Latest news about SnoWE from the SCA

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Research territory

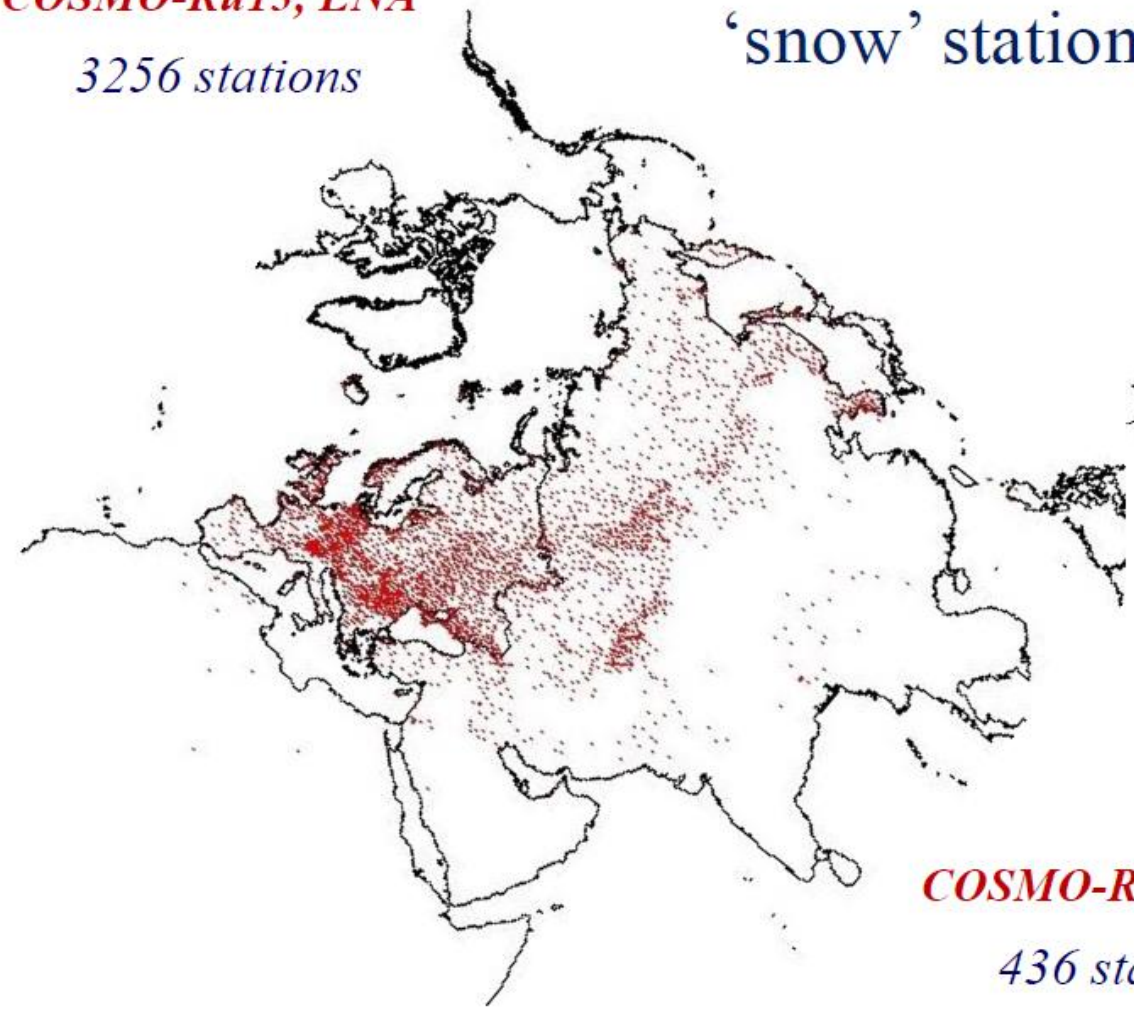
SYNOP
'snow' stations

COSMO-Ru13, ENA

3256 stations

COSMO-Ru7, ETR

2163 stations

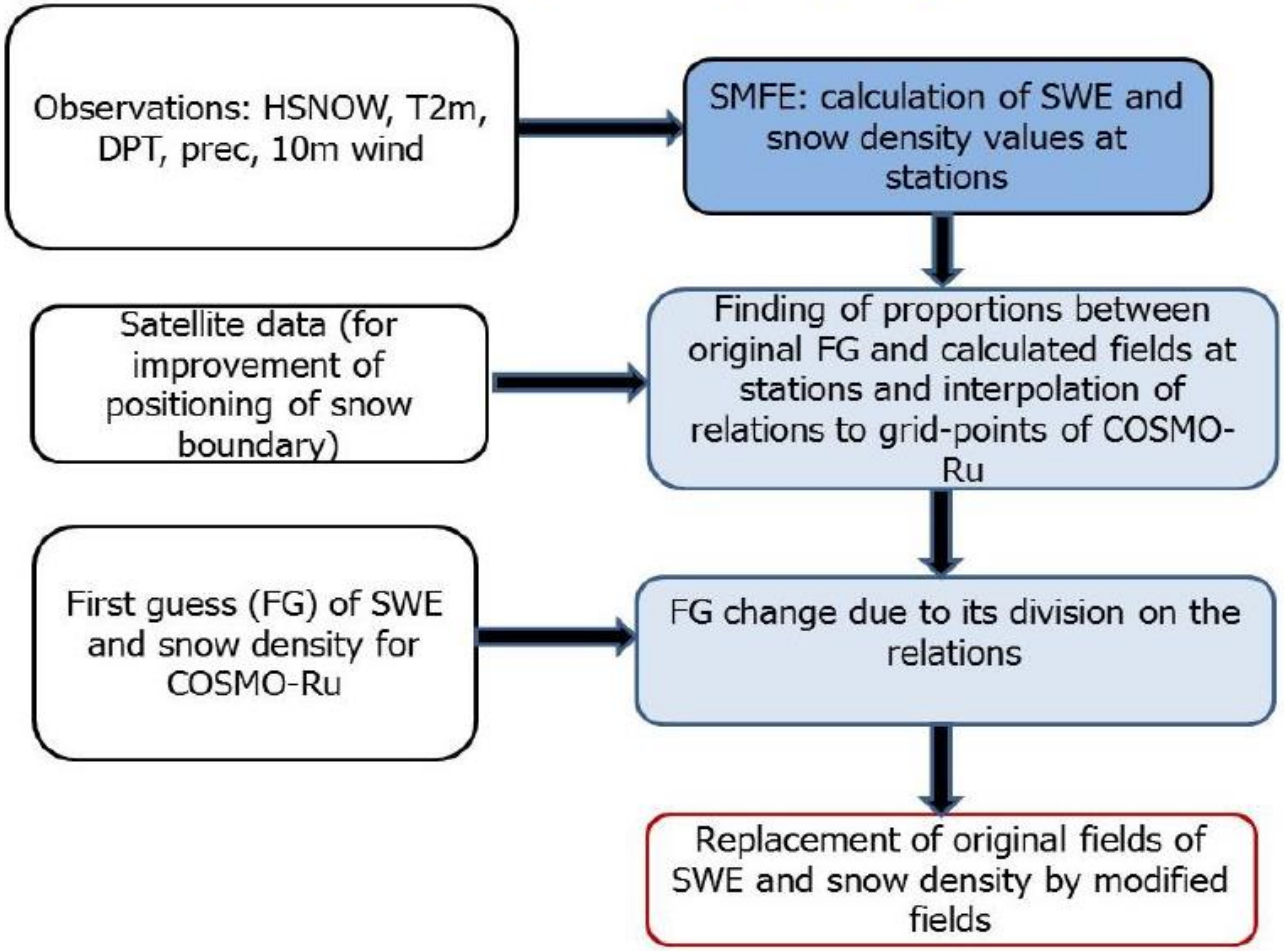


COSMO-Ru 2 CFO

436 stations

Approach

OA of snow cover characteristics for NWP model (exemplifying COSMO-Ru)



In quasi-operational regime since 1 December 2014 for:

COSMO-Ru7, ETR versions with 7 km resolution

COSMO-Ru2, CFO versions with 2 km resolution

Since 1 March 2016 – for COSMO-Ru13, ENA versions with 13.2 km resolution

Approach

Calculation of SWE and snow density (RHO) through the developed snow model SMFE can be executed

