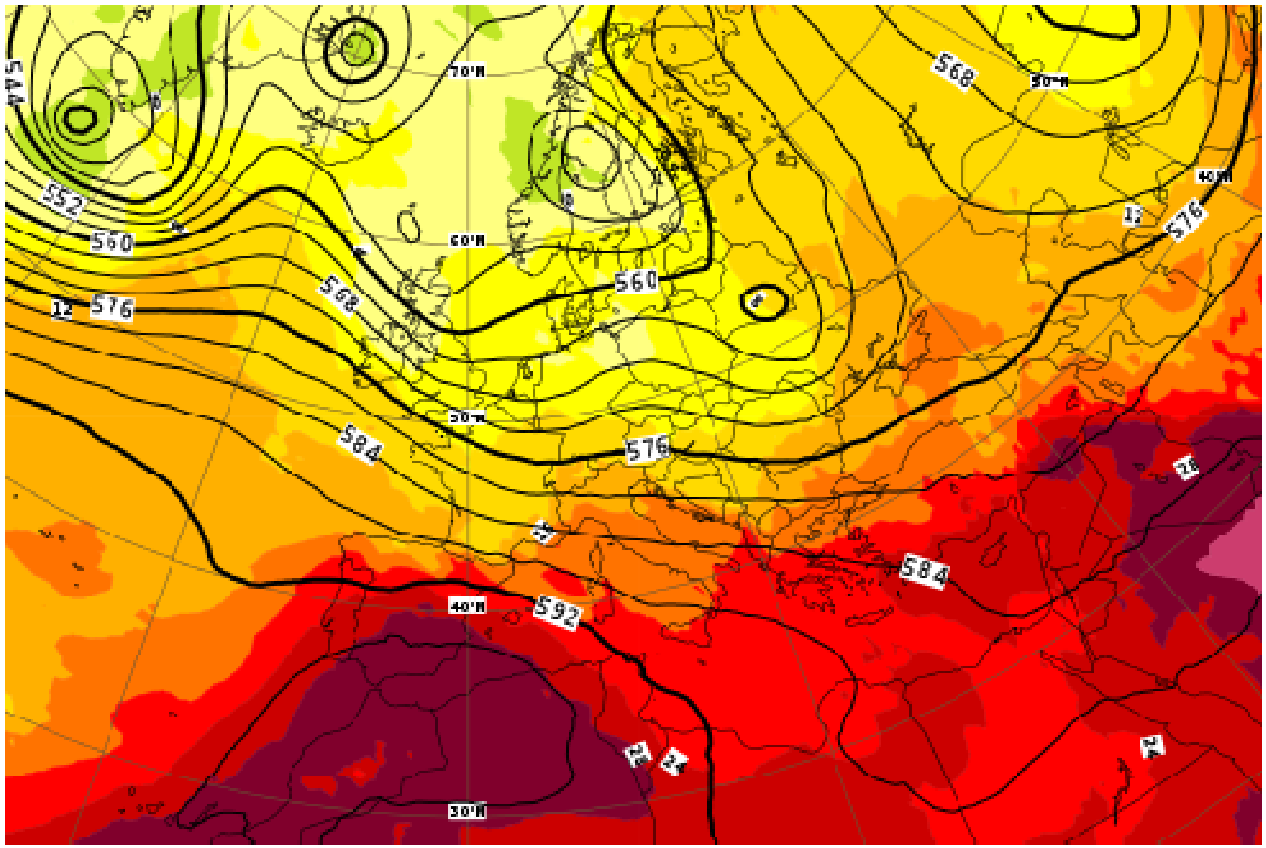
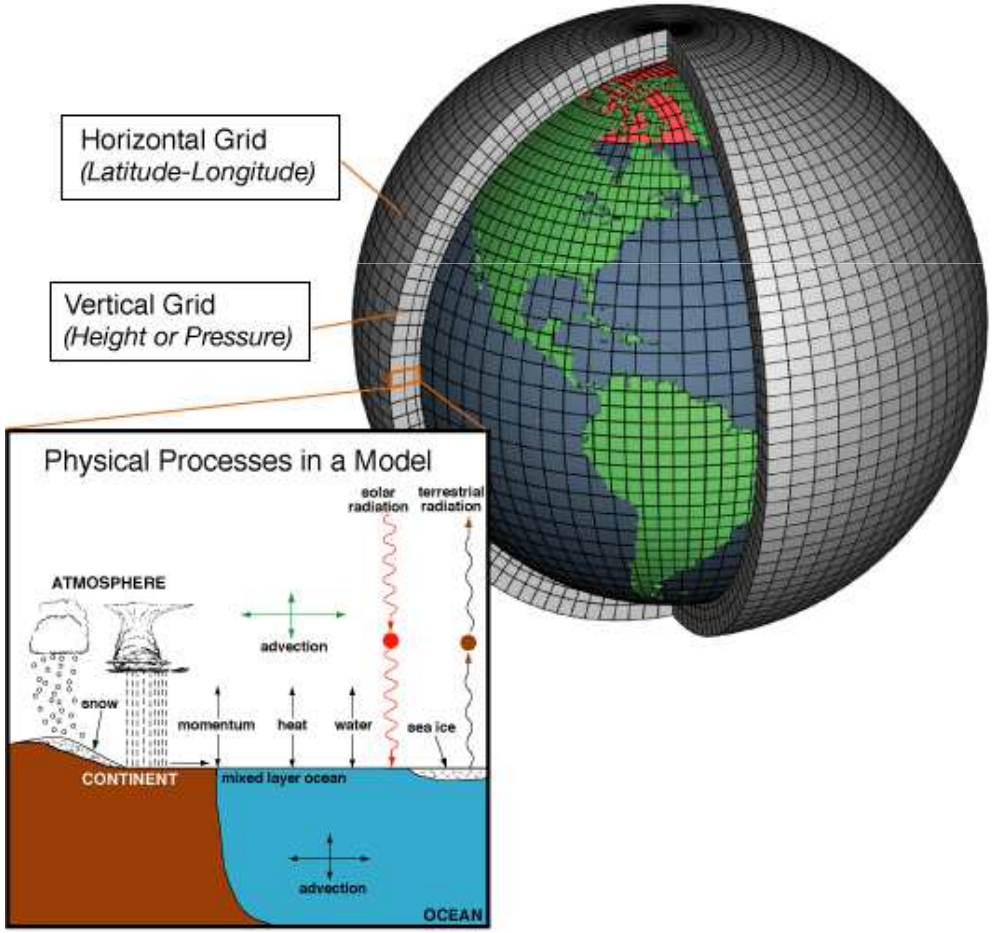
Numerical weather prediction

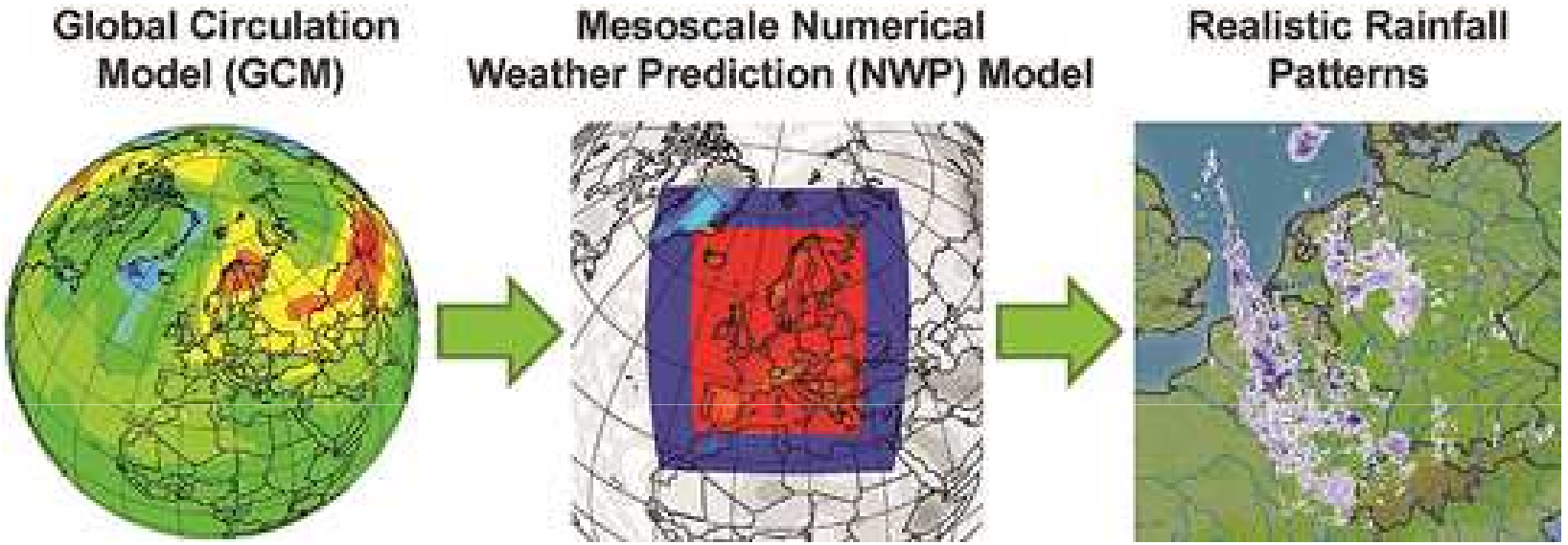


ww.ecmwf.int

The basic concept of Numerical Weather Prediction (NWP) is to divide atmosphere into grid boxes and solving equations in one point which represents the volume of a grid box.



