



*SNOWE – technology
winter 2016/17 and 2017/18*

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Outline



Research territory

Approach

Preprocessing of initial data

Snowe model

Multi-layer snow model SMFE

Postprocessing

ETR – 7 km

Mean values for the river basin

Snow history for meteorological station



Research territory



SYNOP

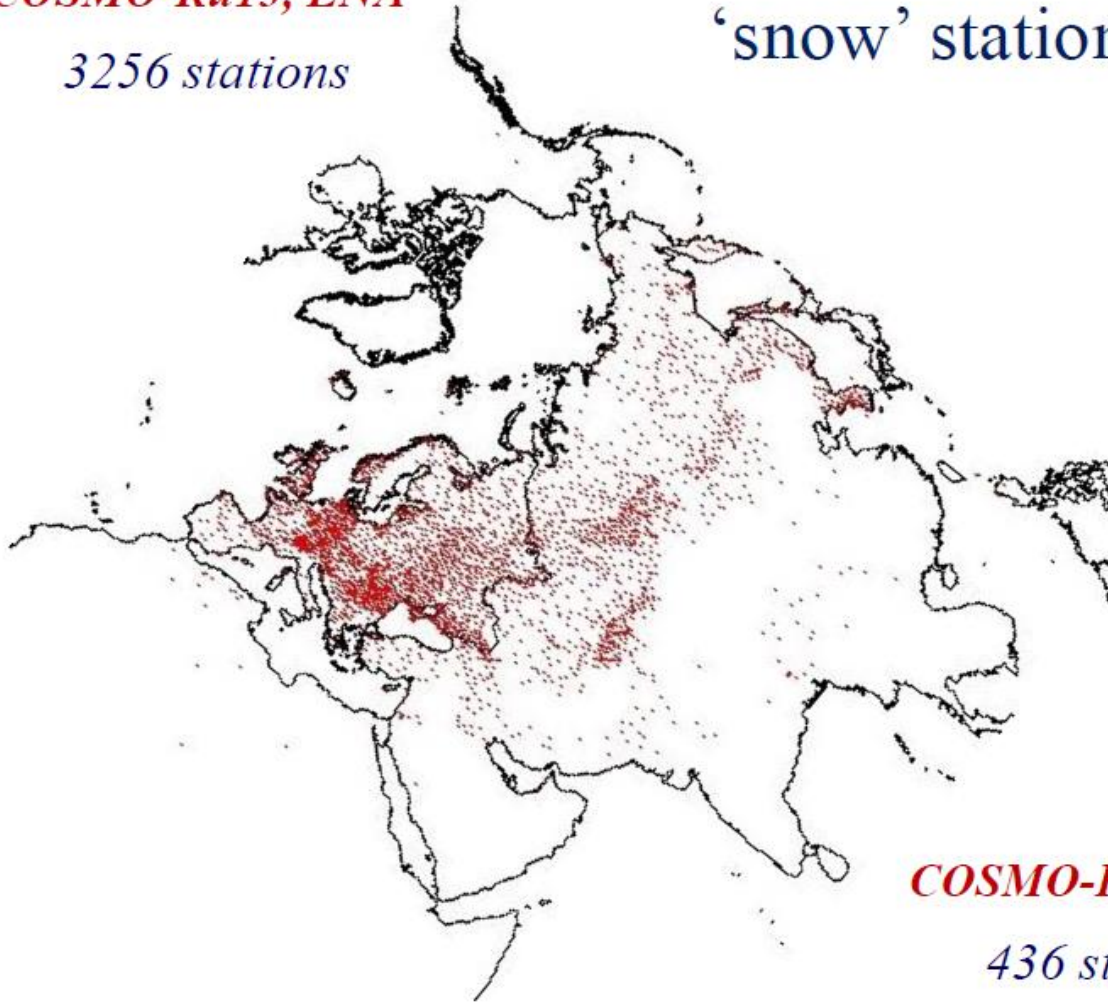
'snow' stations

COSMO-Ru7, ETR

2163 stations

COSMO-Ru13, ENA

3256 stations

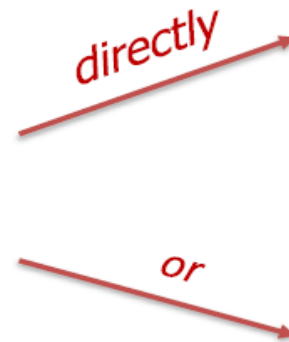


COSMO-Ru7, CFO

436 stations



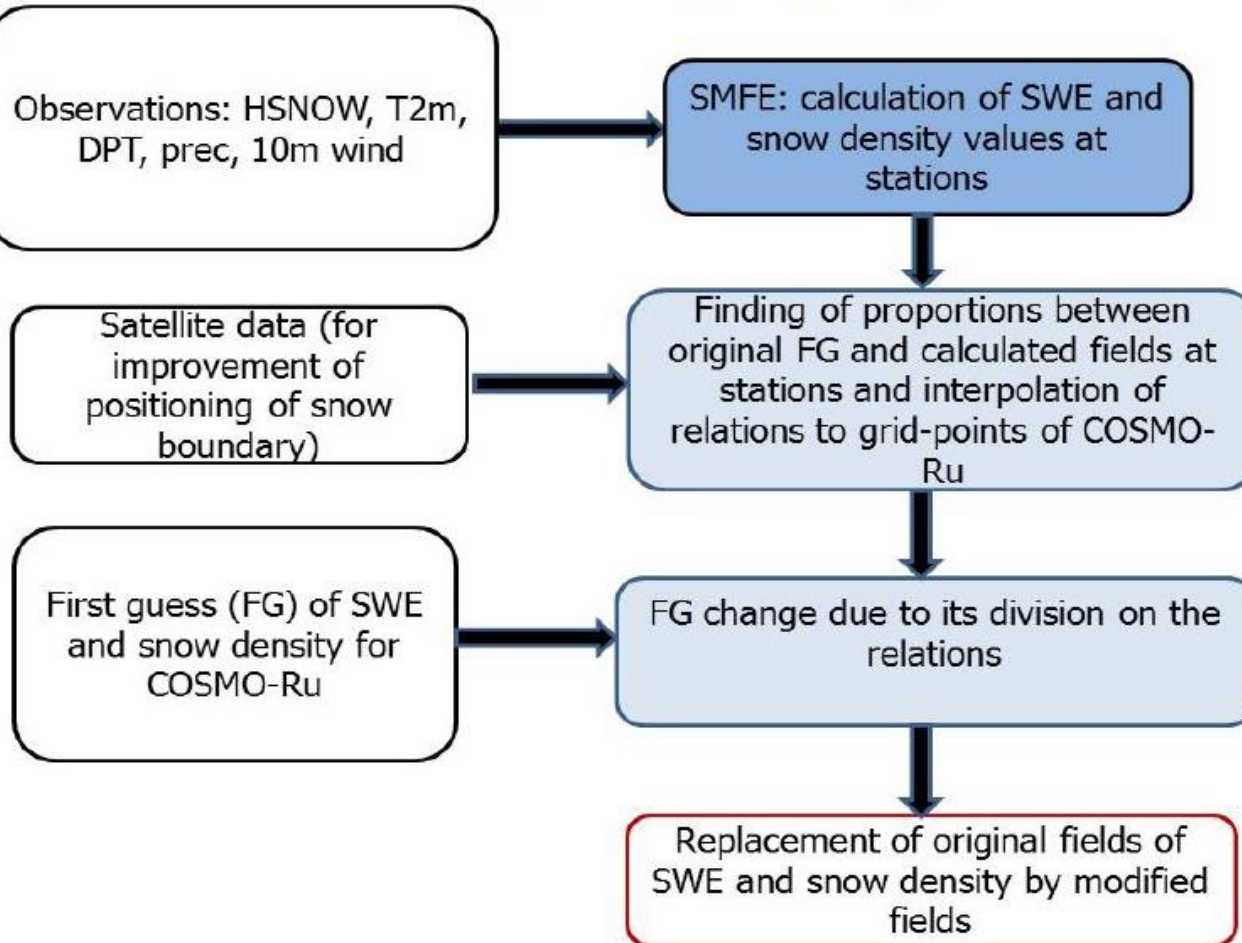
Calculation of *SWE* and *snow density* through the developed snow model SMFE can be executed



At SYNOP stations
 (“stations”, their further interpolation and using COSMO first guess)

At COSMO-grid points (“COSMO past forecasts”)

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



In **quasi-operational regime** since 1 December 2014 for:

