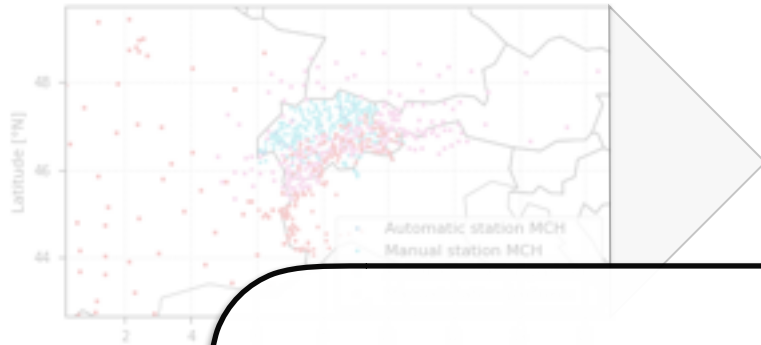
Tool chain





2. Snowpolino driven by in-situ measurements

Tool chain



Input :
ta, rh, uv, u_dir, HS,
(ISWR and/or OSWR),
(ILWR and /or TSS),
TSG

This tool chain will be used for

- model calibration
- data assimilation

ENFORCE_MEASURED_SNOW_HEIGHTS = TRUE

(ISWR and/or OSWR), TSS), TSG

SNOWPOLINO



SNOWPACK

For comparison

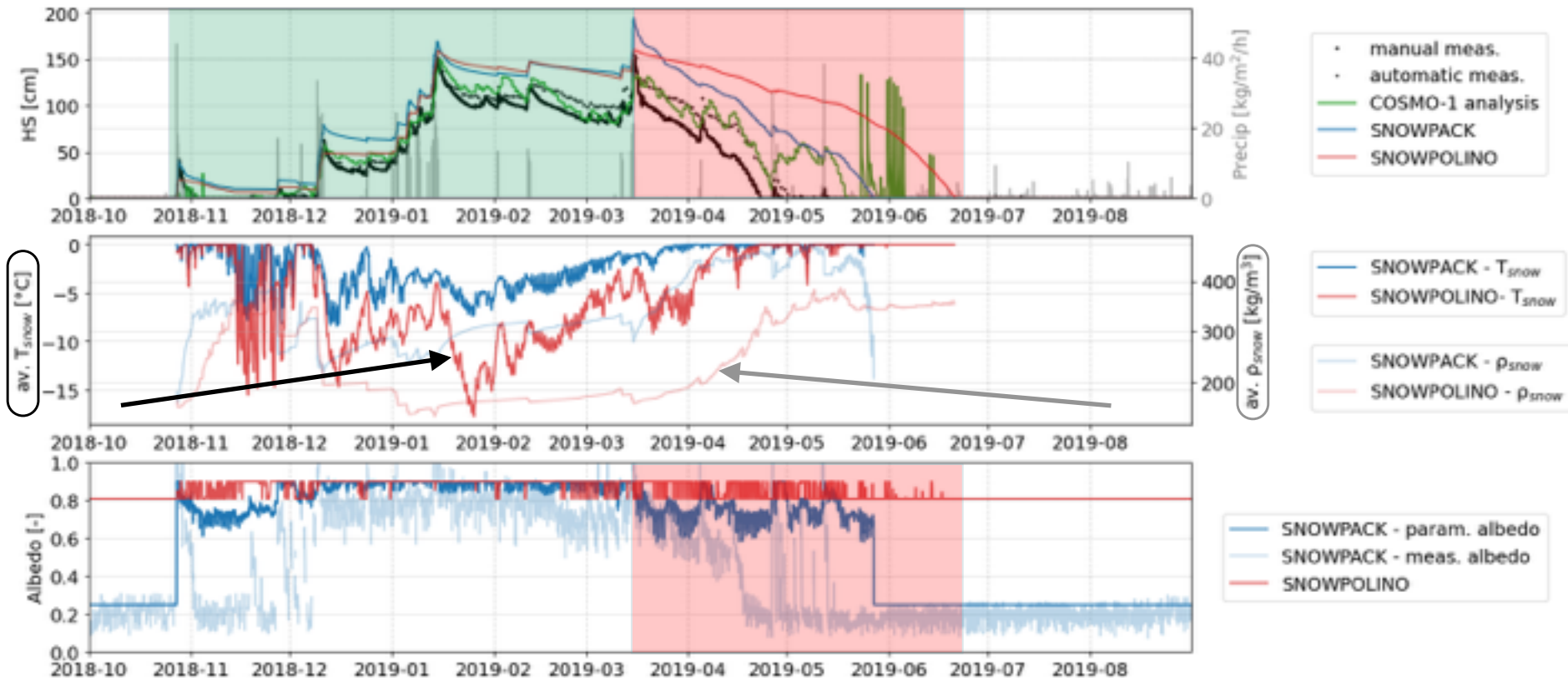
* ENFORCE_MEASURED_SNOW_HEIGHTS = FALSE



2. Snowpolino driven by in-situ measurements

First results at particular measuring stations (examples)