https://en.wikipedia.org/wiki/Numerical_weather_prediction



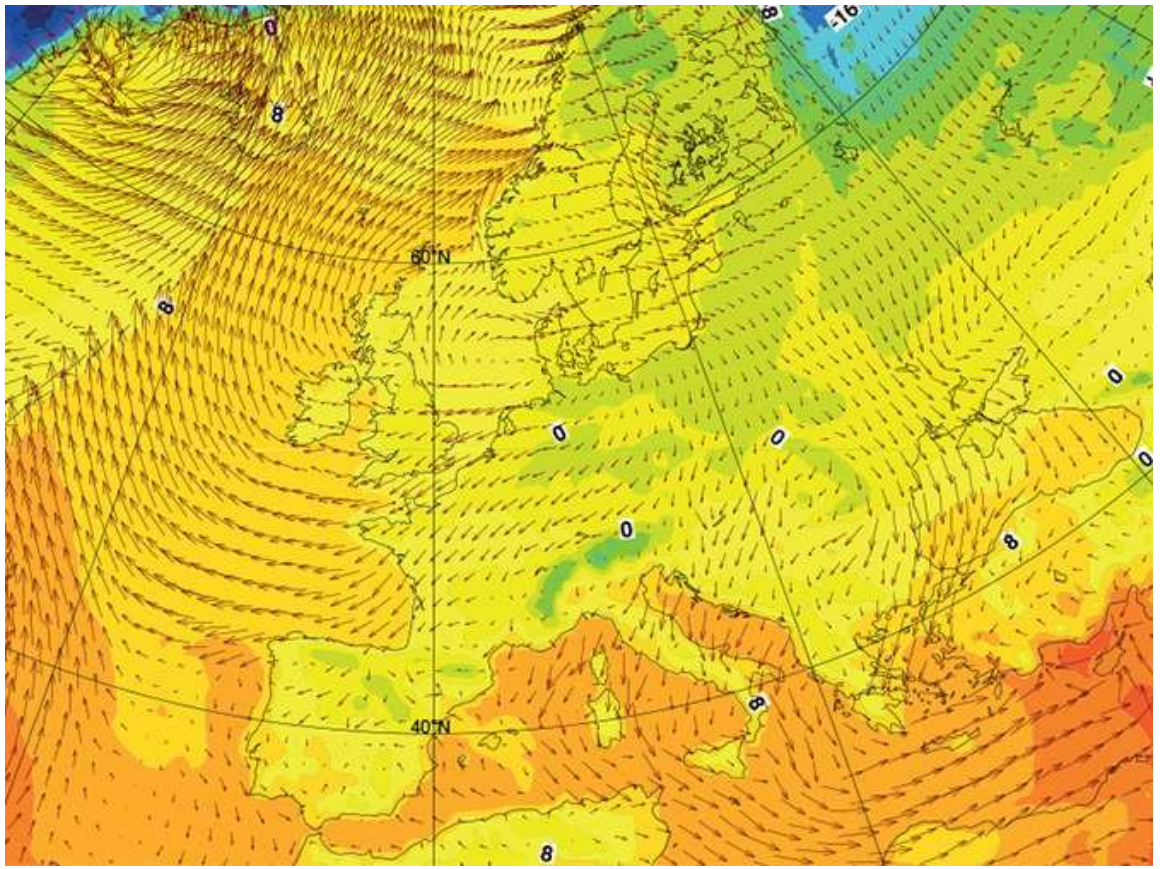
Model domains – from global to regional, horizontal resolution from 100km to 1km.

For running regional model we have to provide Initial and Lateral Boundary Conditions from global model (IC LBC) and put through preprocessing.

Initial and Lateral Boundary Conditions

The European Centre for Medium-Range Weather Forecasts (ECMWF)