→ *At SYNOP stations*

→ *At COSMO-grid points*

New direction - 1: forecast of snow cover characteristics based on COSMO-grid points (until 72 hours)

New direction – 2: Improve situation with calculation of snow cover in forest regions

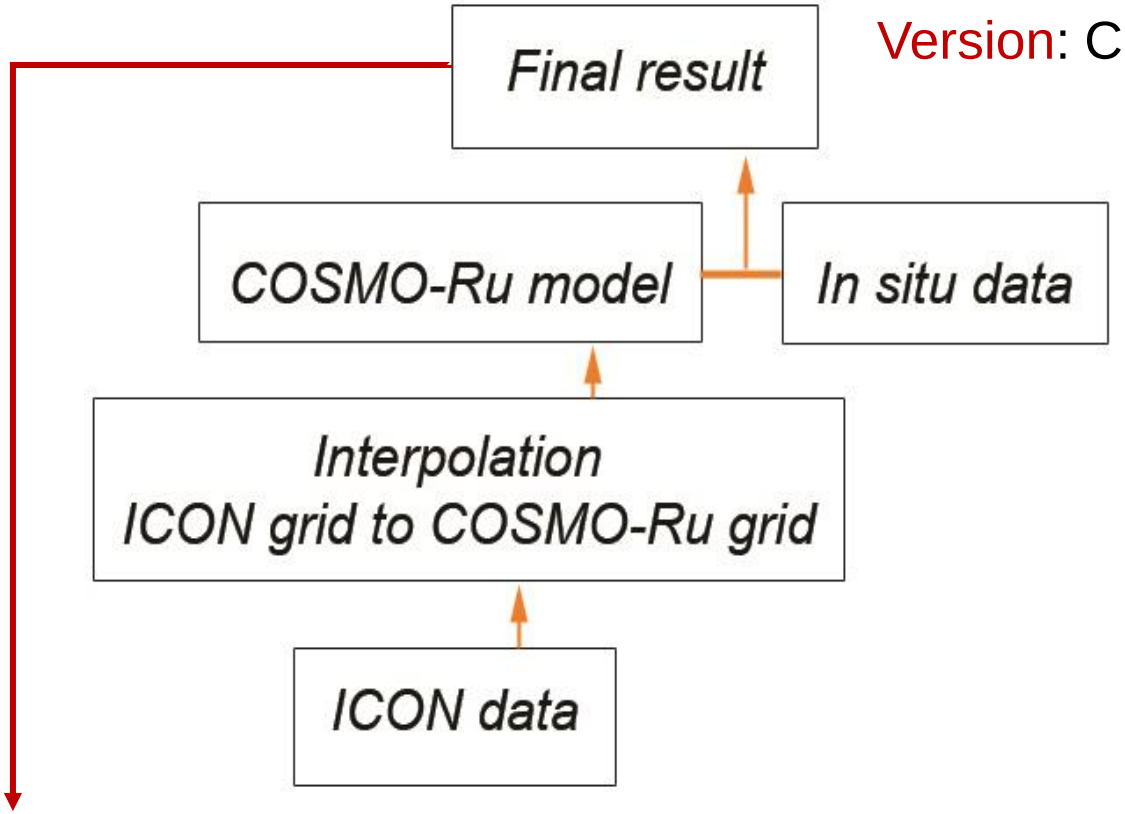
New direction – 3: Improve physical block of SnoWE (increase opportunities of SnoWE)

SnoWE versions

The initial data for SnoWE

Version: SYNOP stations

Version: COSMO grid points



- *Values of air temperature for hours (00, 06, 12, 18 UTC)*
- *Values and physical state of precipitation*
- *Values of SWE and RHO*
- *Values of snow depth*

SnoWE versions

The initial data for SnoWE

Version: SYNOP stations

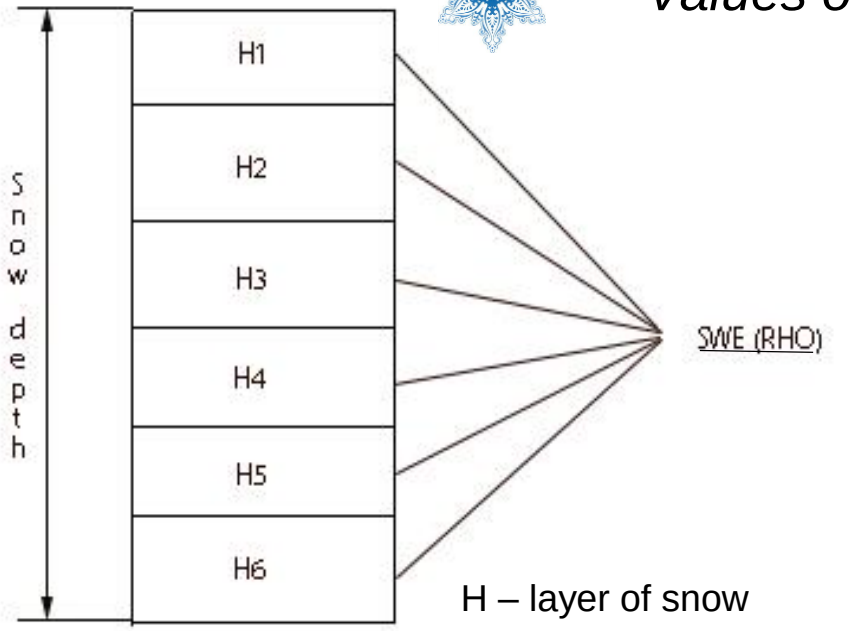
Version: COSMO grid points

Values of air temperature for endurance hours (00, 06, 12, 18 UTC) for 1 day

Average air temperature

Maximum air temperature

Values of SWE and RHO



H – layer of snow

Average values of SWE and RHO for each grid point

For mountain regions use data as border conditions

SnoWE versions

The initial data for SnoWE Version: SYNOP stations

In situ data from a local database (SYNOP information)

Hsnow *T2m* *DPT* *precipitation* *10m wind*

Calculating of SnoWE model based on the available meteorological data

If we have a dense network of the meteorological observations

A step of irregular grid <100 km

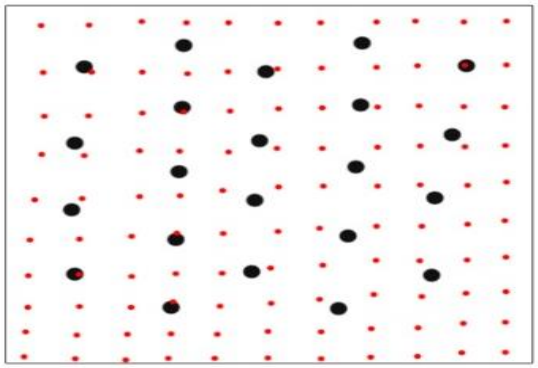
If we have a sparse network of the meteorological observations

A step of irregular grid > 100 km

SnoWE versions

Version: SYNOP stations

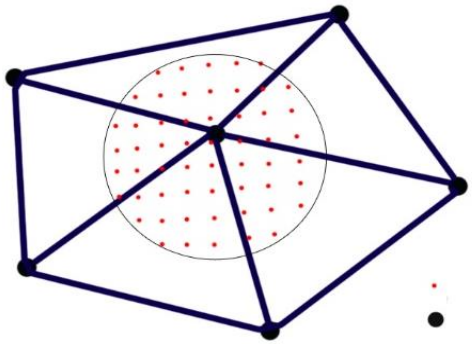
Interpolation of SWE (RHO) calculated values in the resulting COSMO-Ru grid



- COSMO or ICON grid points
- In situ data

Interpolation of the ratio between SWE (RHO) calculated values at meteorological stations and average values of ICON for grid-points inside a certain radius

Correction of the ICON values by the interpolation ratio



- COSMO or ICON grid points
- In situ data

$$R = \frac{\text{SWE calculation}}{\text{SWE icon(cosmo)}}$$

SnoWE versions

Research territory	Radius (Default)
COSMO-Ru 13, ENA	14000 meters
COSMO-Ru 7, ETR	8000 meters
COSMO-Ru 2, CFO	3000 meters