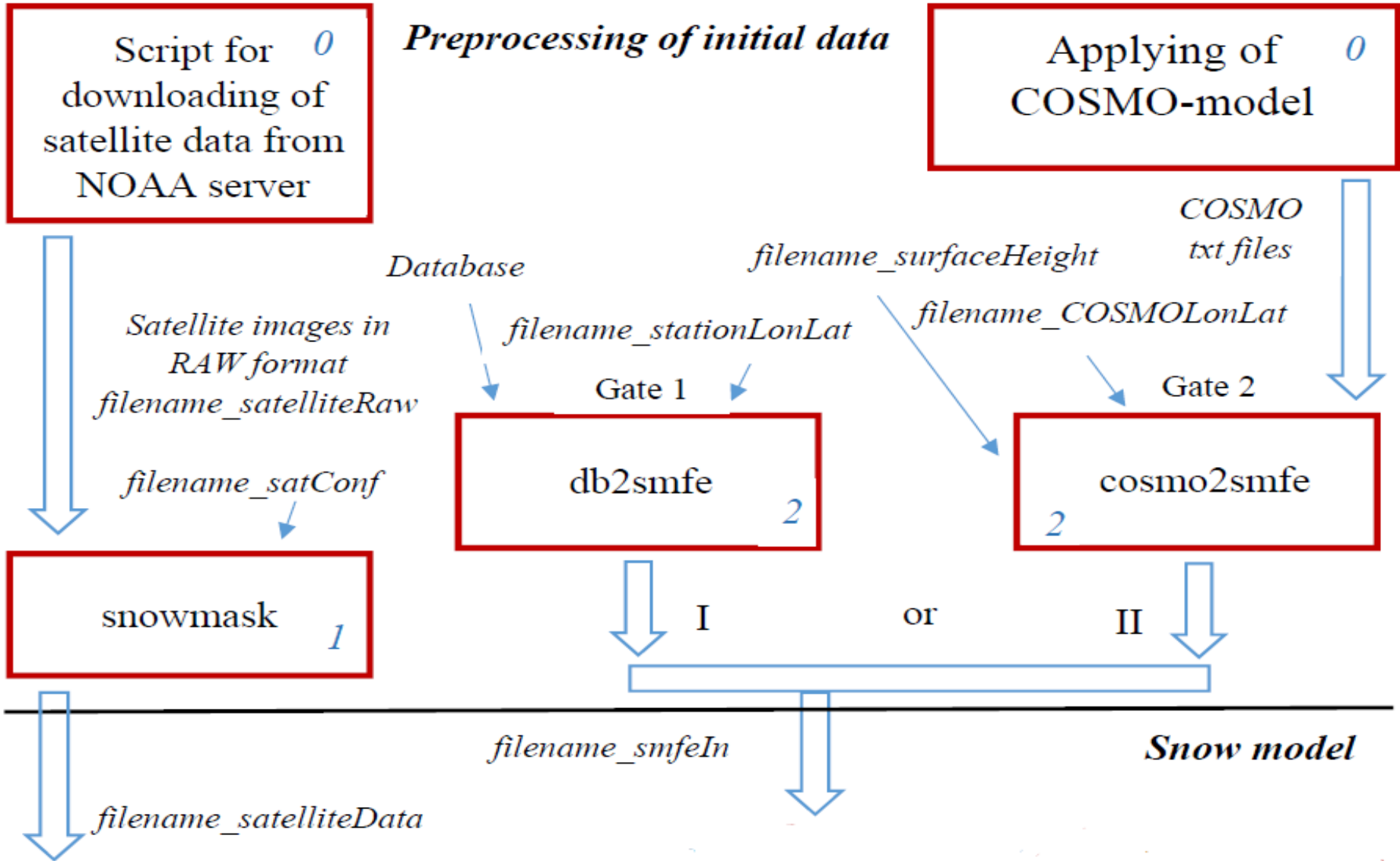
December 2014 for:

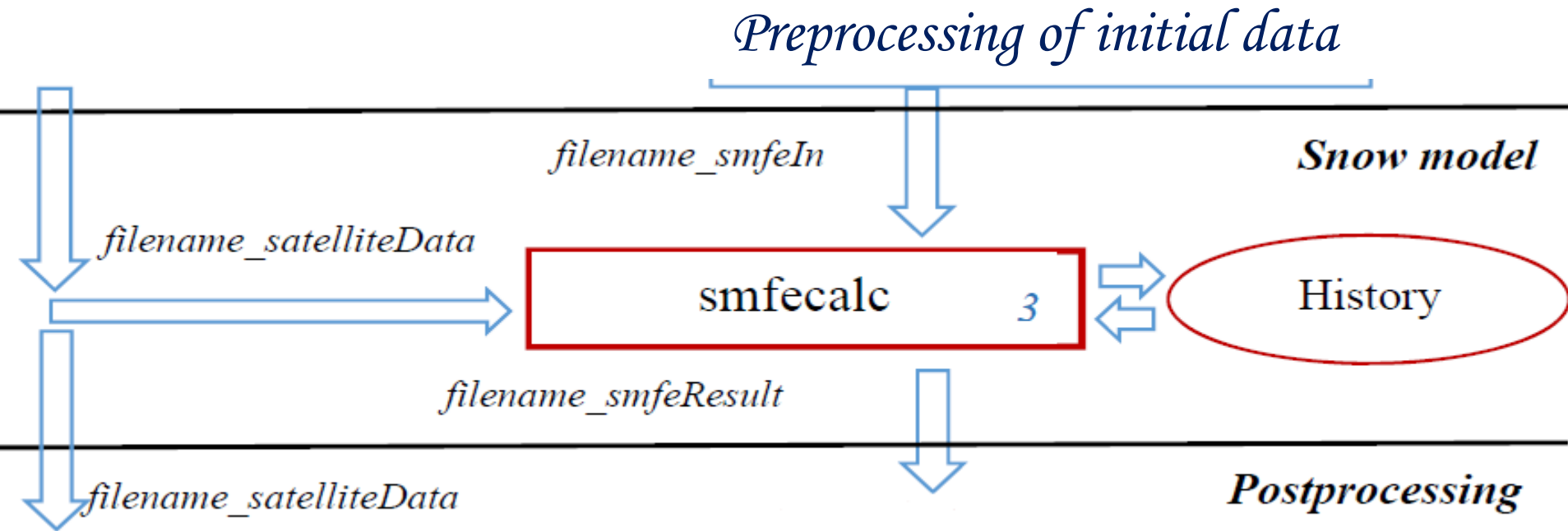
COSMO-Ru7, ETR versions with 7 km resolution