Advancing global NWP through international collaboration



https://www.ecmwf.int/

Initial and Lateral Boundary Conditions

European Centre for Medium Range Weather Forecast **ECMWF**

Integrated Forecast System **IFS**

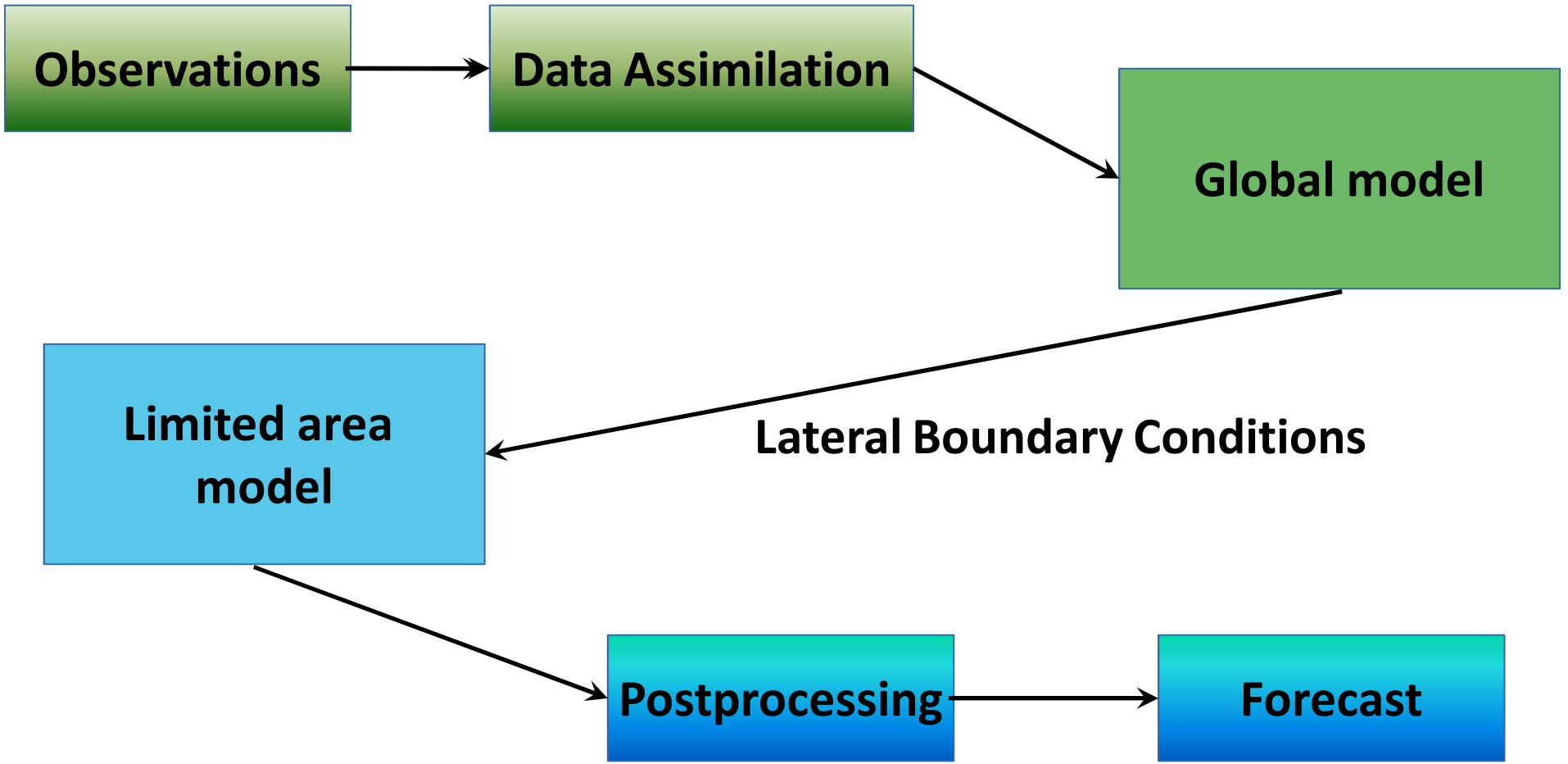
http://www.ecmwf.int

National Centers for Environmental Prediction **NCEP**

Global Forecast System **GFS**

http://nomads.ncdc.noaa.gov/

Limited Area model - workflow

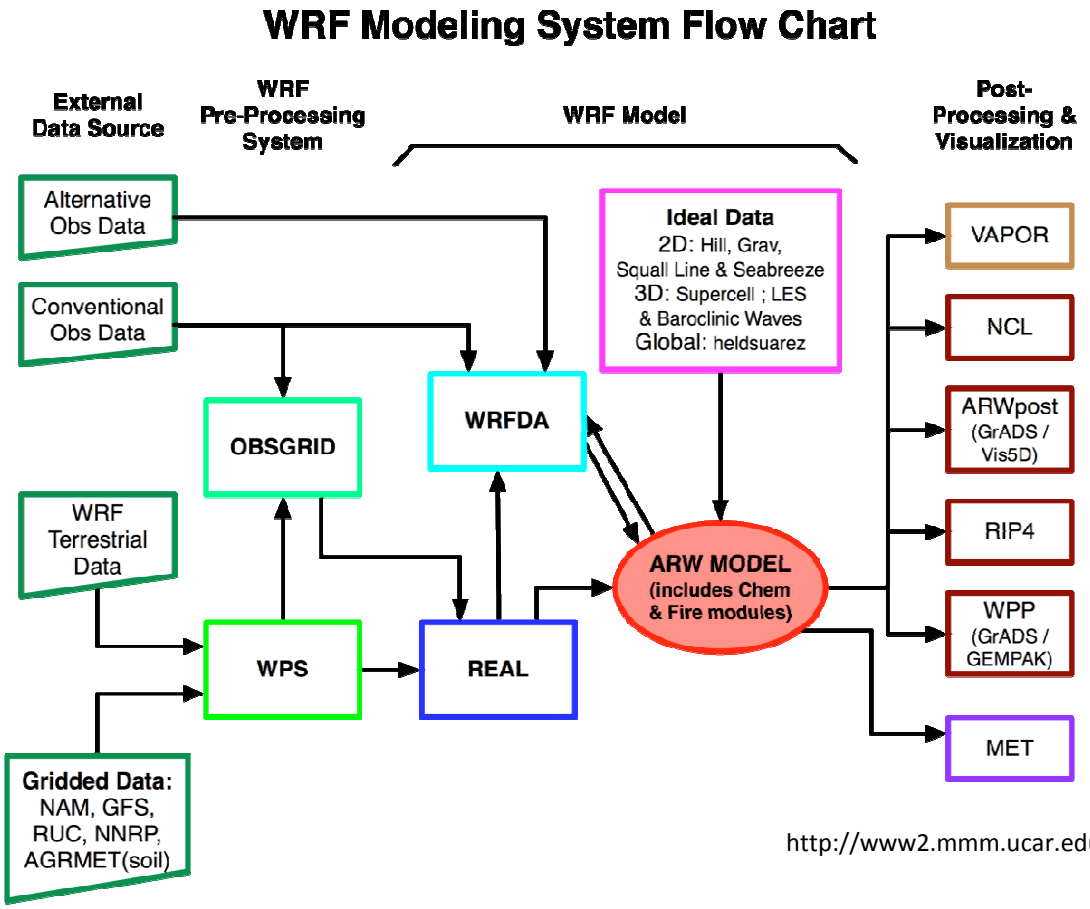


WRF modeling system

Two dynamics solvers

ARW **A**dvanced **R**esearch **W**RF developed in NCAR

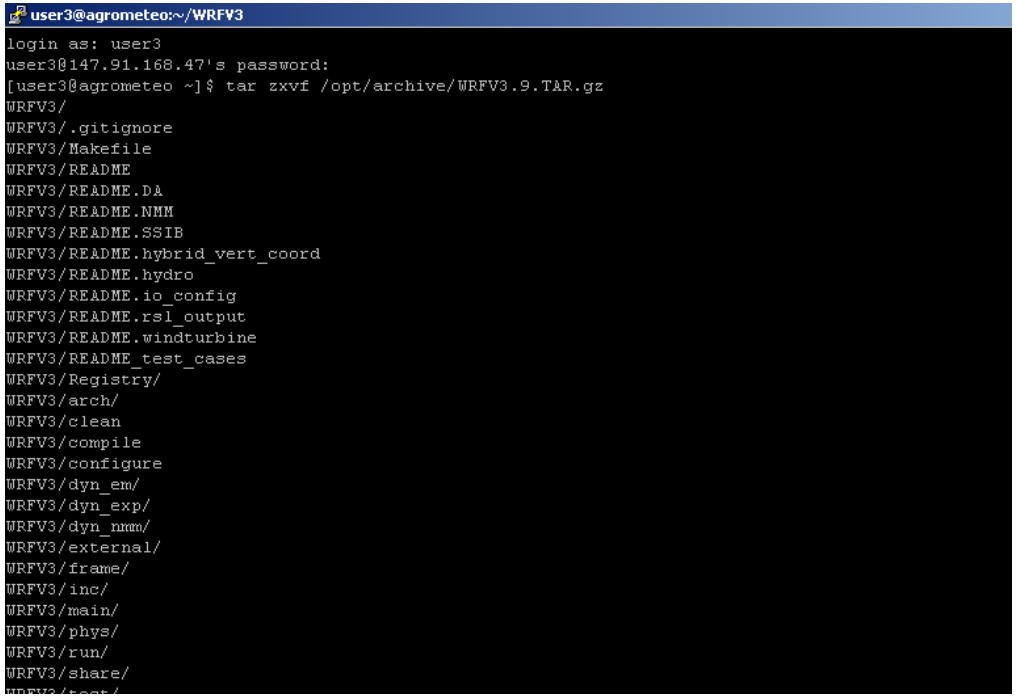
NMM **N**onhydrostatic **M**esoscale **M**odel developed in NCEP