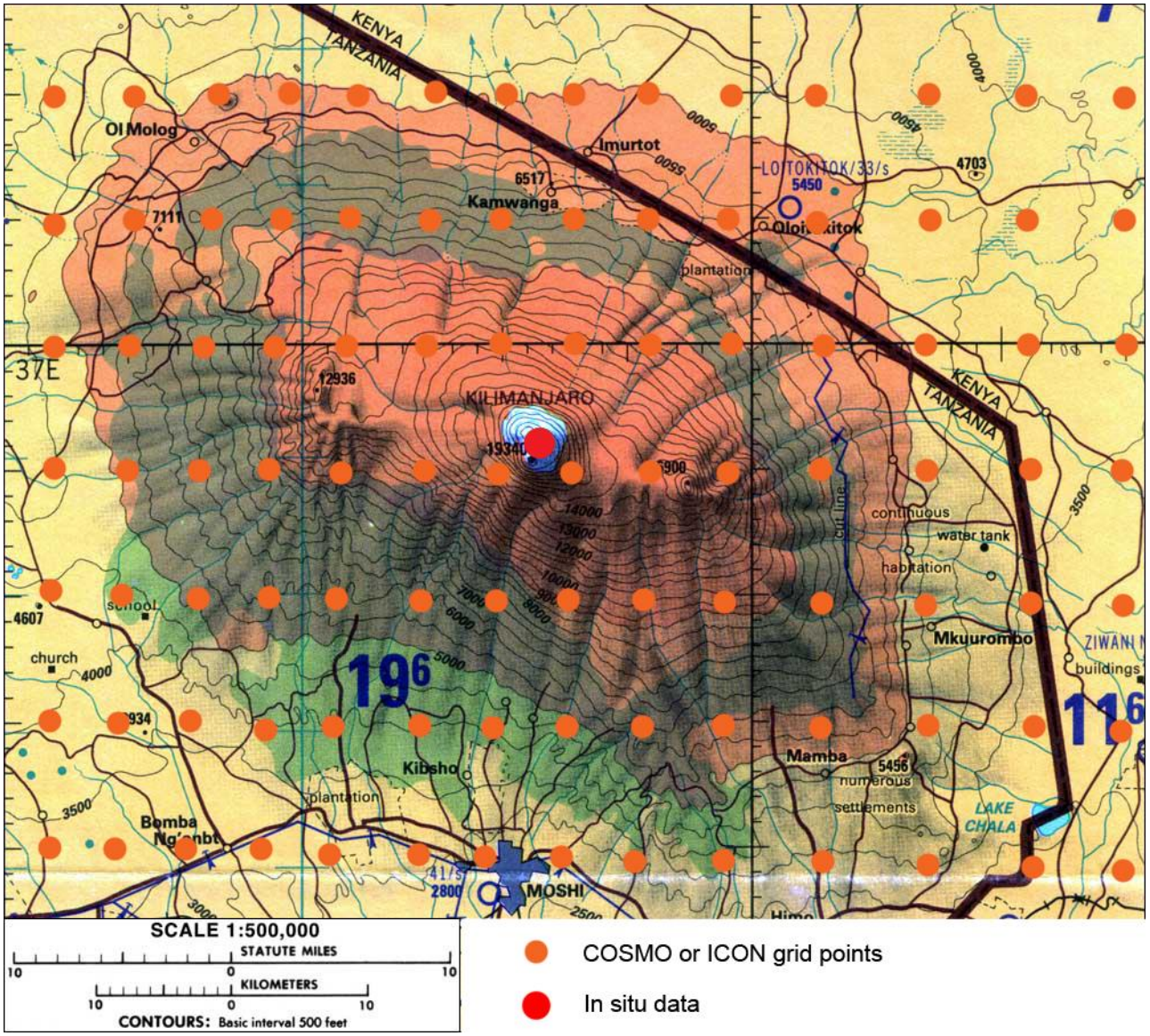
Output data (final result)