COSMO-Ru2, CFO versions with 2 km resolution

Since 1 March 2016 – for

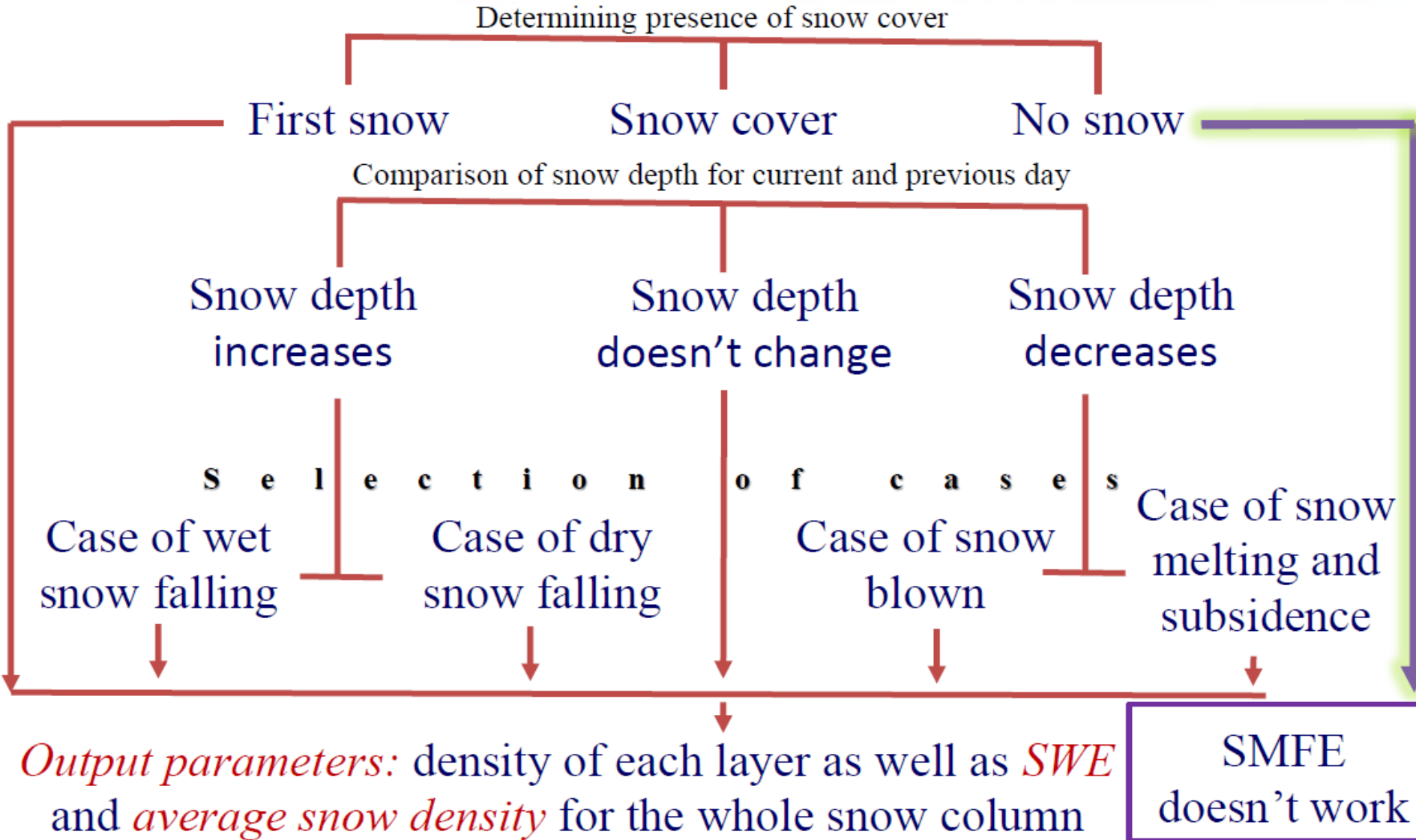
COSMO-Ru13, ENA versions with 13.2 km resolution



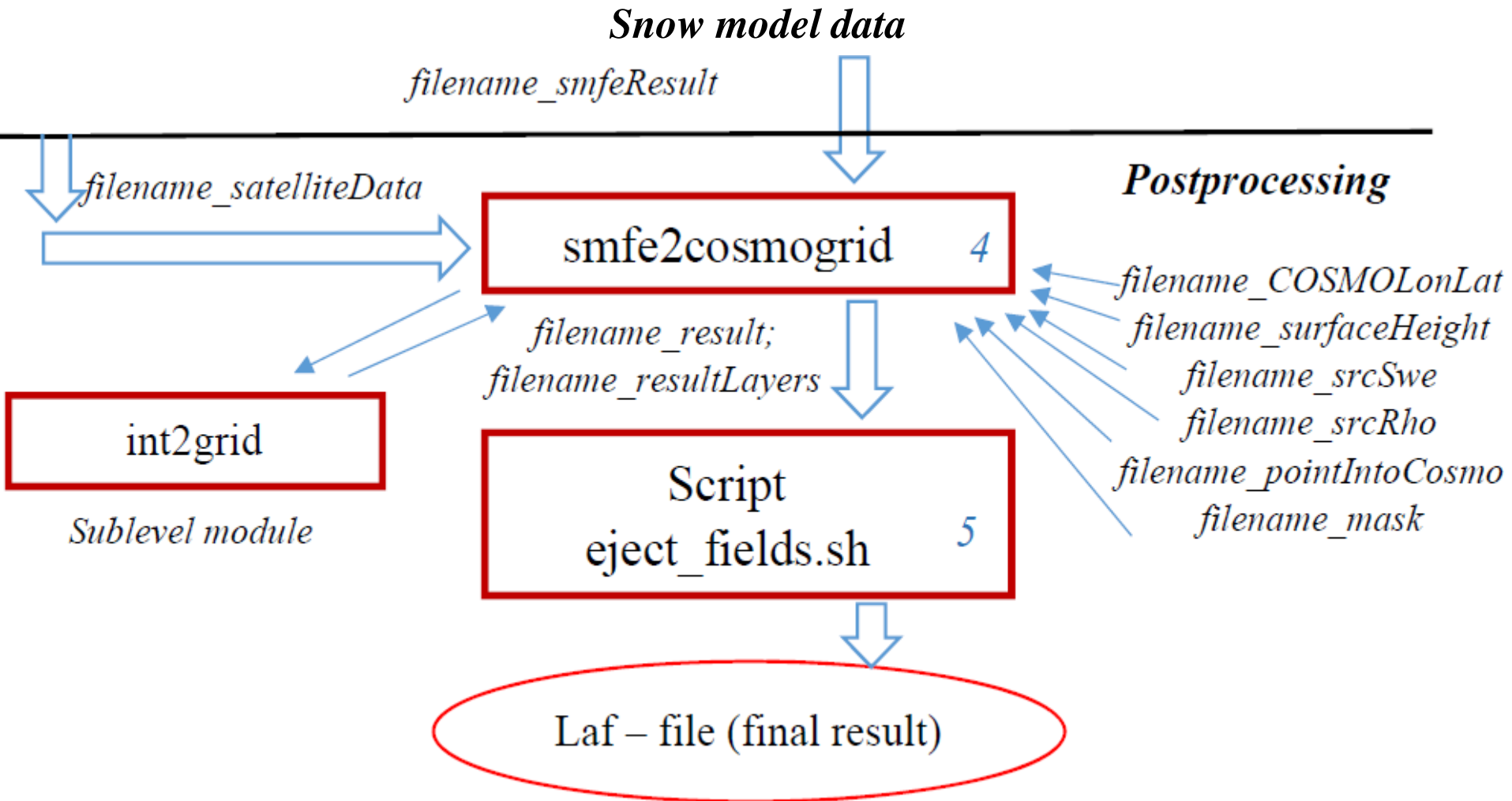


SWE and *SD* values depend on the **whole** previous weather winter history.

Moreover, the use of constants and aging functions for *SD* for long periods can lead to wrong results