http://www2.mmm.ucar.edu/wrf/users/model.html

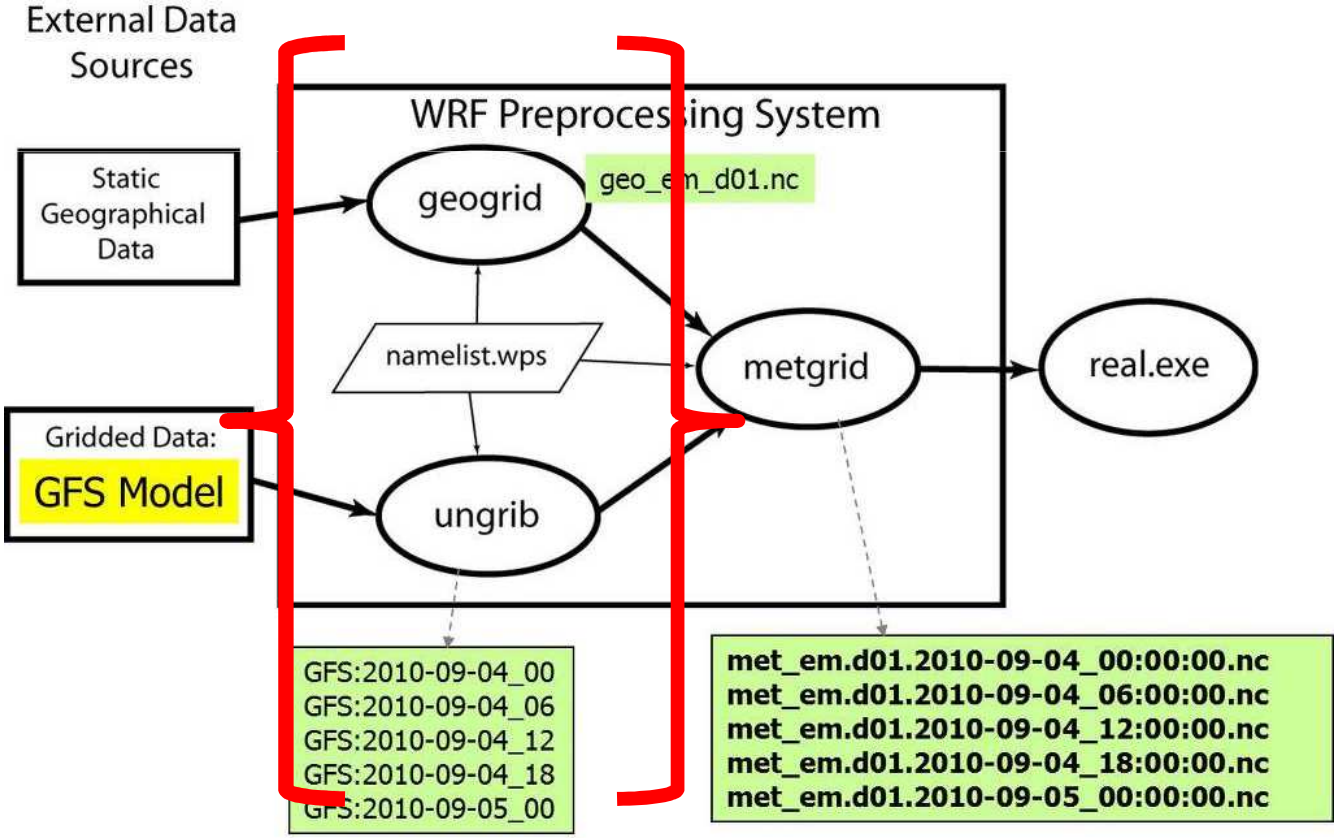
WRF ARW installation

- Virtual machine agrometeo.arm.uns.ac.rs Linux CentOS 6.9 is available for participants
- GEOG data - download geographical input data (static data)
- Preprocessing installation
  - geogrid.exe
  - ungrid.exe
  - metgrid.exe



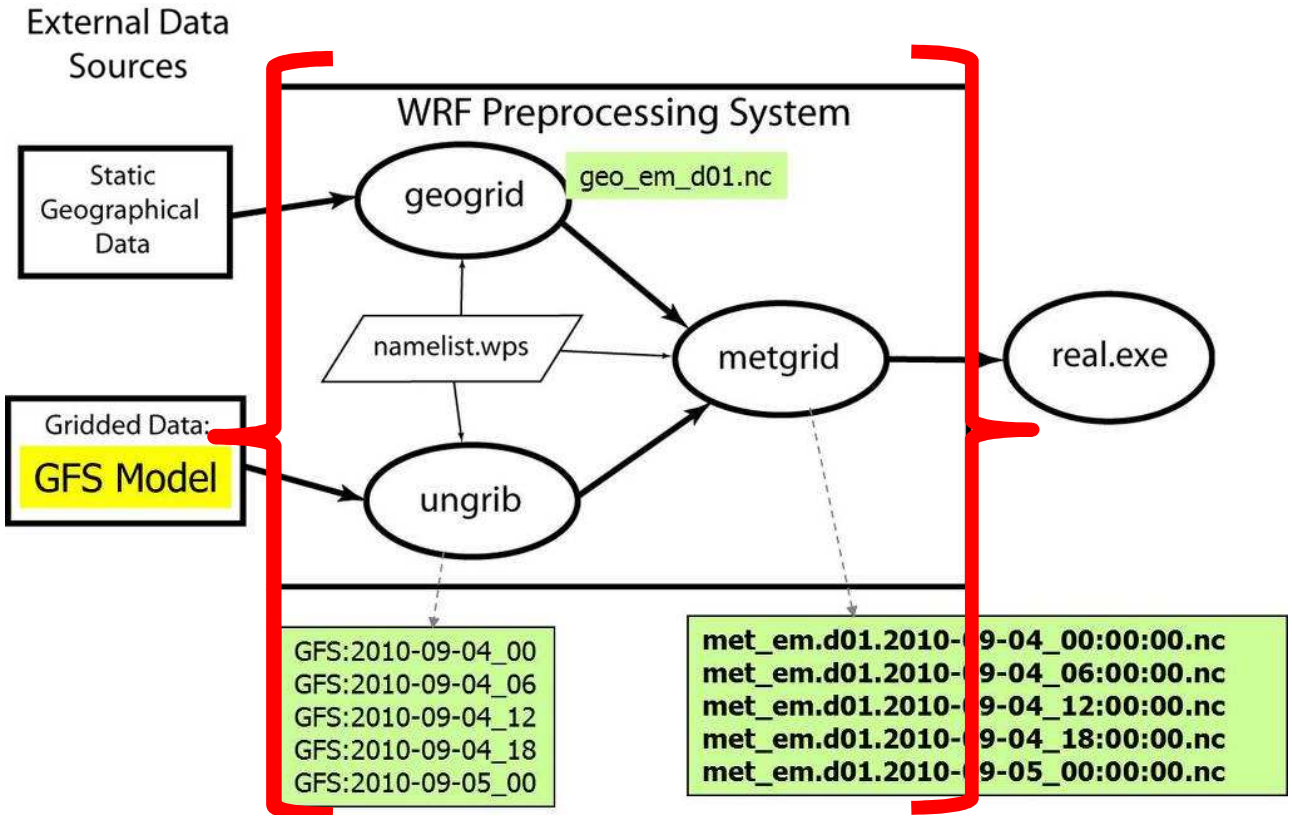
Preprocessing

- set of programs for preparing static data like orography, vegetation, soil types... (geogrid.exe in WRF)
- interpolation from coarse grid of global model data to finer resolution of regional model (ungrib.exe in WRF)



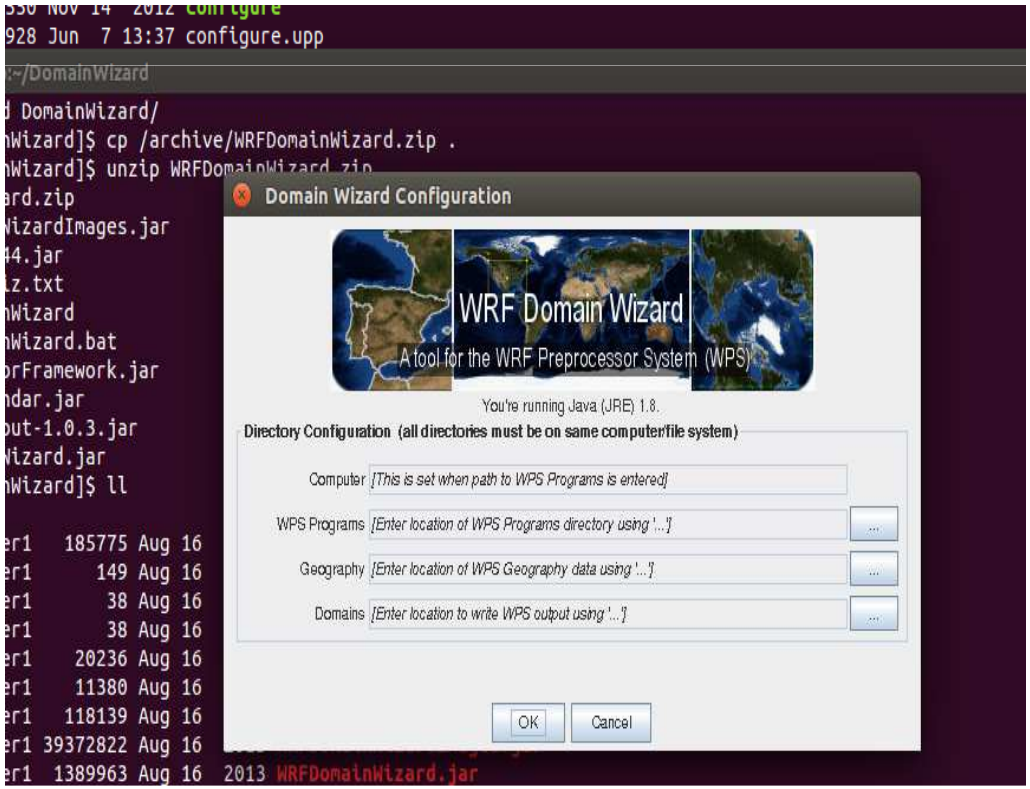
Preprocessing

- set of programs for preparing static data like orography, vegetation, soil types... (geogrid.exe in WRF)
- interpolation from coarse grid of global model data to finer resolution of regional model (ungrib.exe in WRF)
- horizontal interpolation of meteorological fields (from ungrib) to domain grid (defined by geogrid) (metgrid.exe in WRF)