DAV - Davos - (lat, lon, alt)=(46.813, 9.844, 1594.0)

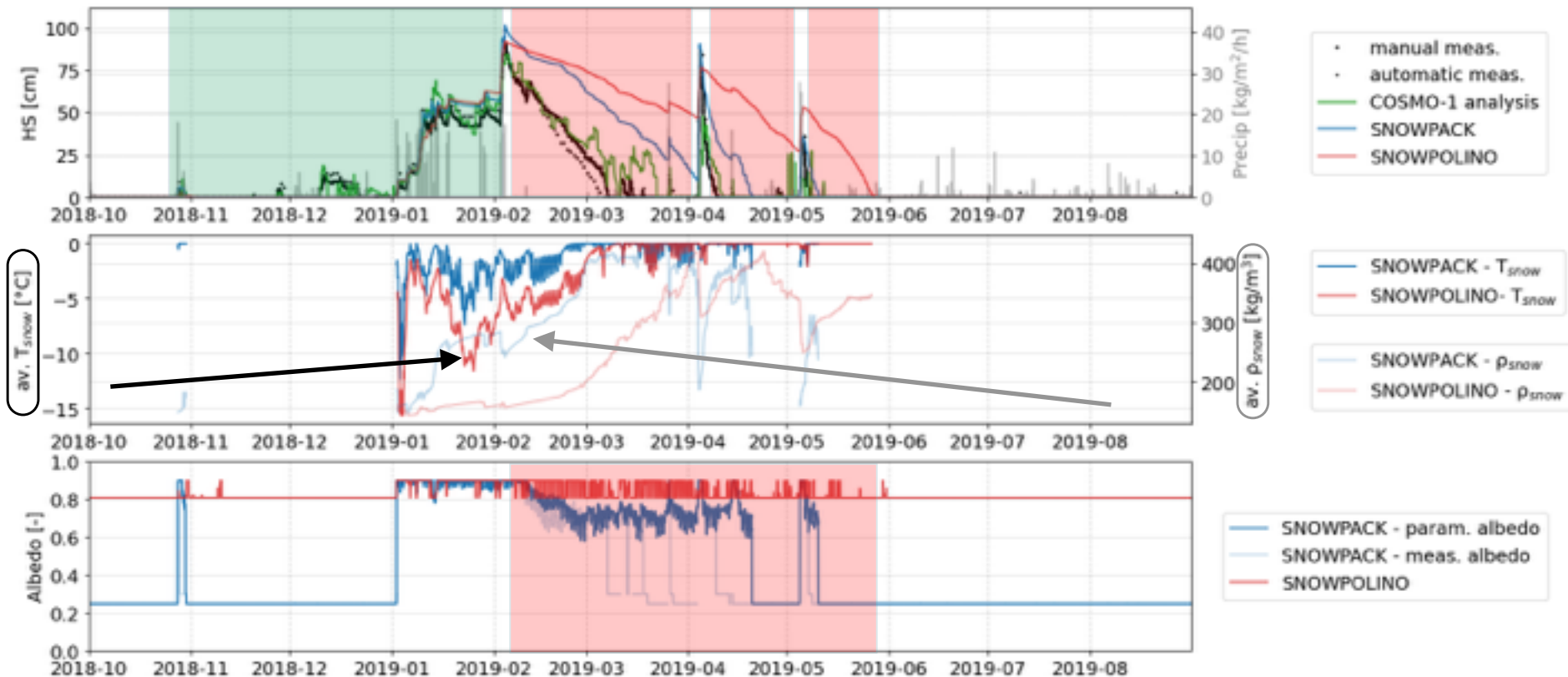




2. Snowpolino driven by in-situ measurements

First results at particular measuring stations (examples)

ENG - Engelberg - (lat, lon, alt)=(46.822, 8.411, 1036.0)