Version: SYNOP stations

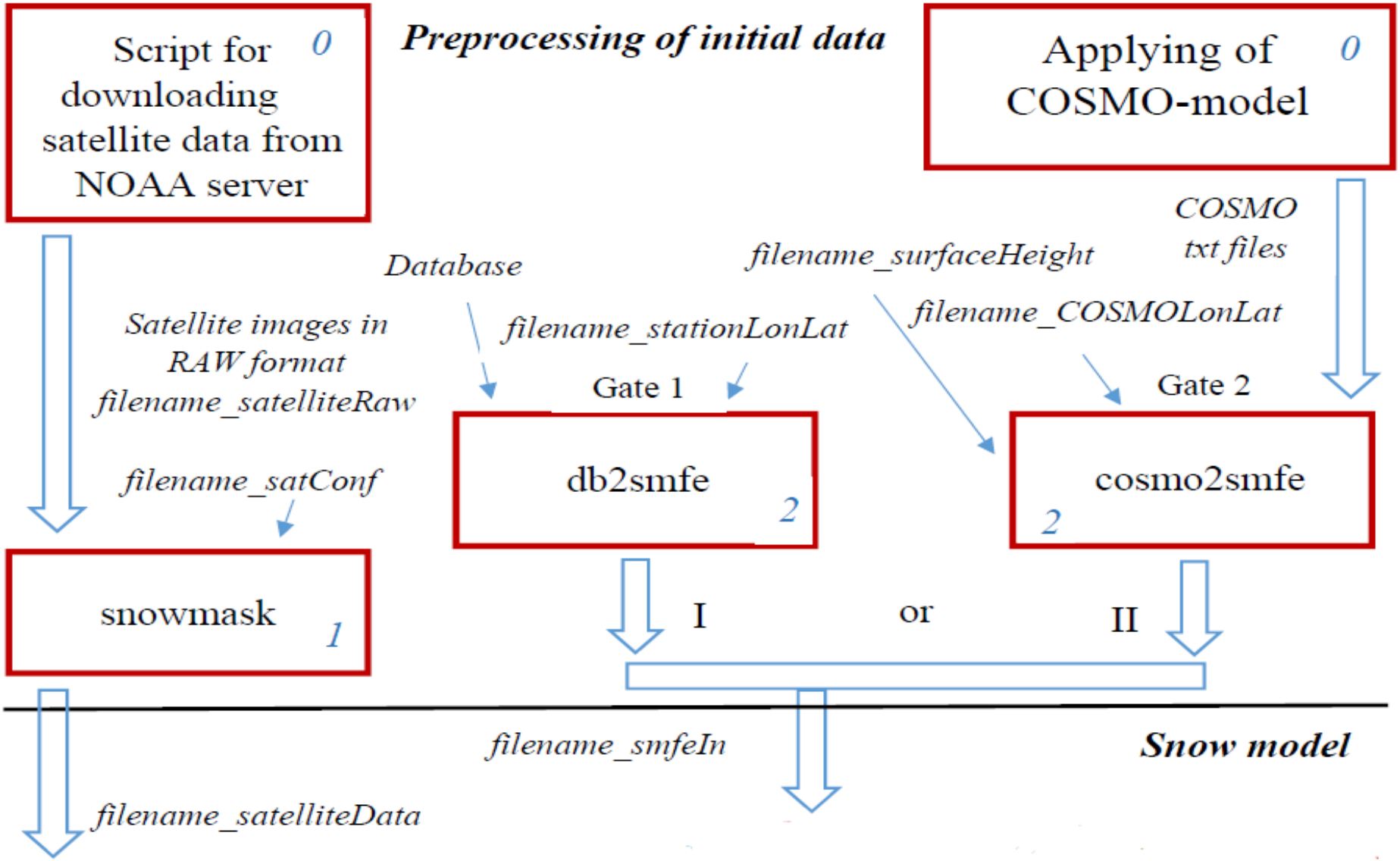
Version: COSMO grid points

Field of SWE (RHO) values for each COSMO-Ru grid point in GRIB format

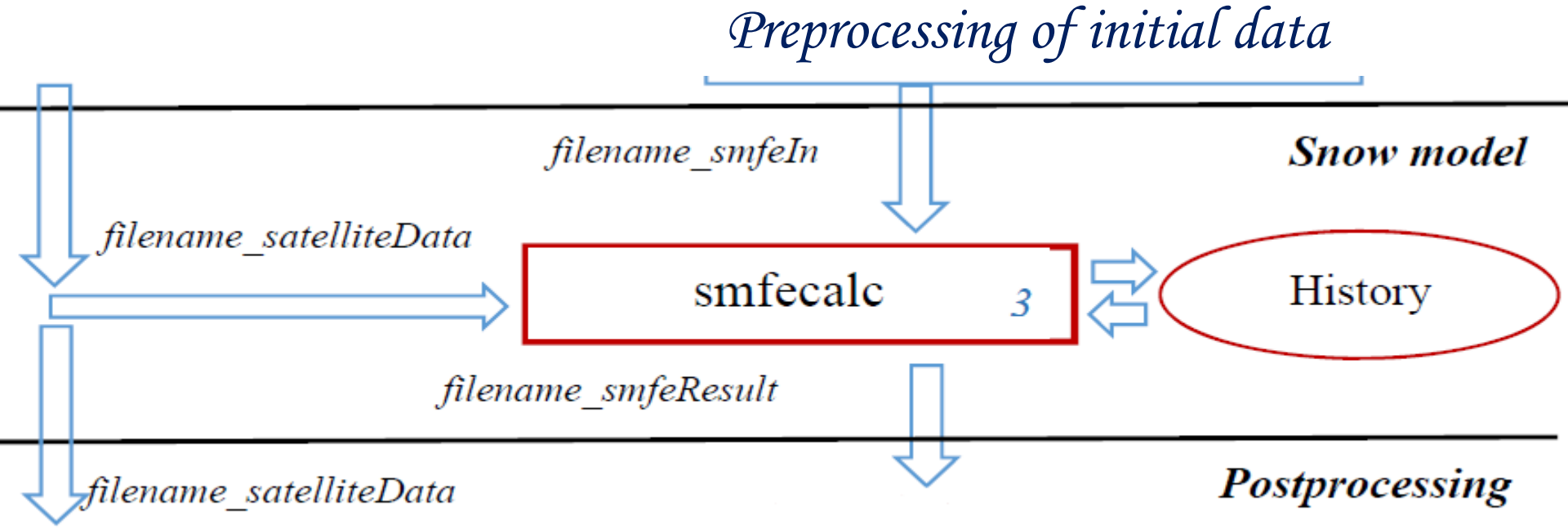
Example of mountain region



Preprocessing of initial data