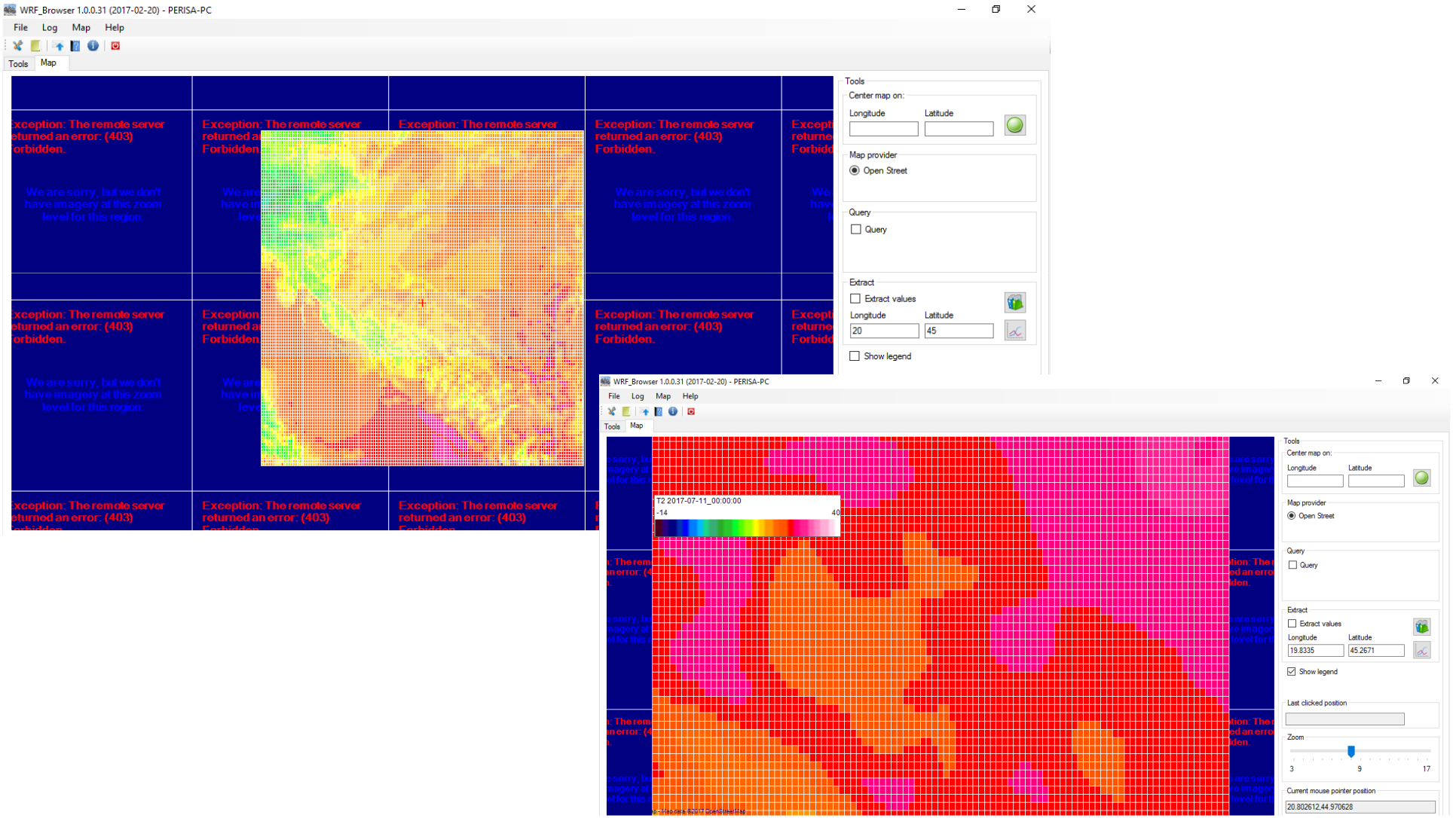


WRF Domain Wizard

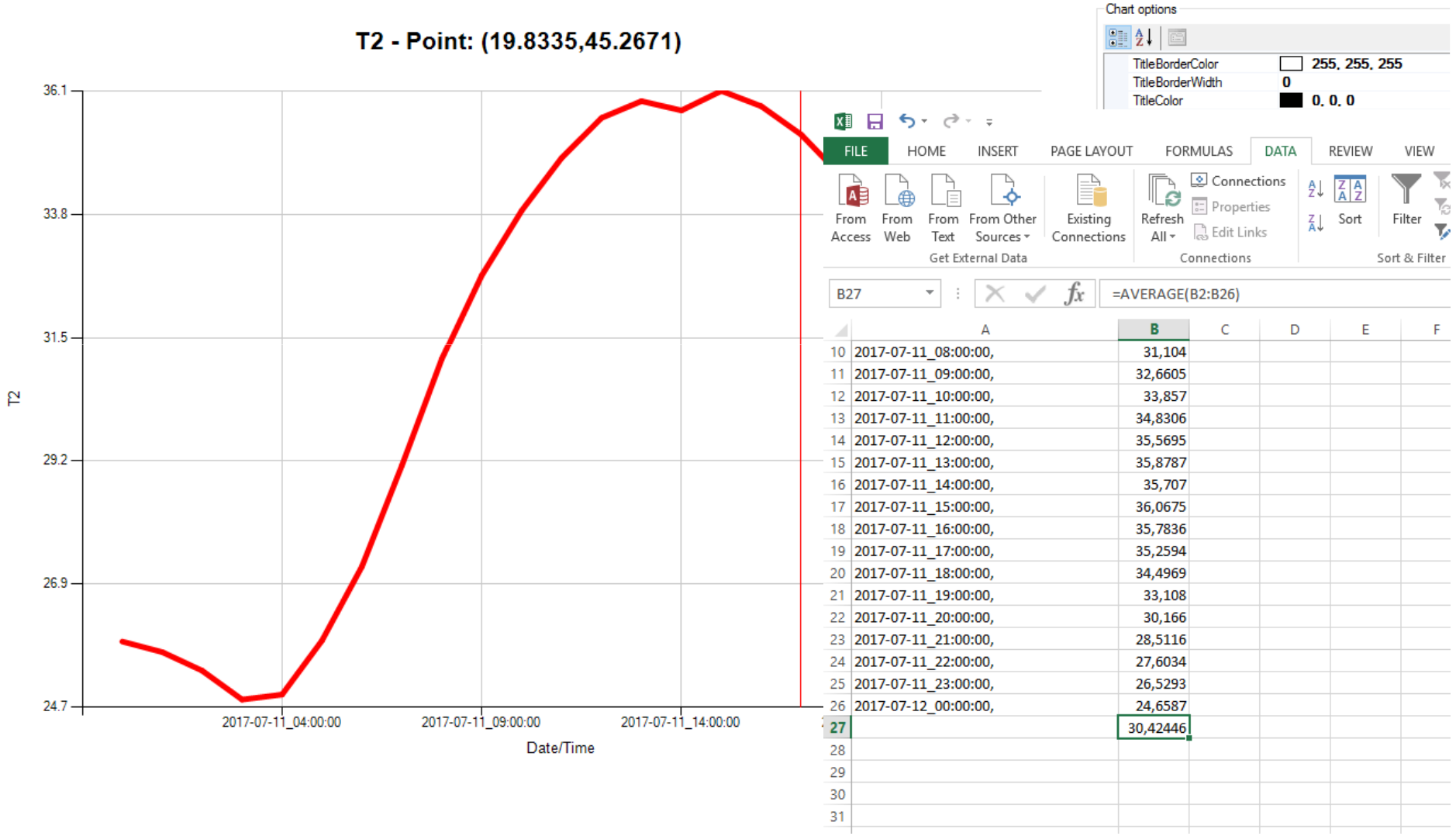
- is a graphical user interface for the WRF Preprocessing System (WPS)
- enables users to easily define and localize domains (cases) by selecting a region of the Earth and choosing a map projection