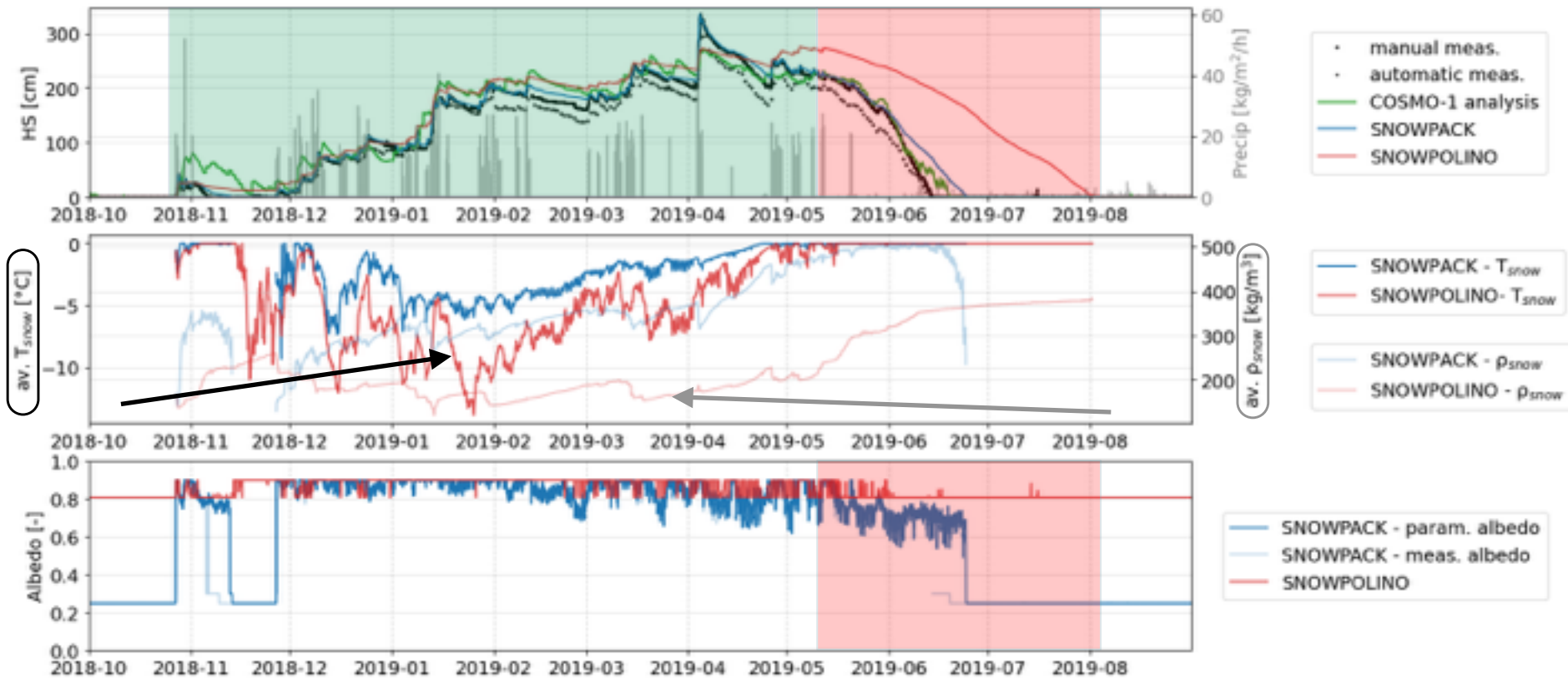




2. Snowpolino driven by in-situ measurements

First results at particular measuring stations (examples)

GRH - Grimsel Hospiz - (lat, lon, alt)=(46.572, 8.333, 1980.0)