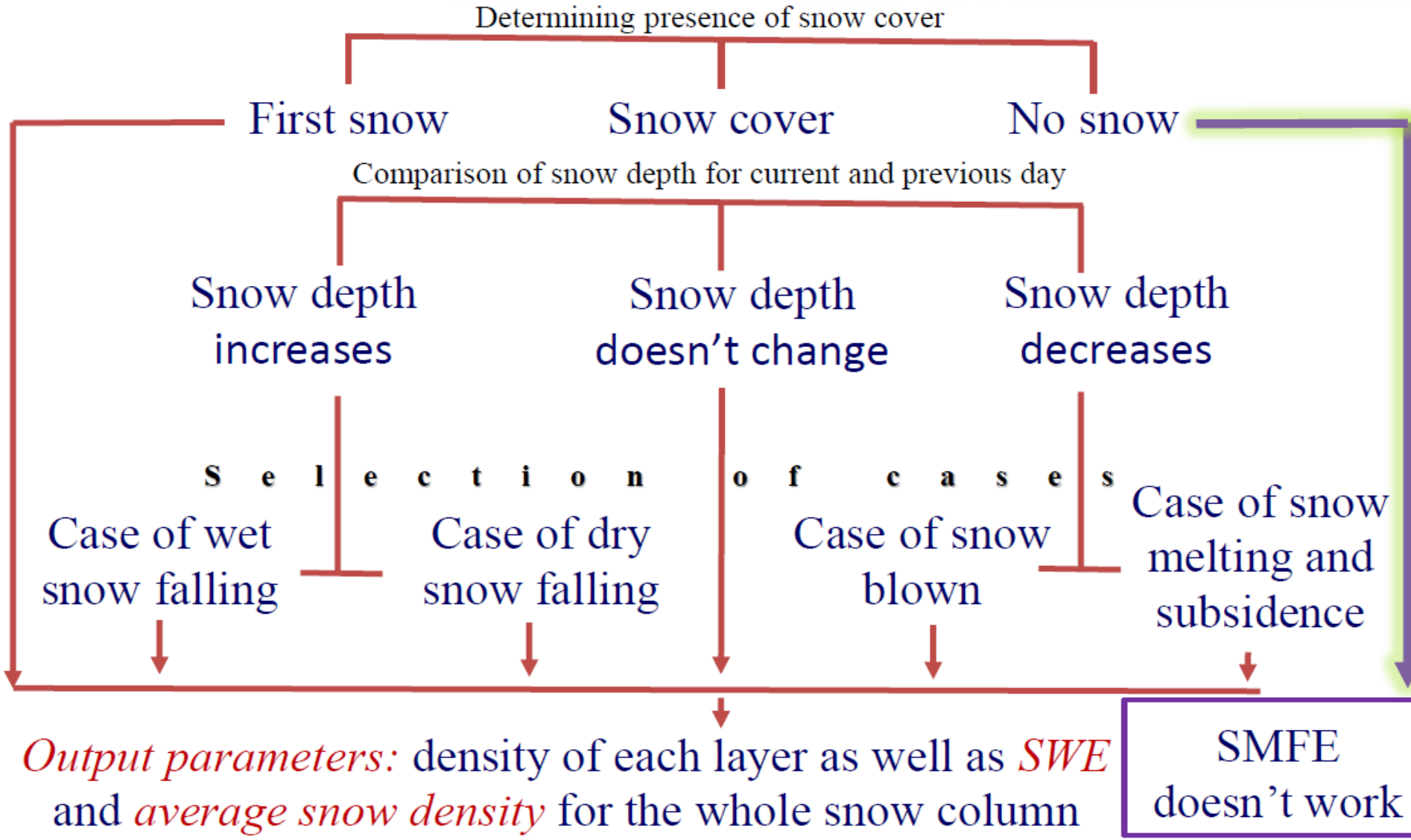


SnoWE model

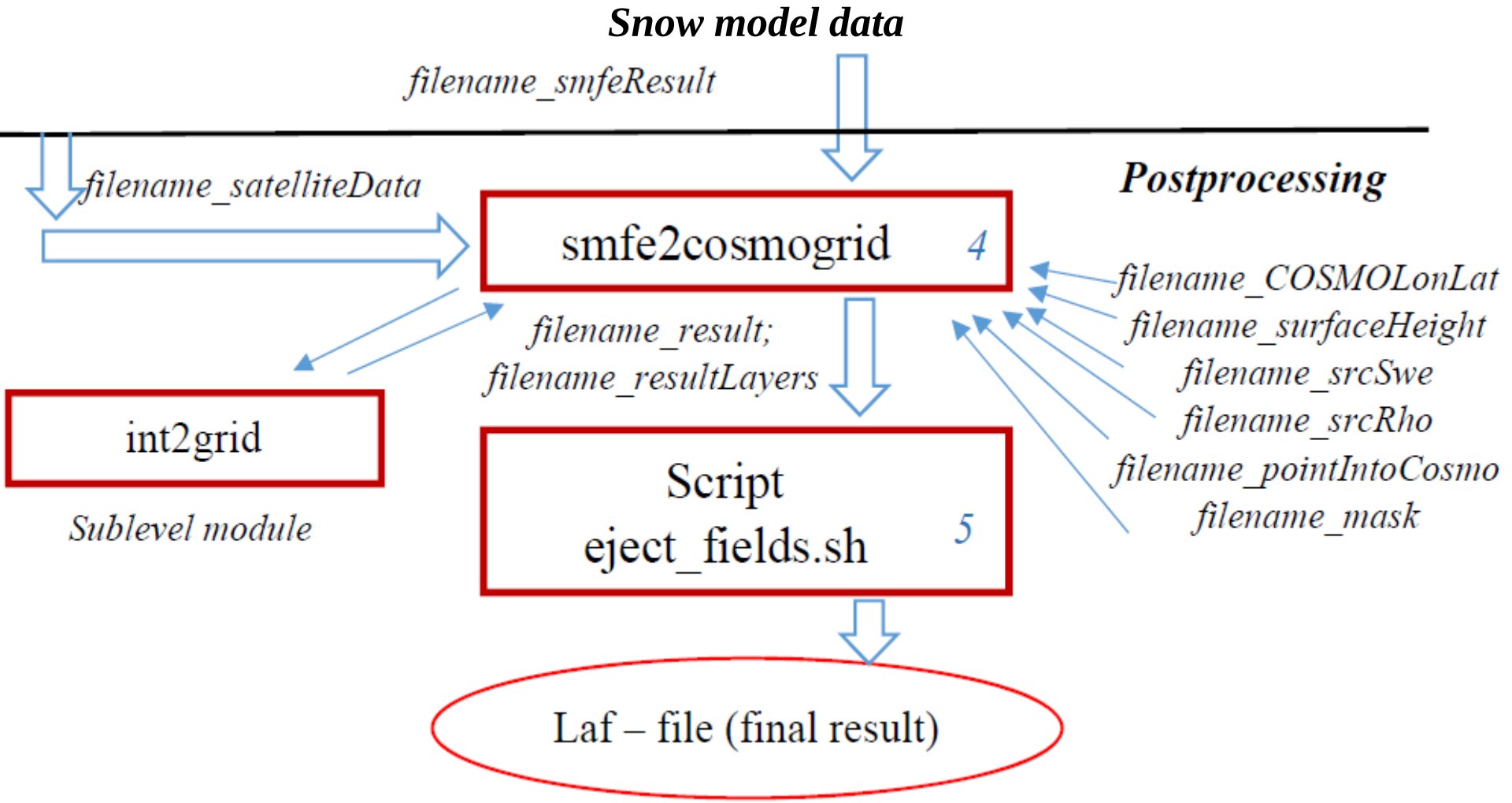


SWE and SD values depend on the whole previous weather winter history. Moreover, the use of constants and aging functions for SD for long periods can lead to ***wrong results***