After model finished, NetCDF –C and WRF Browser are installed on Windows



We were running 24 hours WRF model with ECMWF BC start 11.07.2017 00:00



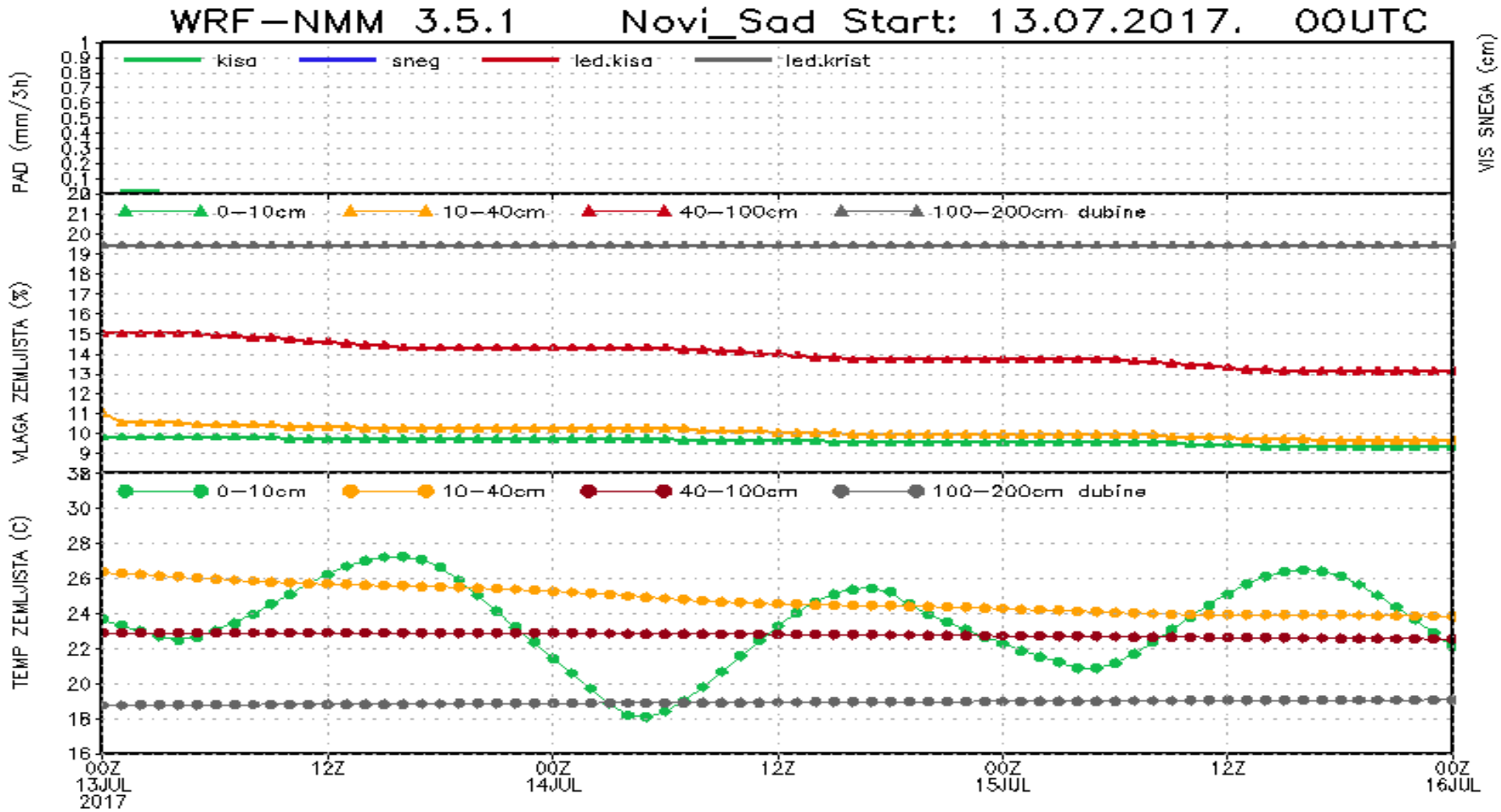
	A	B
10	2017-07-11_08:00:00,	31,104
11	2017-07-11_09:00:00,	32,6605
12	2017-07-11_10:00:00,	33,857
13	2017-07-11_11:00:00,	34,8306
14	2017-07-11_12:00:00,	35,5695
15	2017-07-11_13:00:00,	35,8787
16	2017-07-11_14:00:00,	35,707
17	2017-07-11_15:00:00,	36,0675
18	2017-07-11_16:00:00,	35,7836
19	2017-07-11_17:00:00,	35,2594
20	2017-07-11_18:00:00,	34,4969
21	2017-07-11_19:00:00,	33,108
22	2017-07-11_20:00:00,	30,166
23	2017-07-11_21:00:00,	28,5116
24	2017-07-11_22:00:00,	27,6034
25	2017-07-11_23:00:00,	26,5293
26	2017-07-12_00:00:00,	24,6587
27		30,42446
28		
29		
30		
31		

ECMWF Forecast resolution of 9 km

ECMWF FORECAST - NOVI SAD

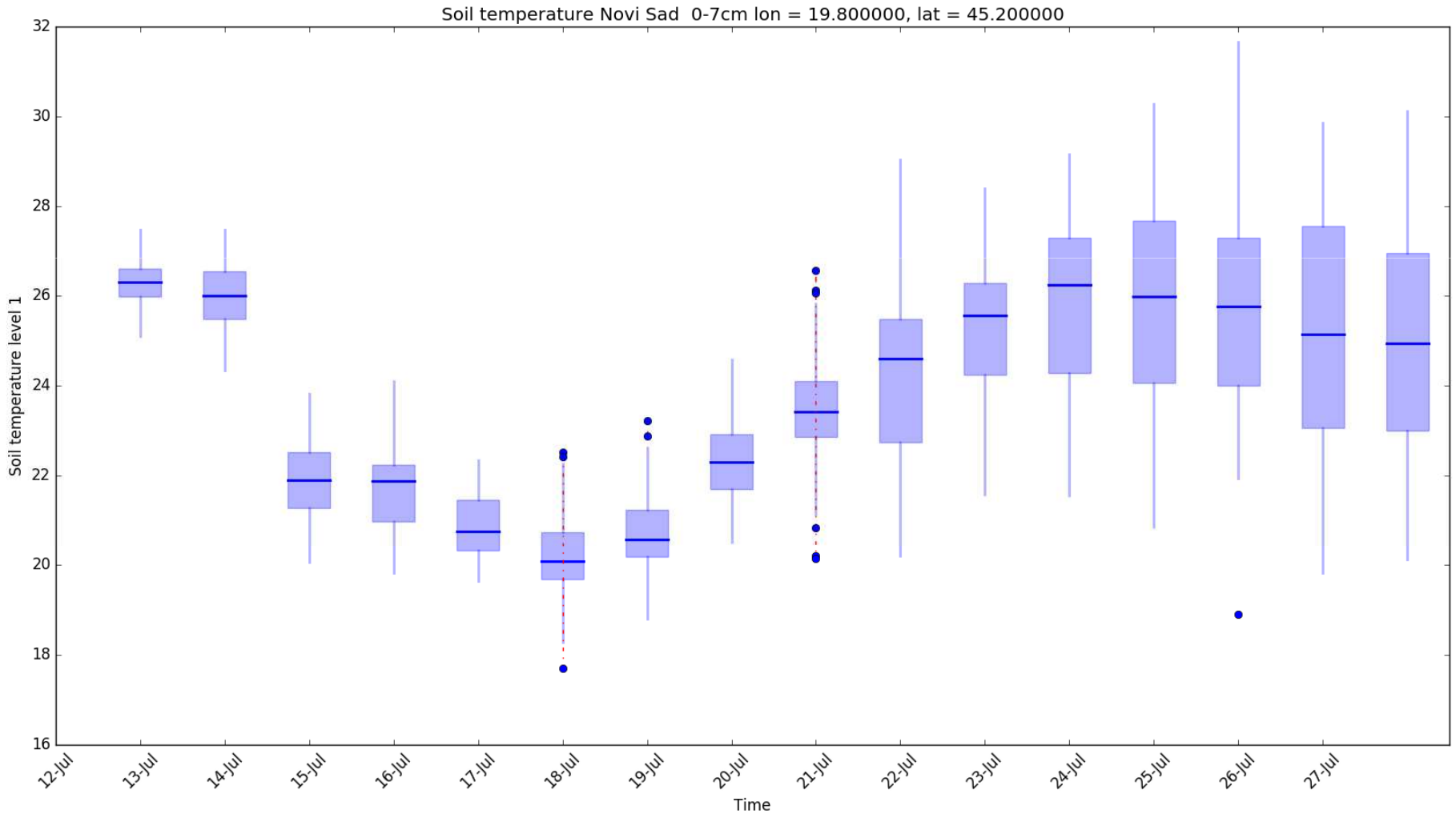
START 12.07.2017. 00UTC

DAT	MIN(oC)	MAX(oC)	AVG(oC)	W(m/s)	P(mm)
12.07.2017.	22	31	26.6	2	0
13.07.2017.	17	29	22.9	3	3
14.07.2017.	15	28	22.3	2	-
15.07.2017.	17	28	22.5	3	0
16.07.2017.	16	25	21.2	4	-
17.07.2017.	15	29	23.4	2	-
18.07.2017.	17	31	25.1	2	-
19.07.2017.	19	33	26.5	2	1
20.07.2017.	21	33	27.4	2	-
21.07.2017.	21	33	28.2	3	-