Postprocessing

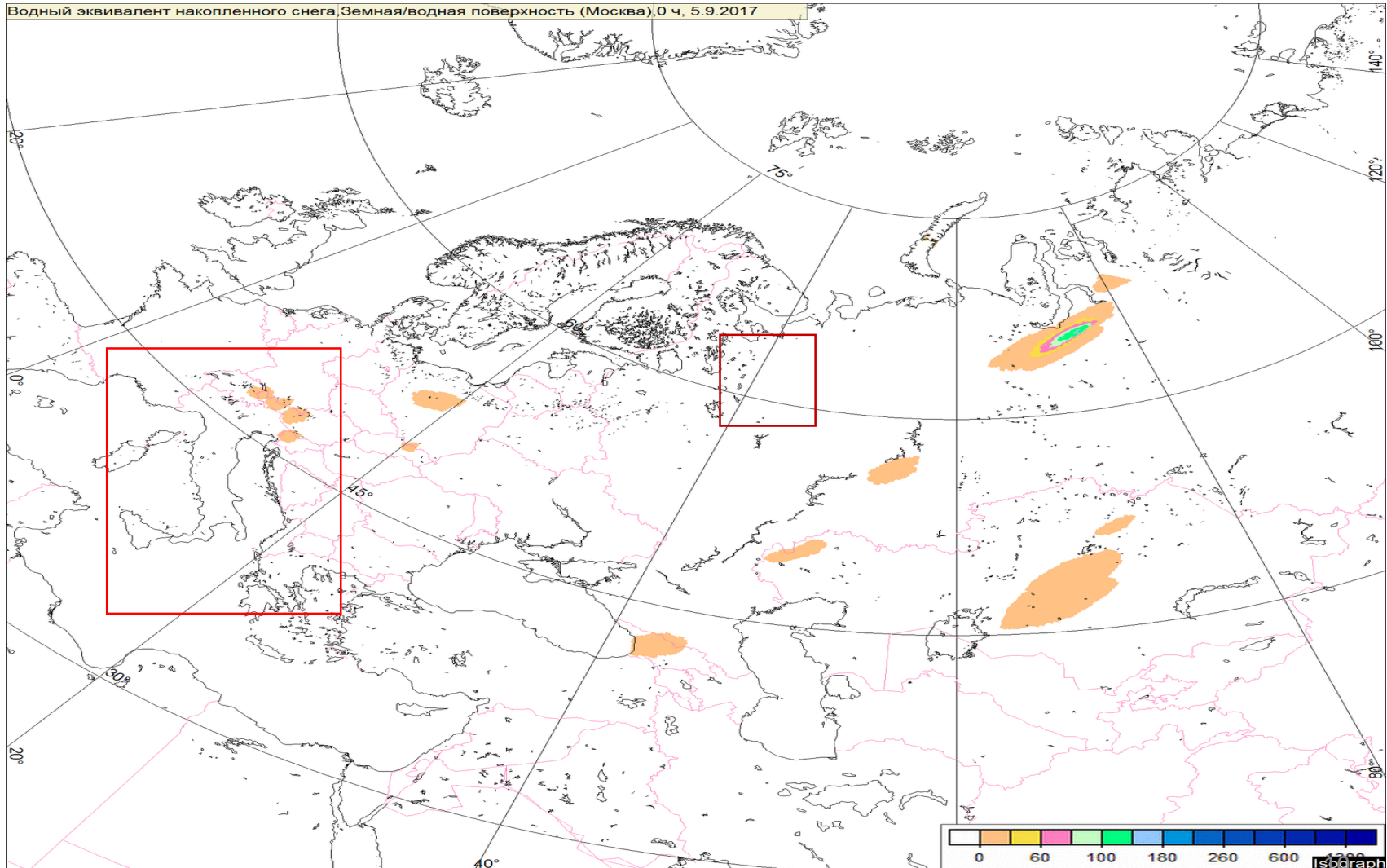


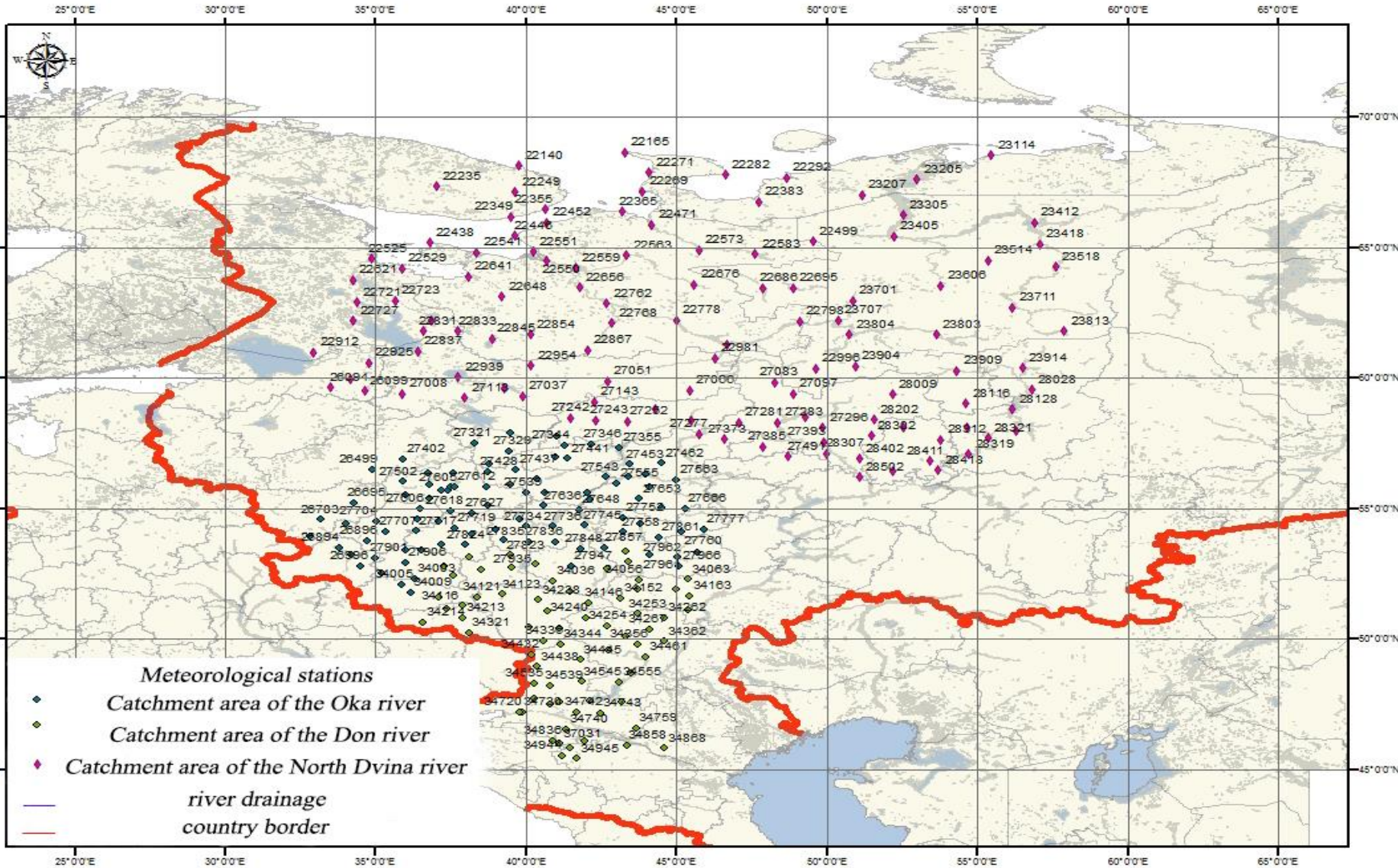


ETR – 7 km



Station version; time range from 05.09.2017 to 22.02.2018

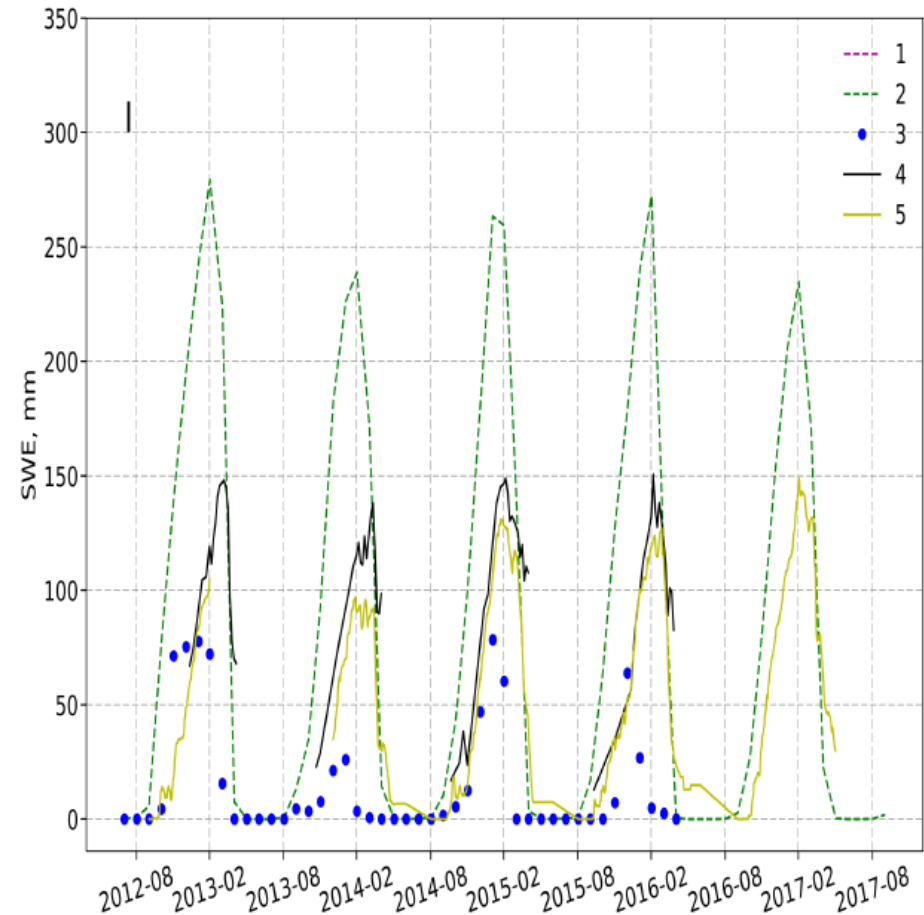
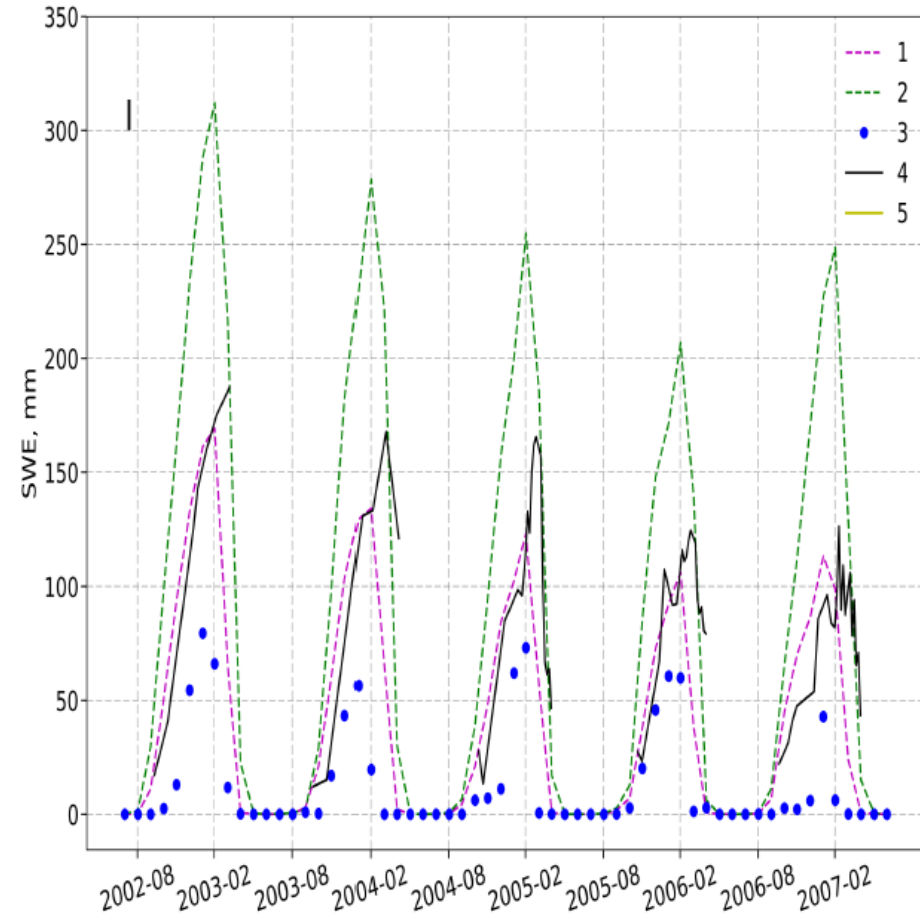