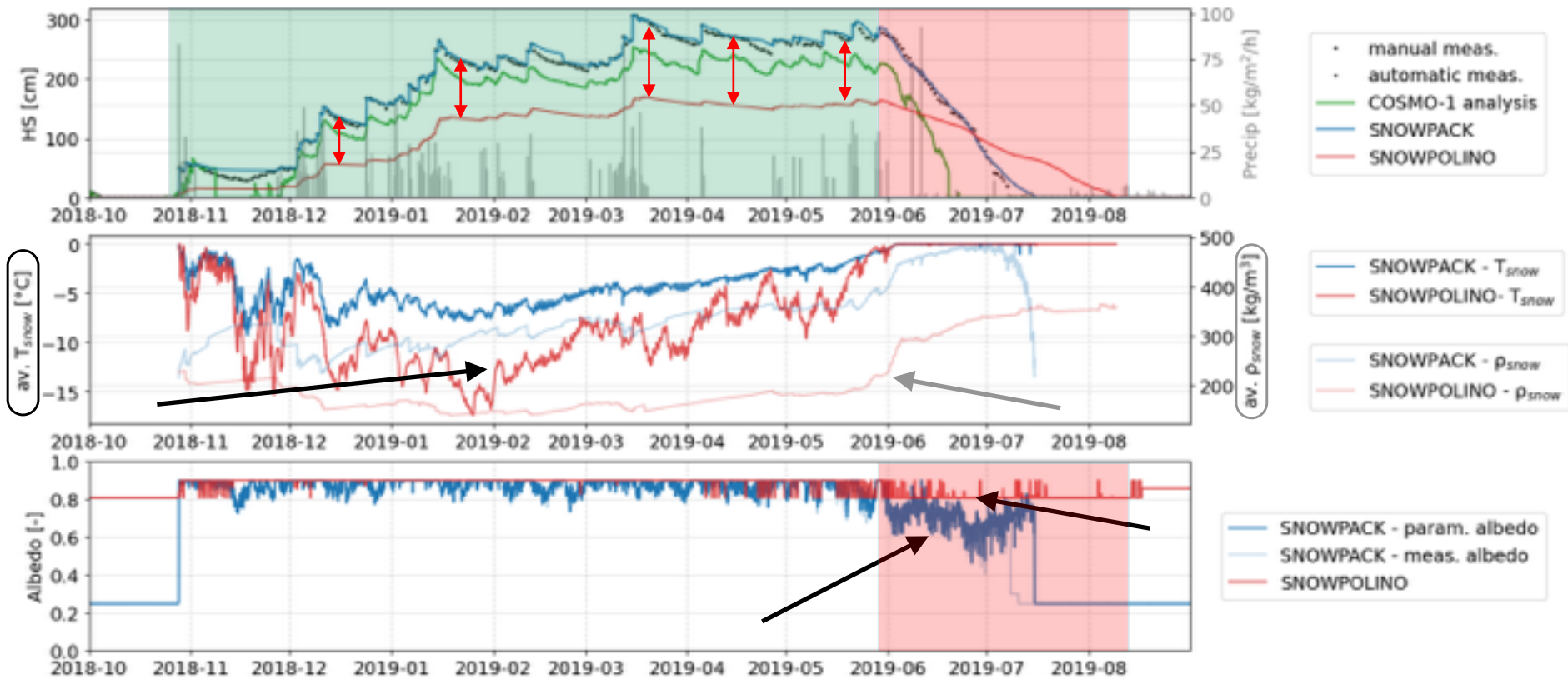




2. Snowpolino driven by in-situ measurements

First results at particular measuring stations (examples)

WFJ - Weissfluhjoch - (lat, lon, alt)=(46.833, 9.806, 2691.0)

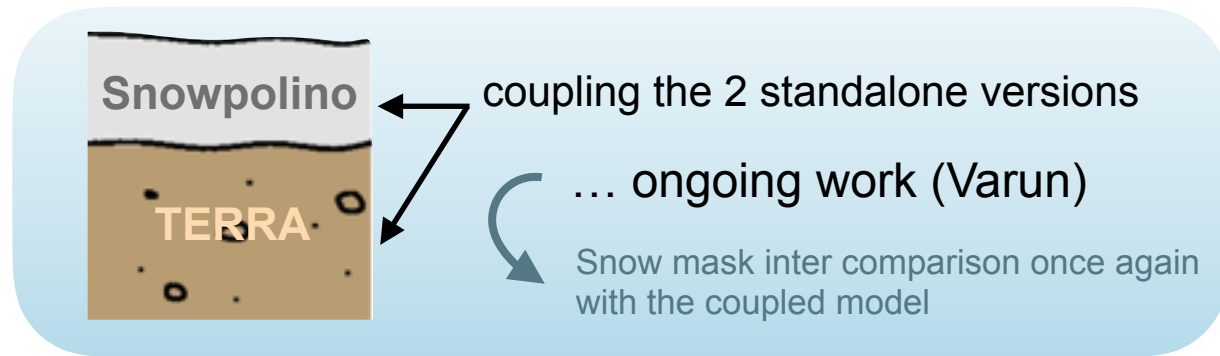




Conclusion

1. Snowpolino driven by COSMO-1 atmospheric analysis

- Aimed to generate snow masks that can be compared to other products.
- Allows to realize that Snowpolino overestimates the snow cover extent because of an unrealistic shallow snowpack at low altitude.
- Possible solution:



2. Snowpolino driven by in-situ measurements

- Will be extremely useful to tune Snowpolino & for data assimilation.