WRF—NMM 3.5.1 Novi_Sad Start: 13.07.2017. 00UTC
PAD (mm/3h)
kisa
sneg
led.kisa
led.krist
VIS SNEGA (cm)
VLAGA ZEMLJISTA (%)
0—10cm
10—40cm
40—100cm
100—200cm dubine
TEMP ZEMLJISTA (C)
0—10cm
10—40cm
40—100cm
100—200cm dubine
00Z 13JUL 2017
12Z
00Z 14JUL
12Z
00Z 15JUL
12Z
00Z 16JUL

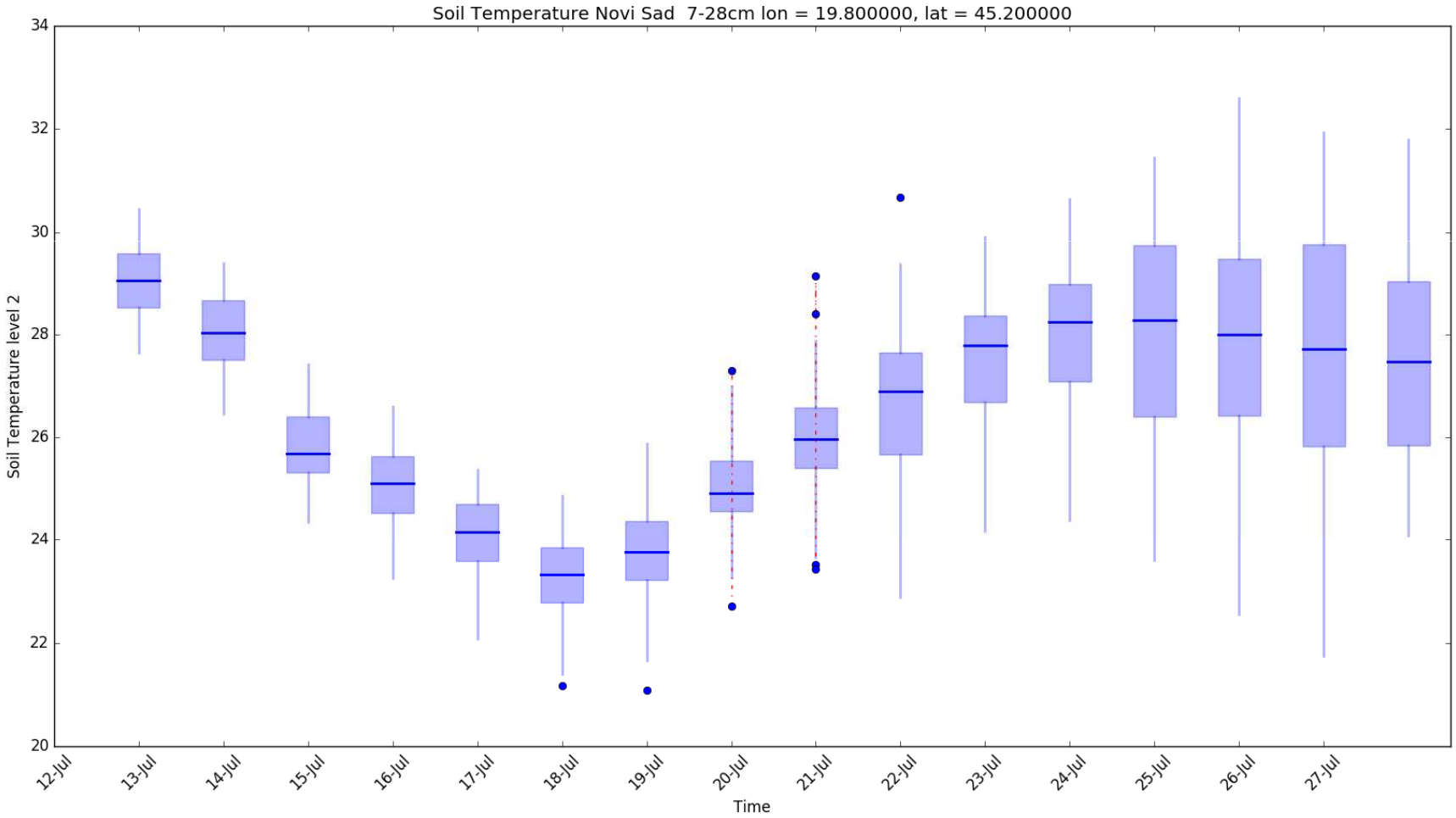
ECMWF ENS Forecast resolution of 18 km

Soil Temperature Novi Sad 0-7 cm



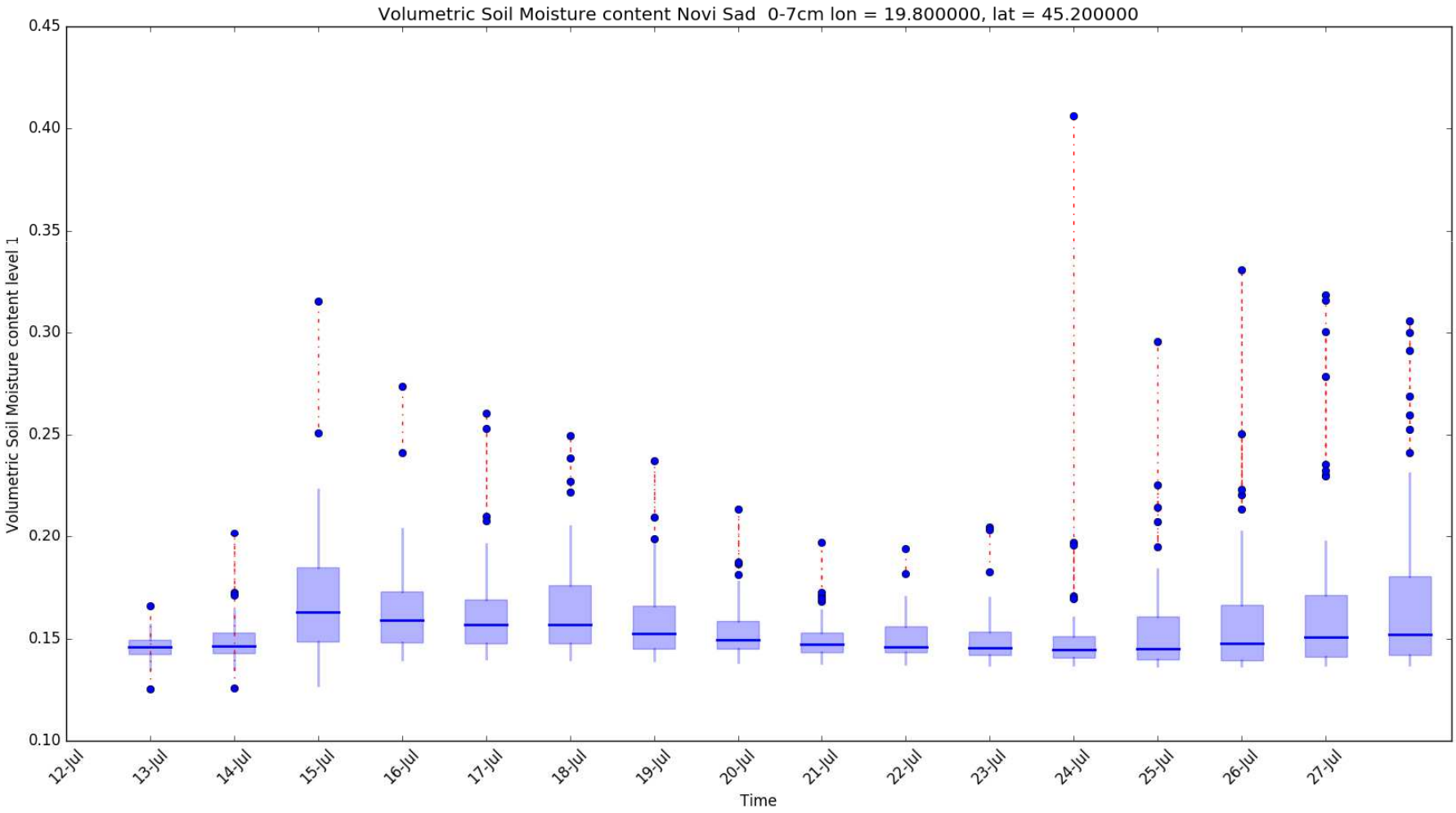
ECMWF ENS Forecast resolution of 18 km

Soil Temperature Novi Sad 7-28 cm