The North Dvina river

from 08.2002 to 07.2007

from 08.2012 to 08.2017



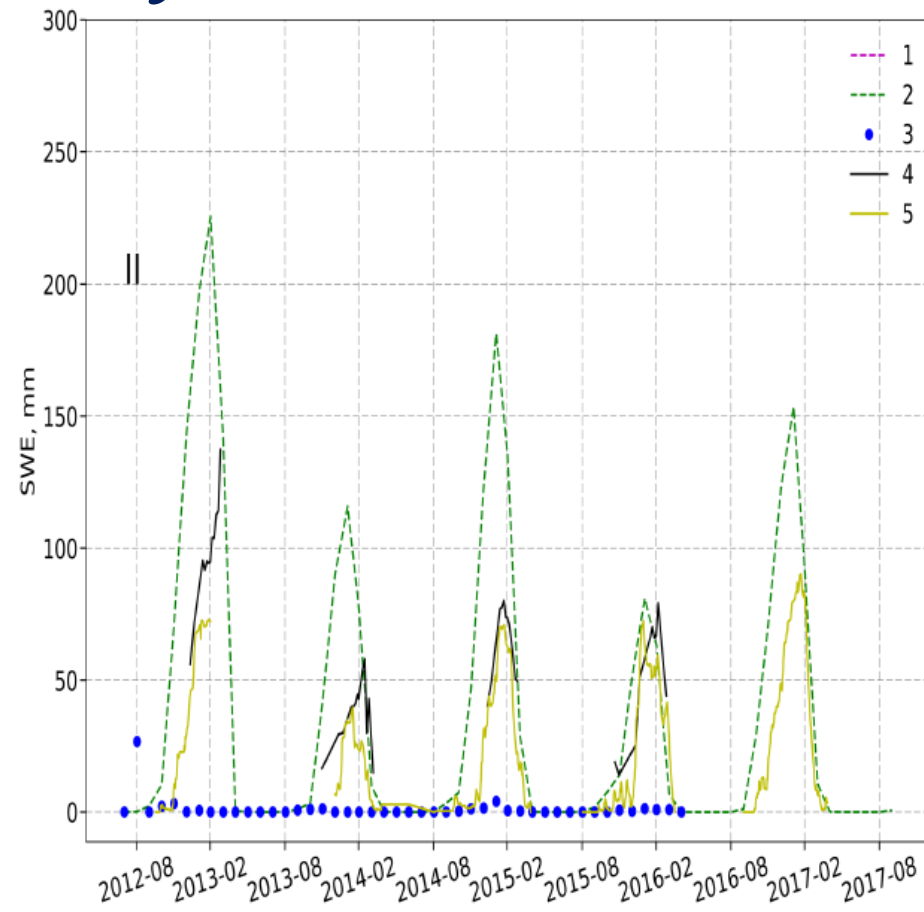
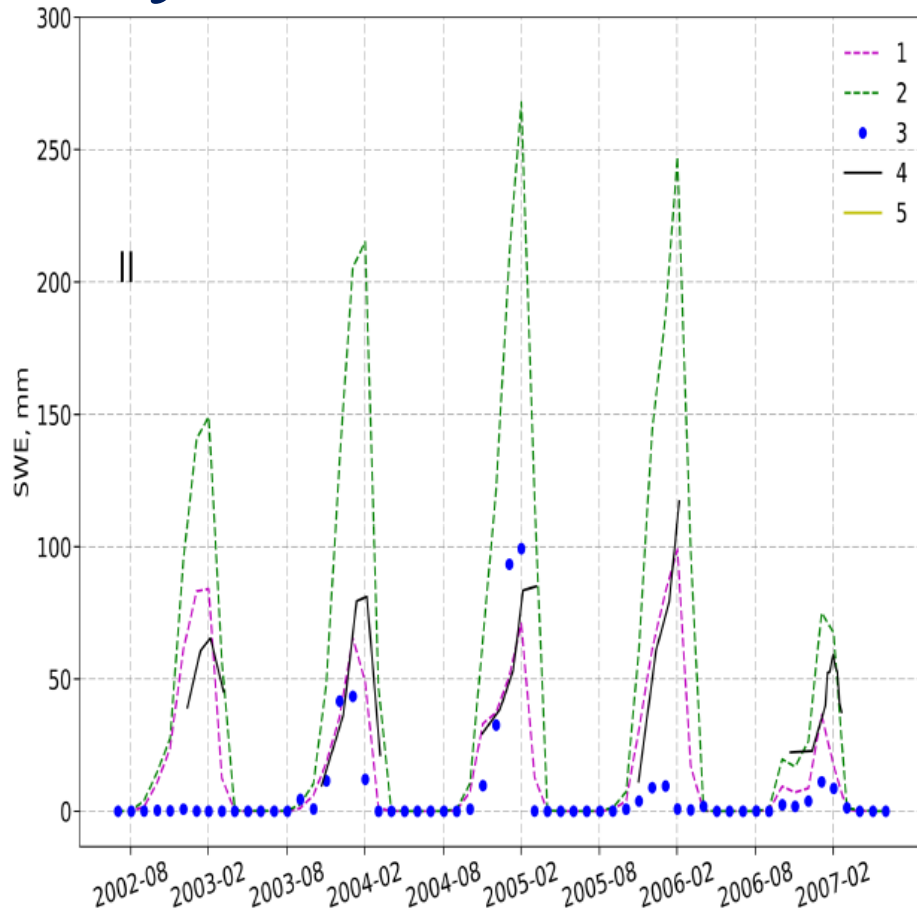
Comparison charts of restored SWE values and real SWE values

1 – GLADAS 1987 – 2010; 2 – GLADAS 2000 – 2017; 3 – GlobSnow; 4 – in-situ data; 5 –