Multi-layer SnoWE



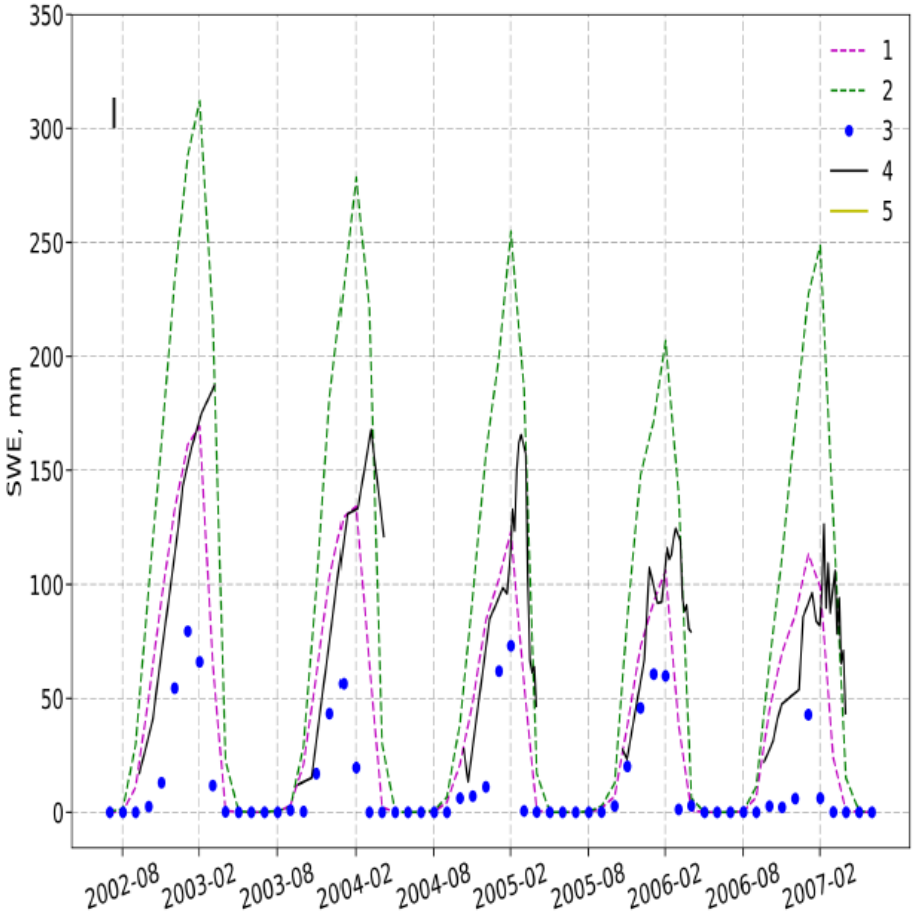
Postprocessing



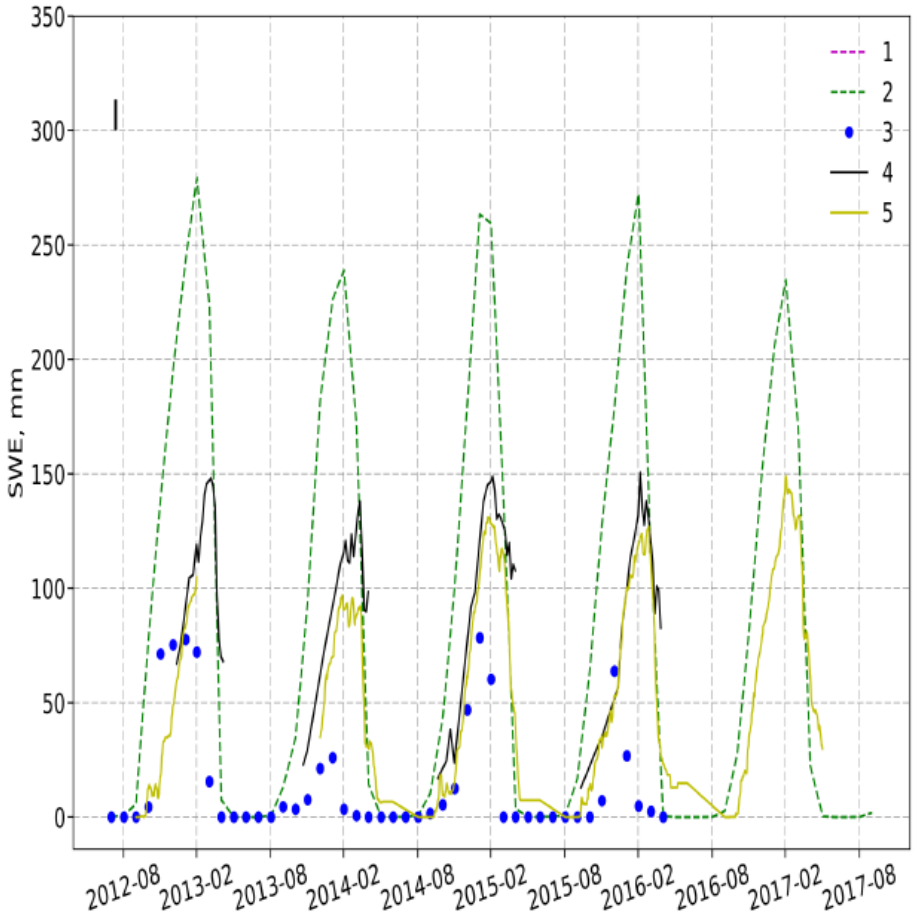
Mean values for the river basin

The North Dvina river

from 08.2002 to 07.2007



from 08.2012 to 08.2017



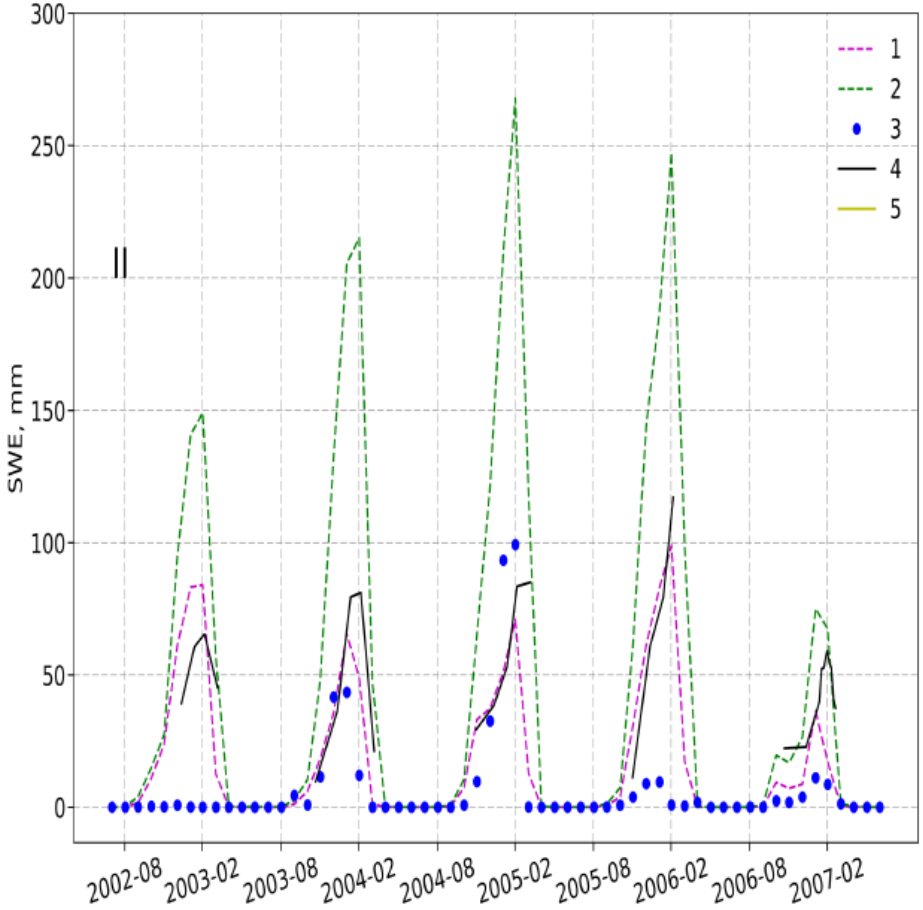
Comparison charts of restored SWE values and real SWE values

1 – GLADAS (1 type); 2 – GLADAS (2 type); 3 – GlobSnow; 4 – in-situ data; 5 – SnoWE technology

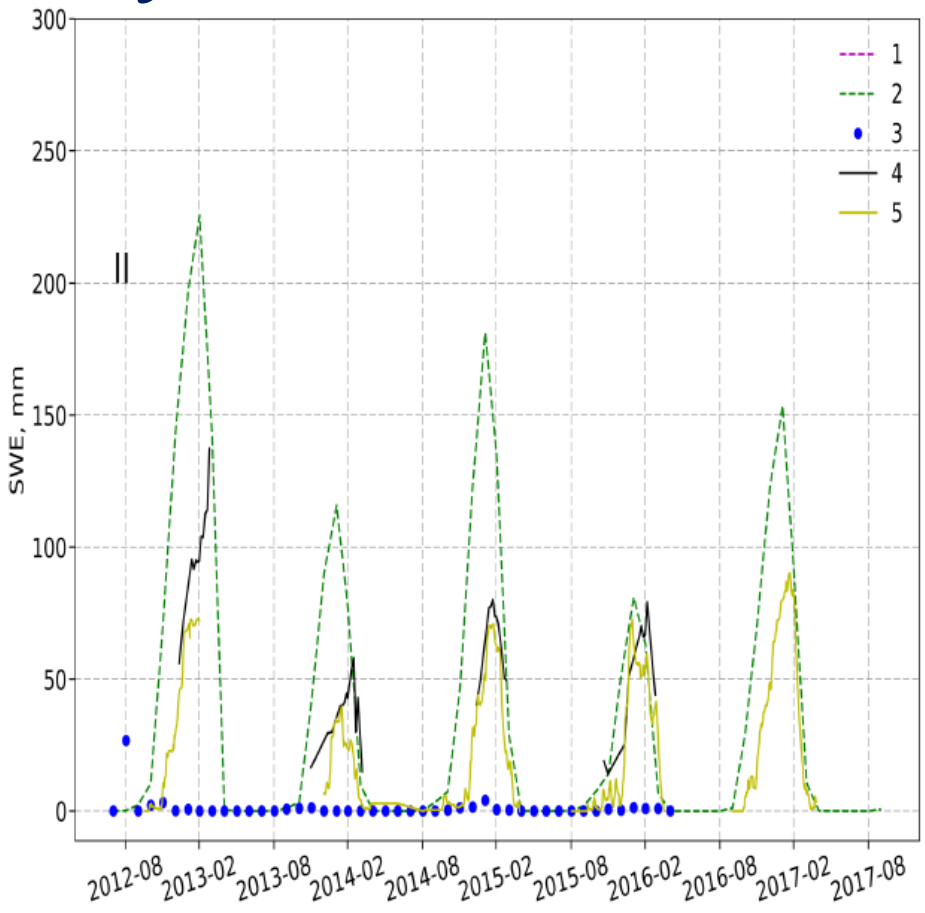
Mean values for the river basin

The Oka river

from 08.2002 to 07.2007



from 08.2012 to 08.2017



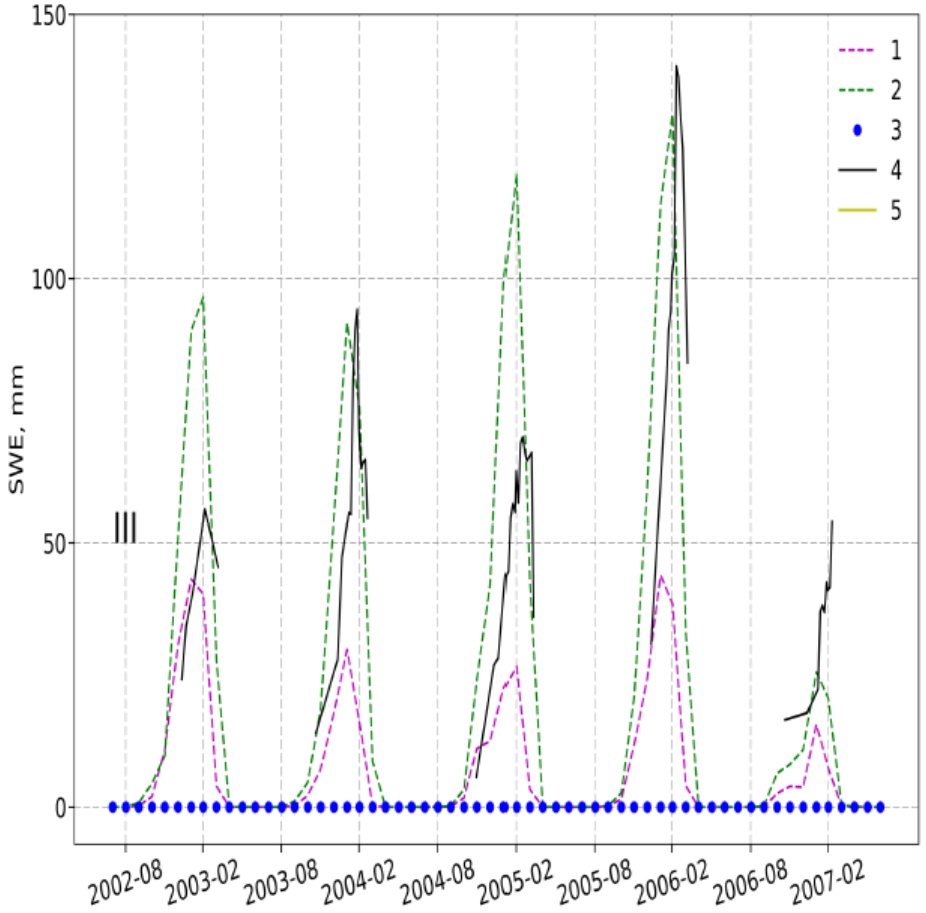
Comparison charts of restored SWE values and real SWE values

1 – GLADAS (1 type); 2 – GLADAS (2 type); 3 – GlobSnow; 4 – in-situ data; 5 – SnoWE technology