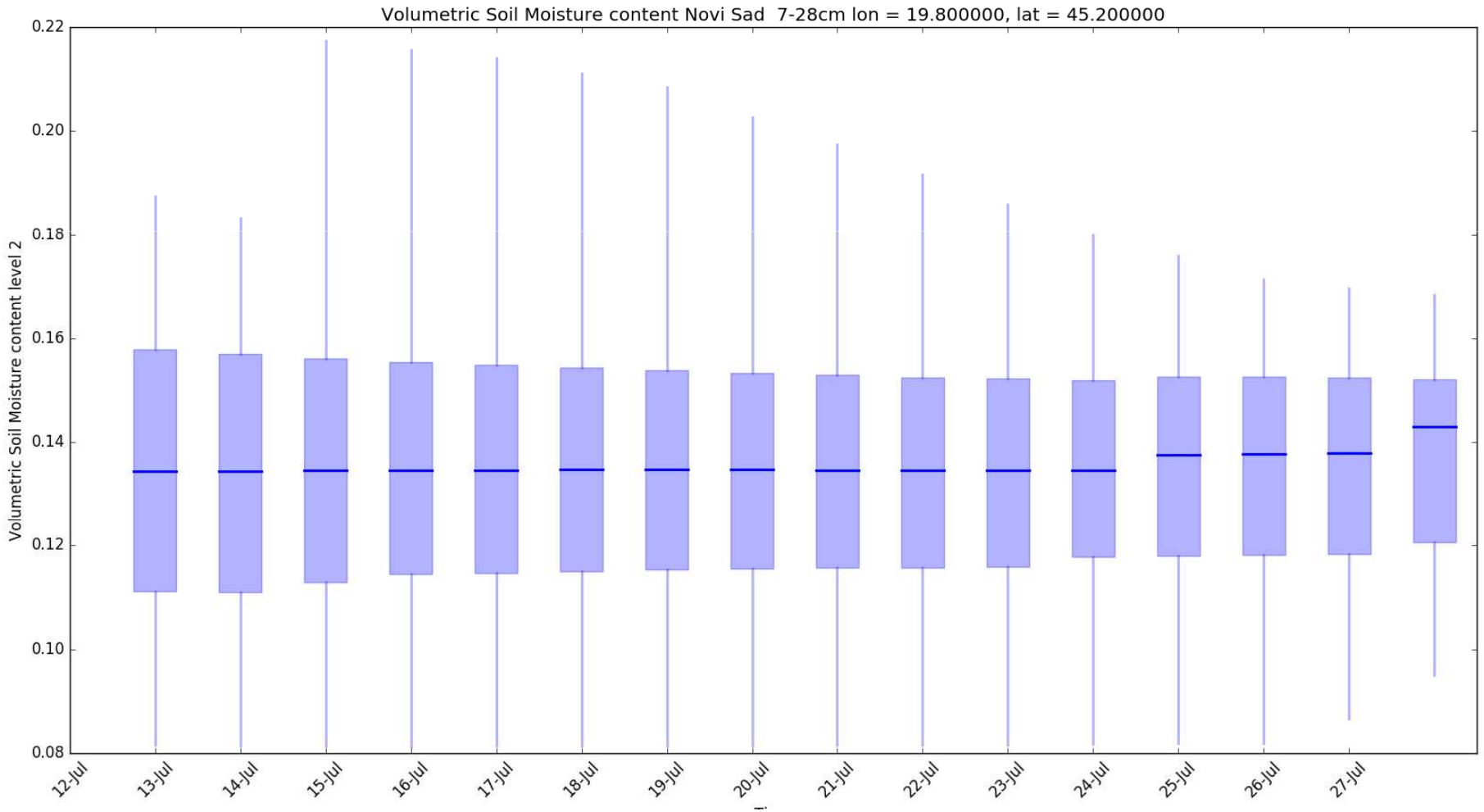
ECMWF ENS Forecast resolution of 18 km

Volumetric Soil Moisture content Novi Sad 0-7 cm



ECMWF ENS Forecast resolution of 18 km

Volumetric Soil Moisture content Novi Sad 7-28 cm

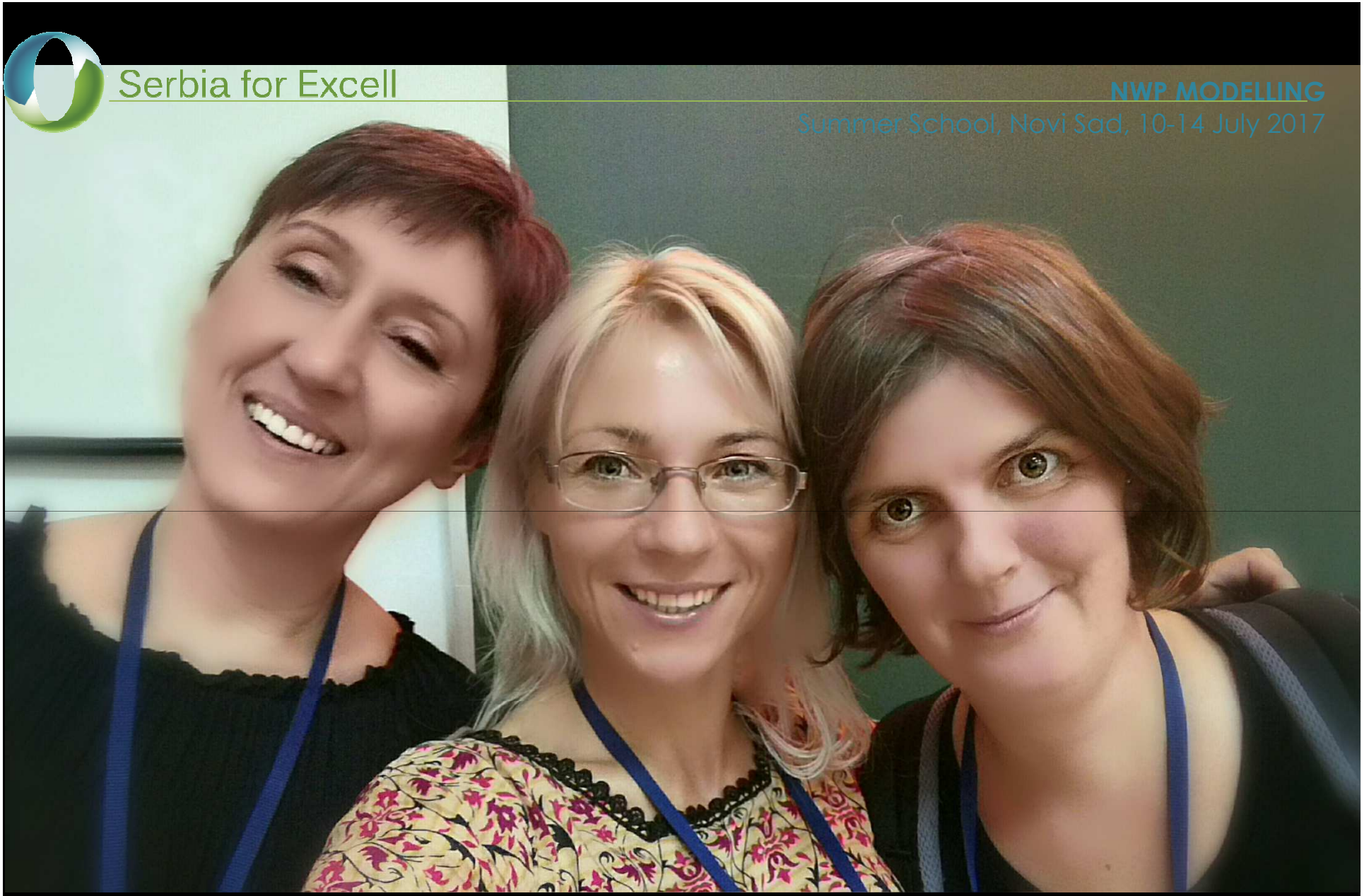


Collection and comparing of observed and predicted data.

How can be shared this information with interested persons?

Which information would be interesting for farmers ?

soil moisture
temperature
wind
precipitation



Thank you very much for your attention!