The Oka river

from 08.2002 to 07.2007

from 08.2012 to 08.2017



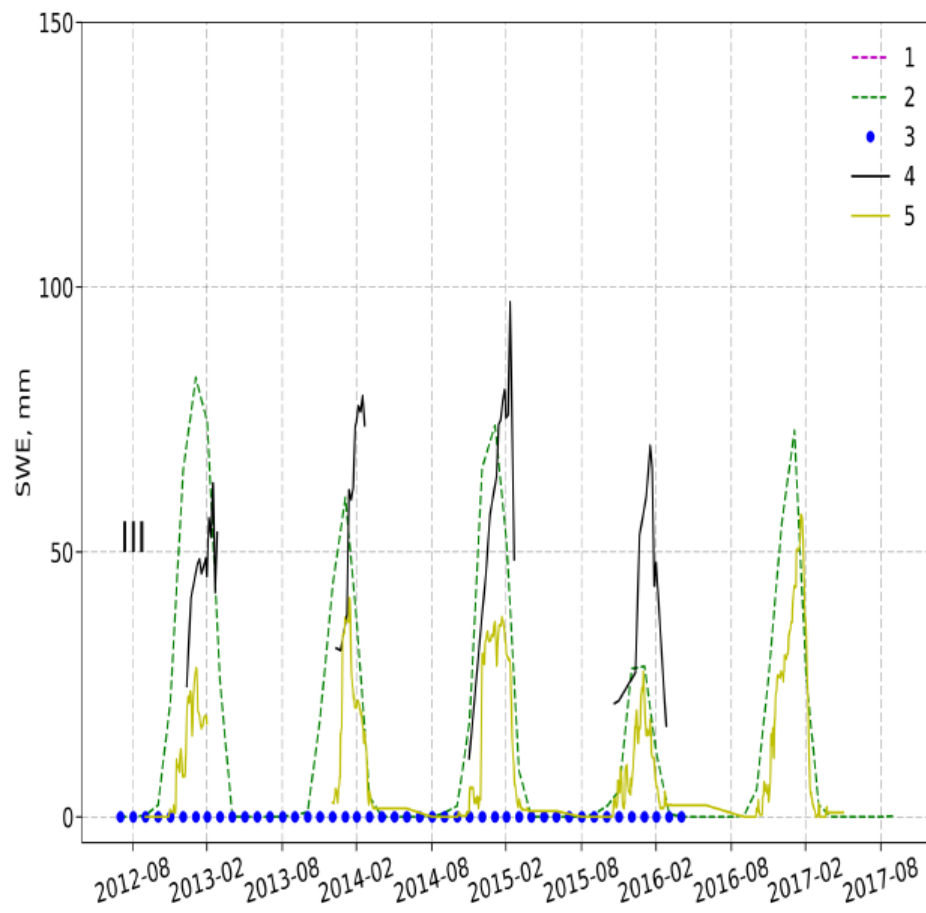
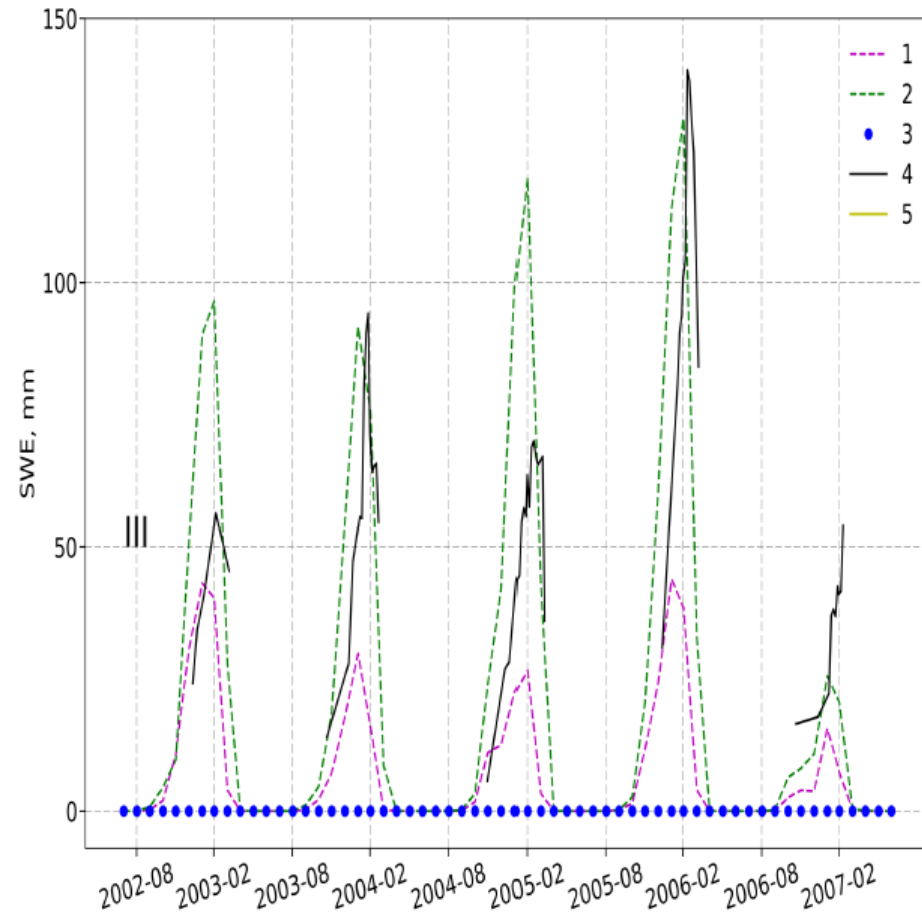
Comparison charts of restored SWE values and real SWE values

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The Don river

from 08.2002 to 07.2007

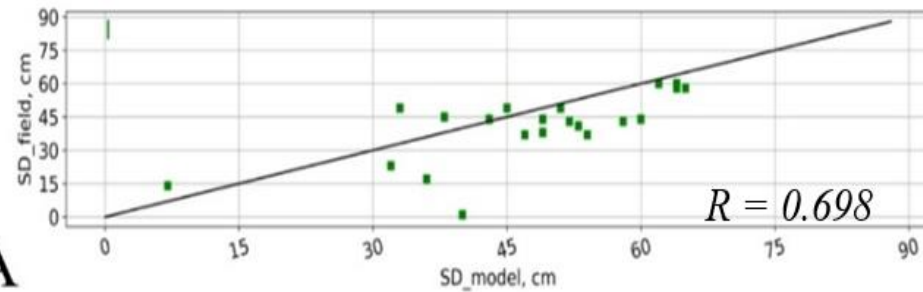
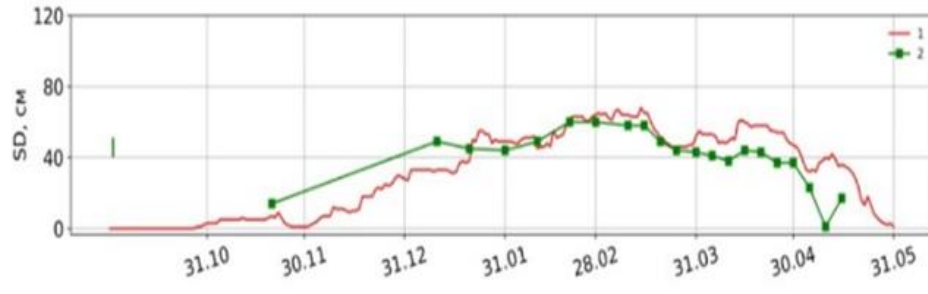
from 08.2012 to 08.2017