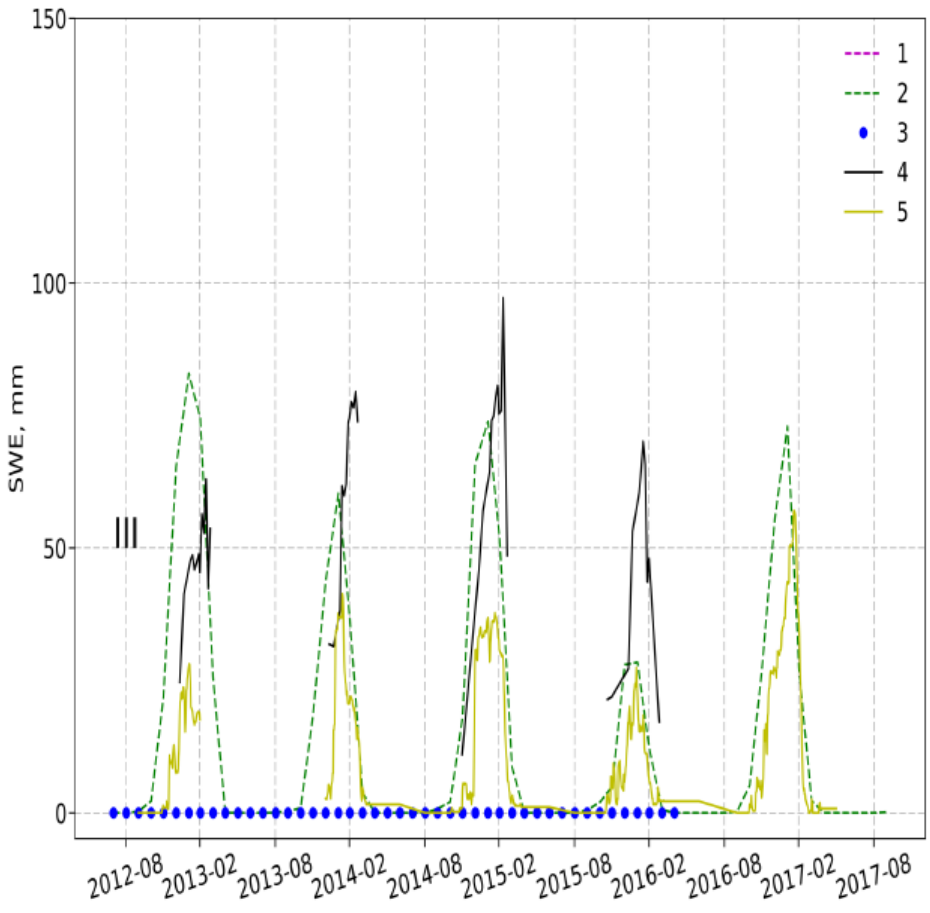
Mean values for the river basin

The Don river

from 08.2002 to 07.2007



from 08.2012 to 08.2017



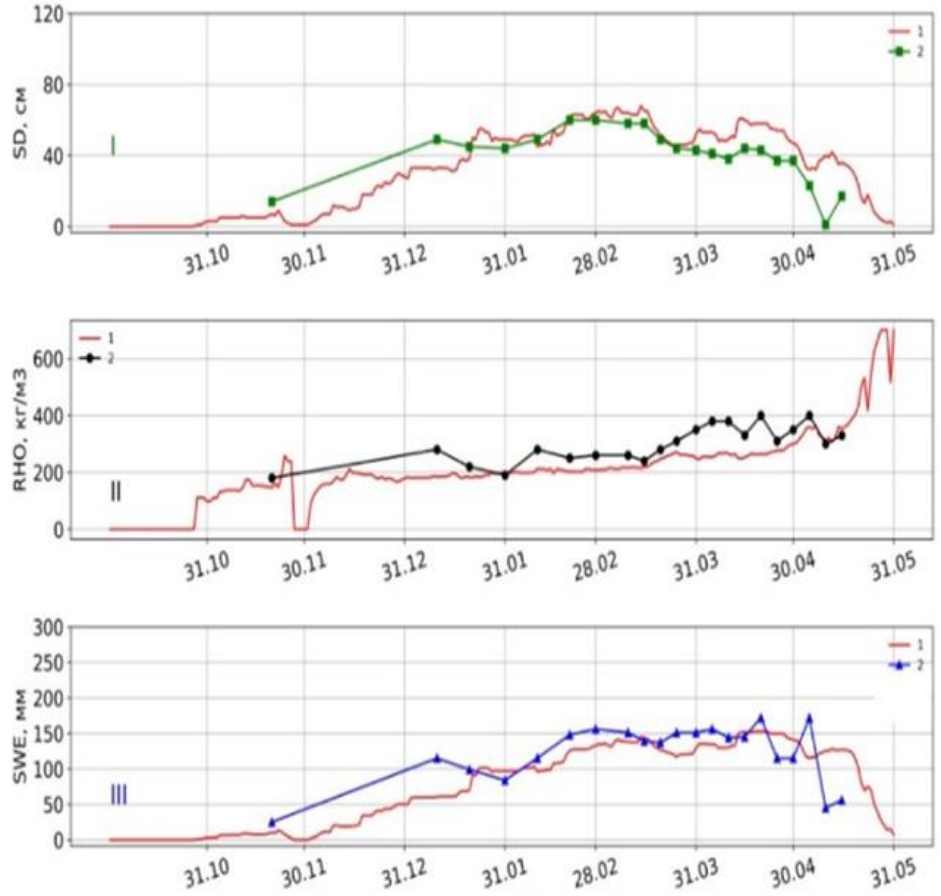
Comparison charts of restored SWE values and real SWE values

1 – GLADAS (1 type); 2 – GLADAS (2 type); 3 – GlobSnow; 4 – in-situ data; 5 – SnoWE technology

Snow history for meteorological station

Catchment area of the North Dvina river – the Mezen meteorological station

from 01.08.2016 to 31.05.2017



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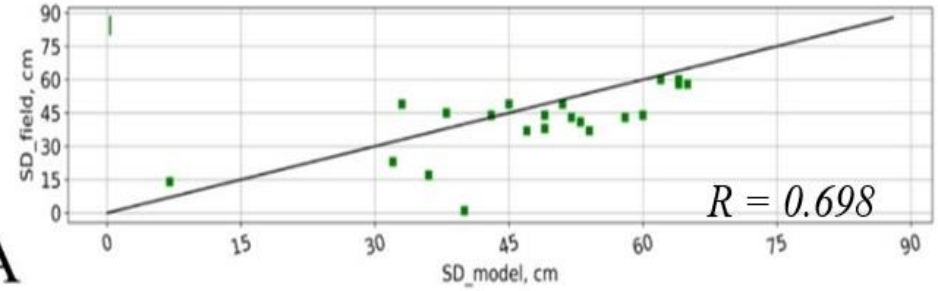
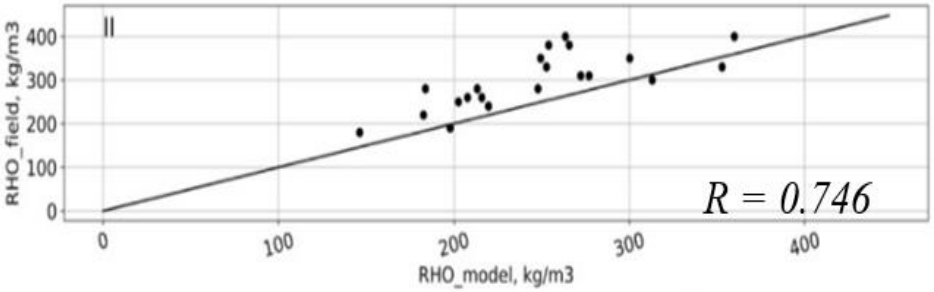
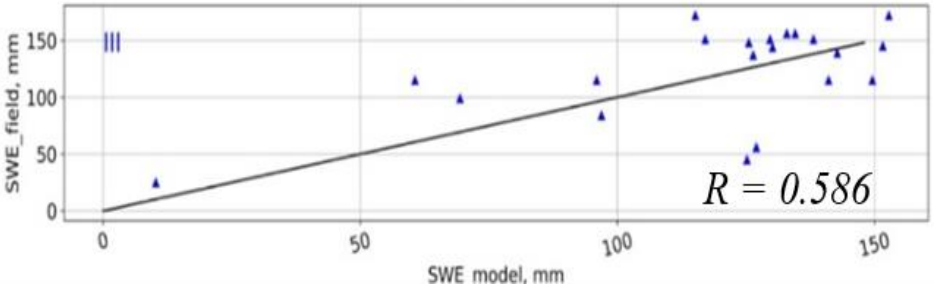