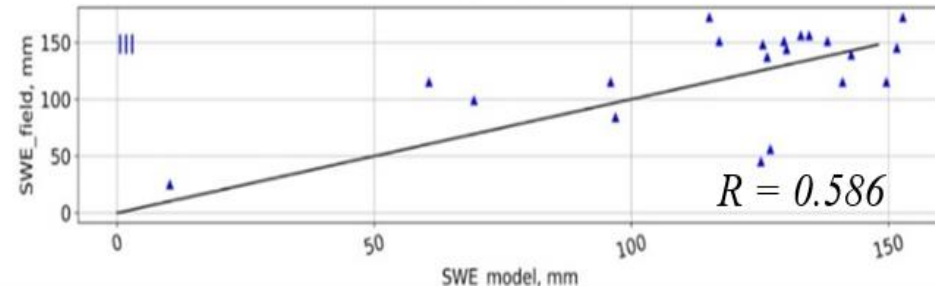
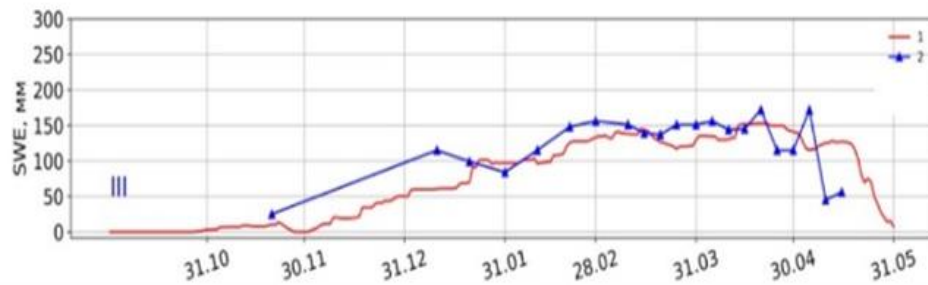
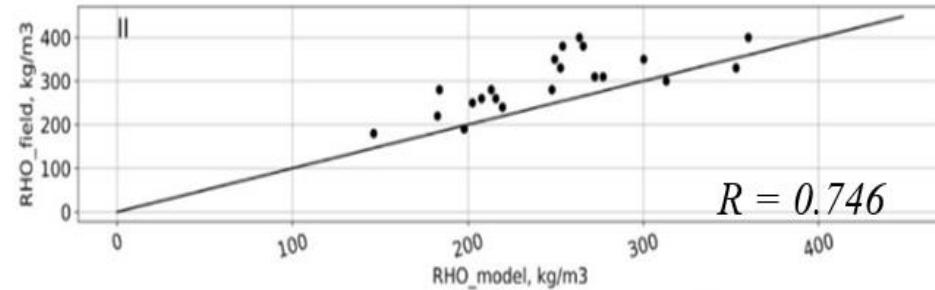
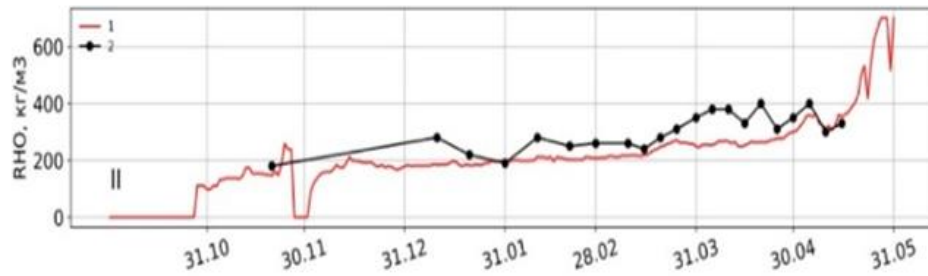
Comparison charts of restored SWE values and real SWE values

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Catchment area of the North Dvina river – the Mezen meteorological station from 01.08.2016 to 31.05.2017

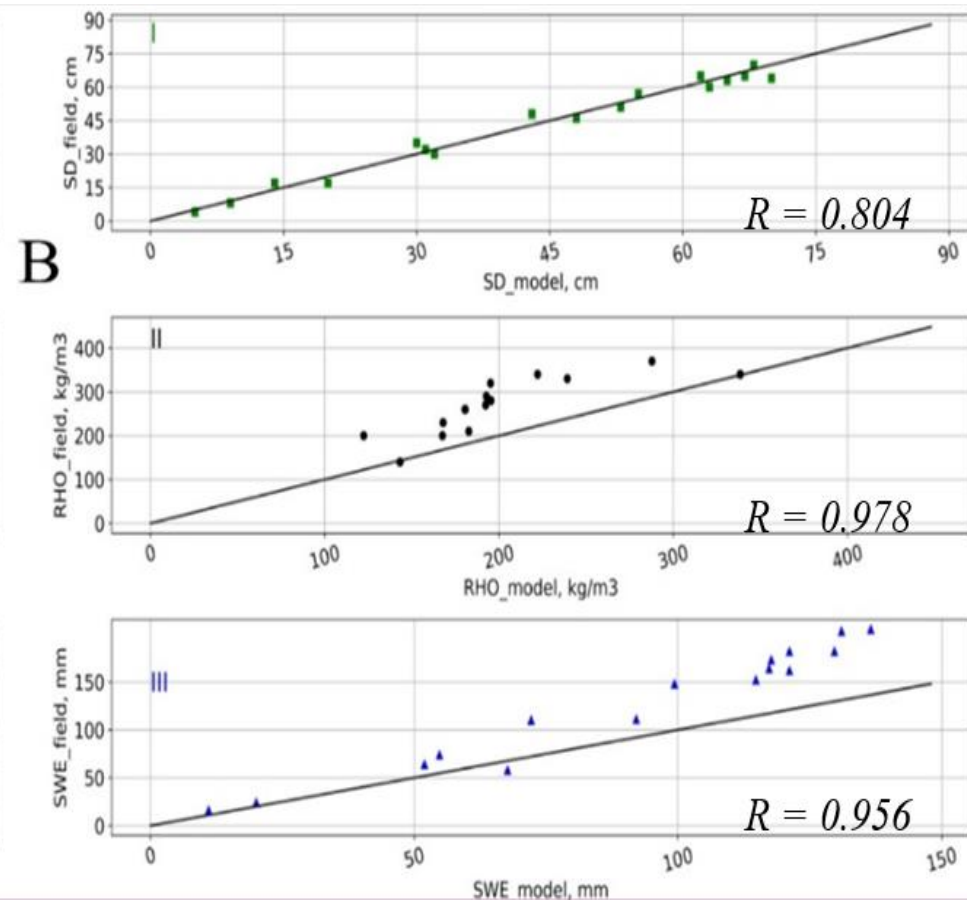
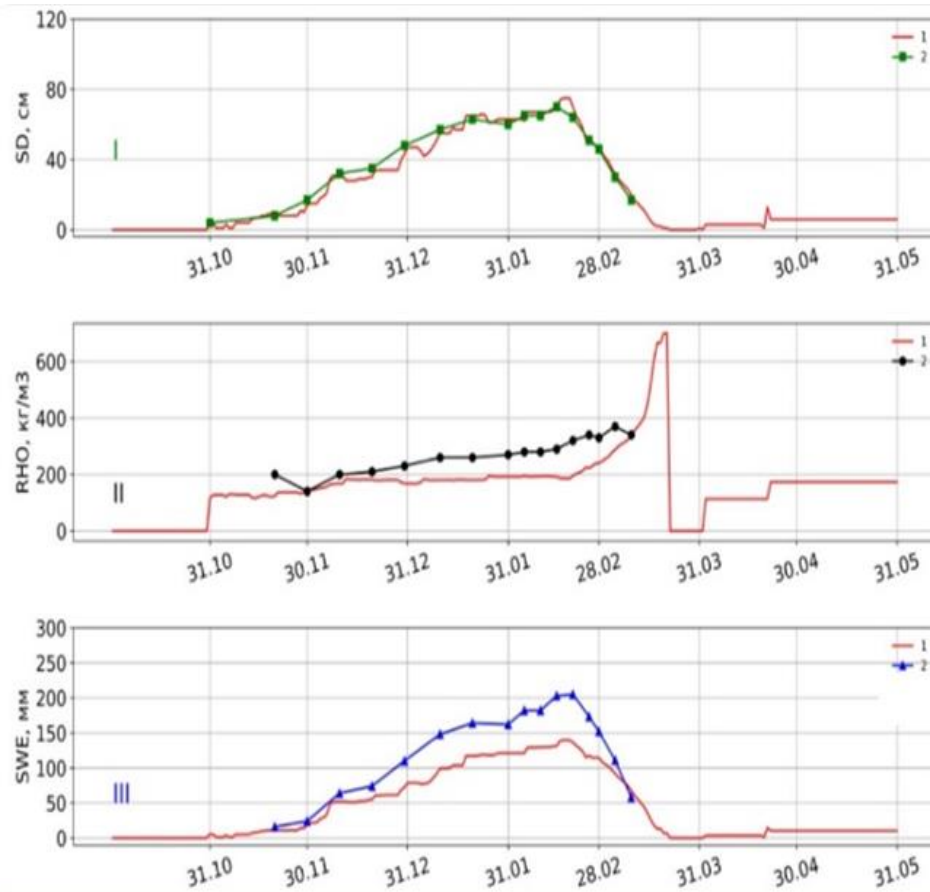