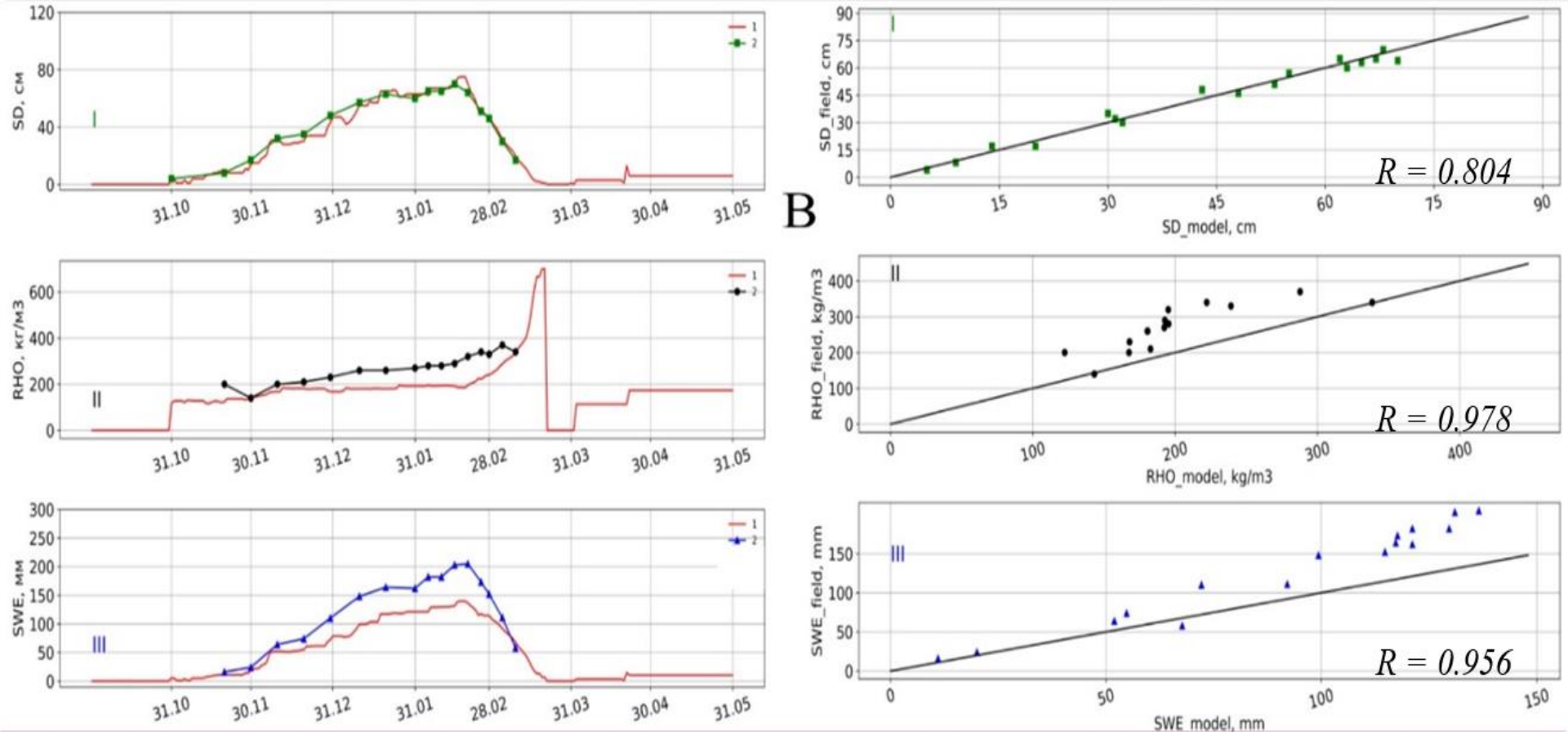


Comparison charts of restored snow values and real snow values: I – height of snow (SD); II – snow density (RHO); III – snow water equivalent (SWE); 1 – SnoWE technology; 2 – in-situ data

Snow history for meteorological station

Catchment area of the Oka river – the Michurinsk meteorological station

from 01.08.2016 to 31.05.2017



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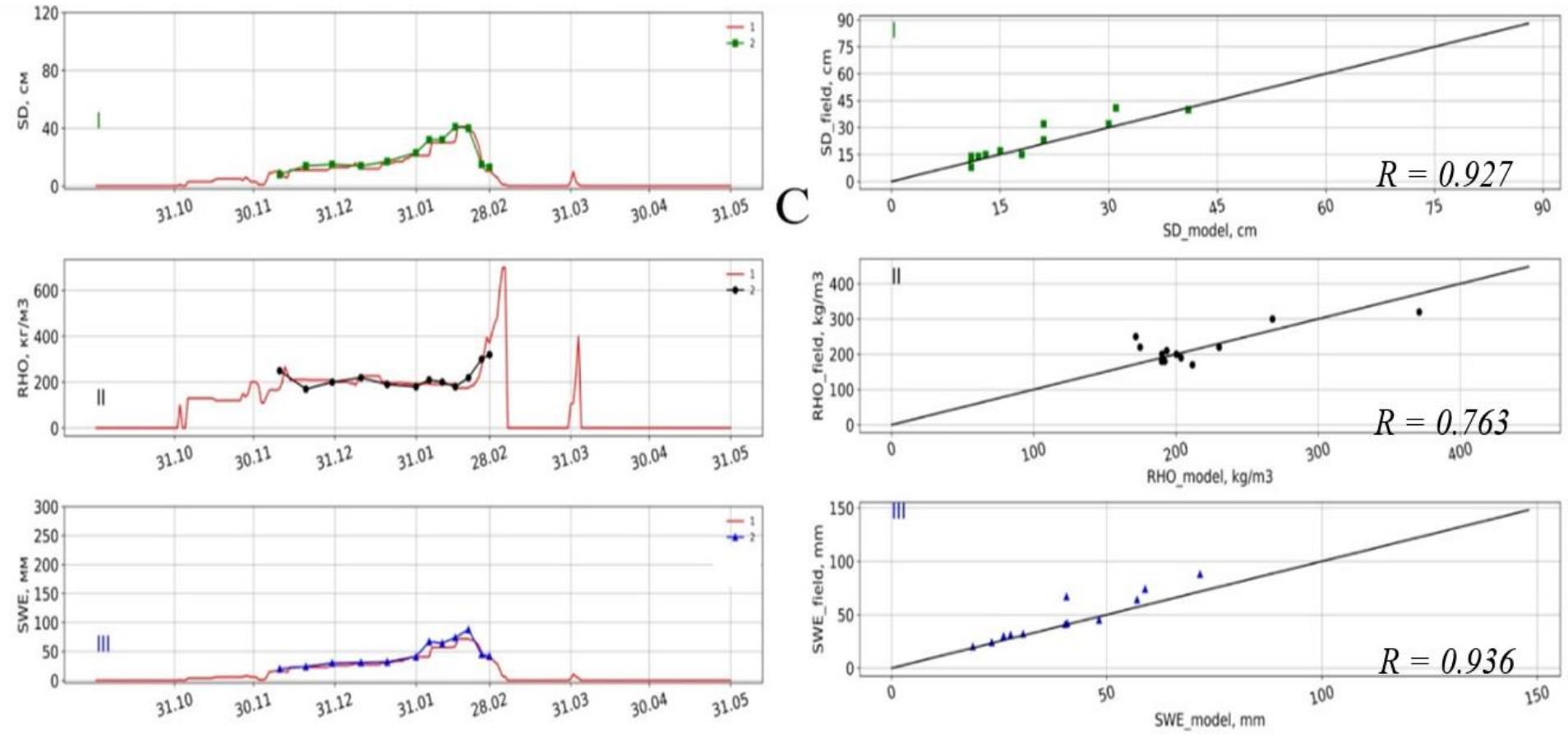
Snow history for meteorological station

Catchment area of the Don river – the Kalach meteorological station

from 01.08.2016 to 31.05.2017



Comparison charts of restored snow values and real snow values: I – height of snow (SD); II – snow density (RHO); III – snow water equivalent (SWE); 1 – SnoWE technology; 2 – in-situ data

Conclusions

The data of SnoWE technology (fields of SWE values) were applied in the spring flood time in 2016/17, 2017/18 for the territory of the Russian Federation

New gates for data downloading have been implemented

Program code of SnoWE technology were updated

Python scripts for graphical visualization were created

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Best regards, Churiulin E