A



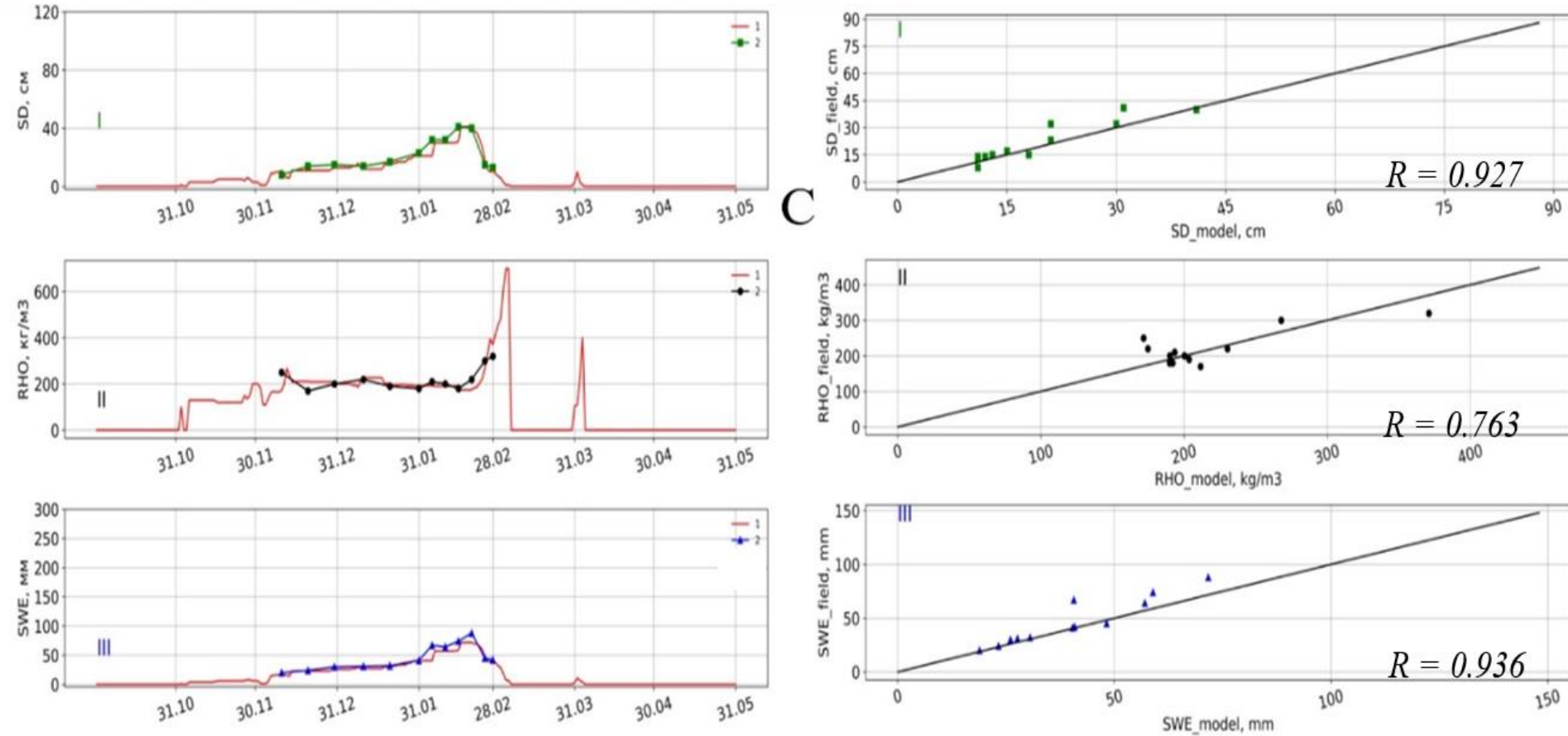
Comparison charts of restored snow values and real snow values: I – height of snow (**SD**); II – snow density (**RHO**); III – snow water equivalent (**SWE**); 1 – SNOWE technology; 2 – in-situ data

Catchment area of the Okka river – the Michurinsk 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

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

Correlation coefficient

<i>Catchment area</i>	<i>GLADAS 1987 – 2010</i>	<i>GLADAS 2000 – 2017</i>	<i>GlobSnow 1987 – 2017</i>	<i>Snowe technology 2011 – 2017</i>
<i>The Don river</i>	0.526	0.712	---	0.632
<i>The Oka river</i>	0.704	0.888	0.080	0.923
<i>The Onega river</i>	0.519	0.812	0.099	0.641
<i>The North Dvina river</i>	0.659	0.824	0.226	0.895
<i>The Nadim river</i>	0.743	0.813	0.088	0.826

Standard deviation

<i>Catchment area</i>	<i>GLADAS 1987 – 2010</i>	<i>GLADAS 2000 – 2017</i>	<i>GlobSnow 1987 – 2017</i>	<i>Snowe technology 2011 – 2017</i>
<i>The Don river</i>	26.6	33.0	---	23.9
<i>The Oka river</i>	29.1	67.6	33.2	23.9
<i>The Onega river</i>	53.9	73.9	58.0	41.5
<i>The North Dvina river</i>	50.1	78.4	53.0	40.0
<i>The Nadim river</i>	56.9	95.7	68.3	60.0

Bias of an estimator

<i>Исследуемый объект: водосбор</i>	<i>GLADAS 1987 – 2010</i>	<i>GLADAS 2000 – 2017</i>	<i>GlobSnow 1987 – 2017</i>	<i>Snowe technology 2011 – 2017</i>
<i>р. Дон</i>	-29.3	5.33	---	-34.0
<i>р. Ока</i>	-10.8	61.4	-46.7	-14.8
<i>р. Онега</i>	-28.3	62.1	-82.9	-28.1
<i>р. Северная Двина</i>	-22.9	63.9	-67.8	-22.6
<i>р. Надым</i>	-41.3	96.2	-102	-7.08

Root-mean-square deviation

<i>Catchment area</i>	<i>GLADAS 1987 – 2010</i>	<i>GLADAS 2000 – 2017</i>	<i>GlobSnow 1987 – 2017</i>	<i>Snowe technology 2011 – 2017</i>
<i>The Don river</i>	37.3	27.5	---	37.8
<i>The Oka river</i>	24.5	81.9	56.7	17.3
<i>The Onega river</i>	58.3	79.0	99.4	43.3
<i>The North Dvina river</i>	46.3	85.7	84.8	28.6
<i>The Nadim river</i>	57.7	115	120	35.6



Conclusions



*Values of SWE which have been calculated are **reliable** and can be useful for hydrological forecasting*

The data of SNOWE technology (fields of SWE values) have been applied in the spring flood time in 2015/16, 2016/17 for the territory of the Russian Federation

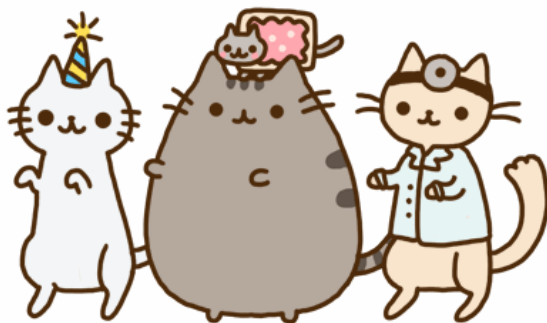
The pre-operational starts of SNOWE in Cosmo-Ru have demonstrated more realistic values of SWE than obtained from DAS system for last winter

Our contacts:

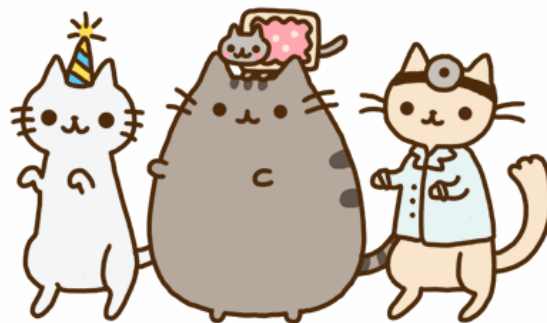
Phone: +79817607640

email: evgenychur@gmail.com

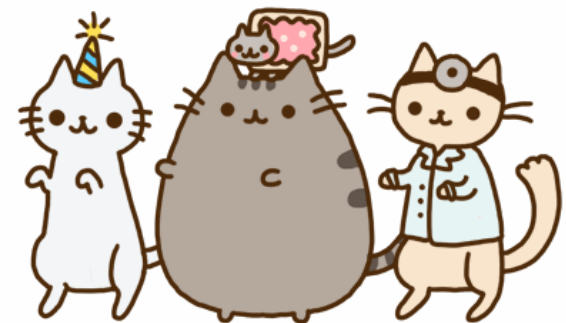
Best regards, Churiulin E.V



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