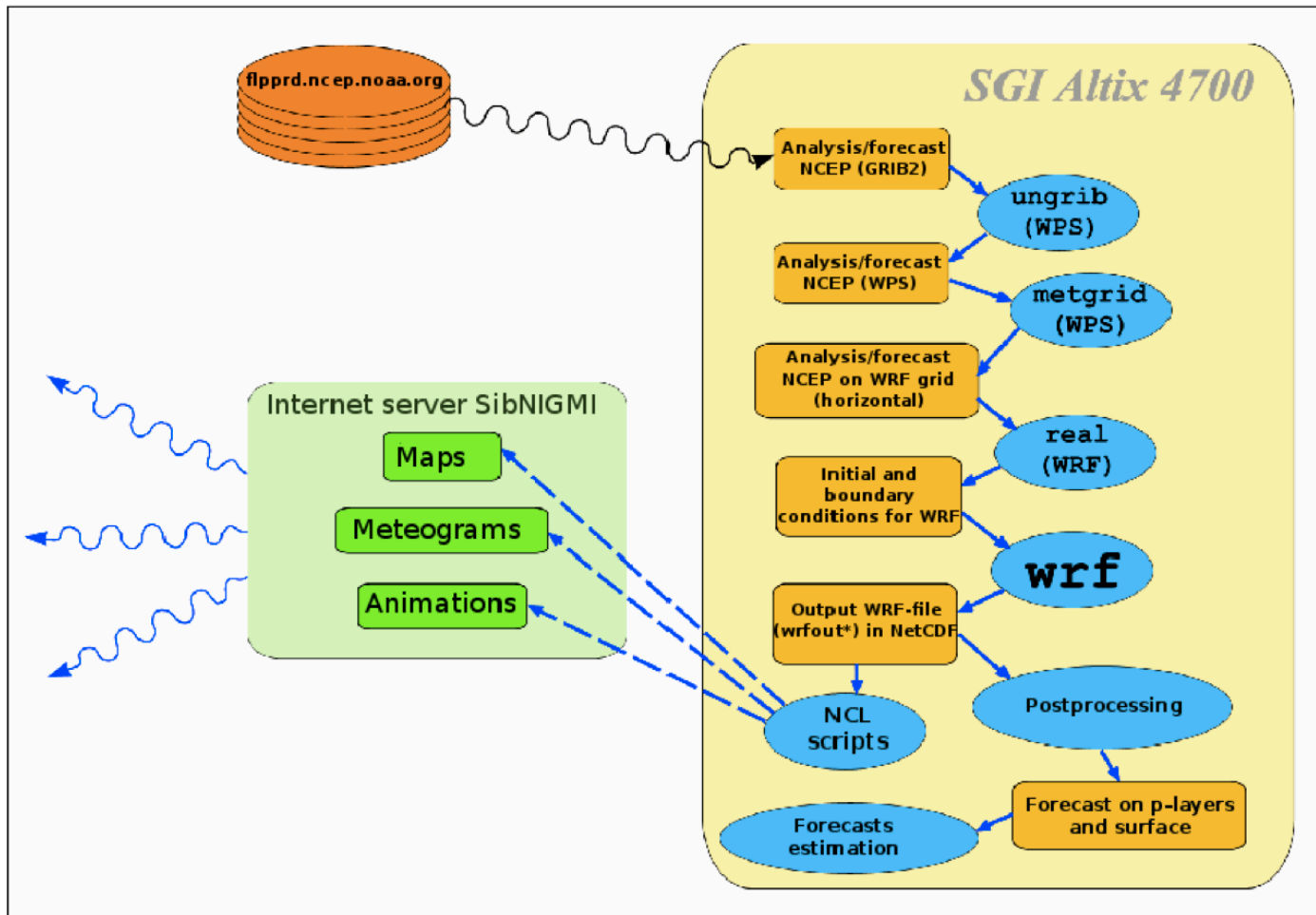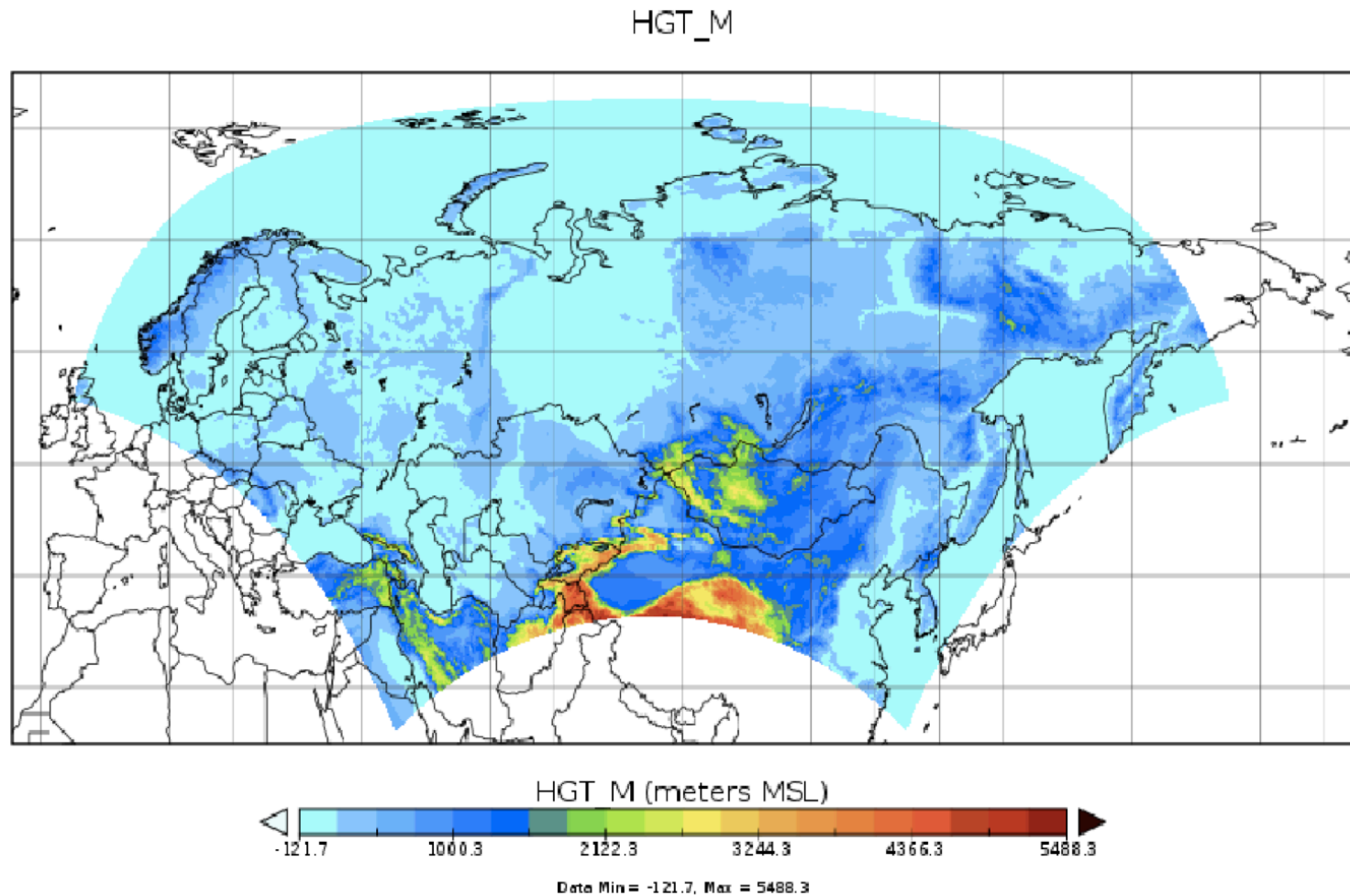# Sensitivity of WRF ARW forecasts to a choice of land use maps

Yu. V. Martynova, R.B. Zaripov, V.N. Krupchatnikov

Introduction
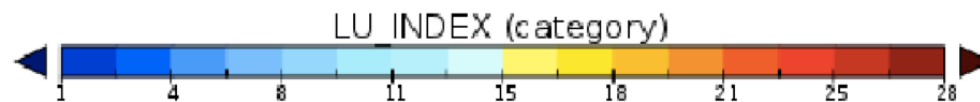
Domain

HGT_M
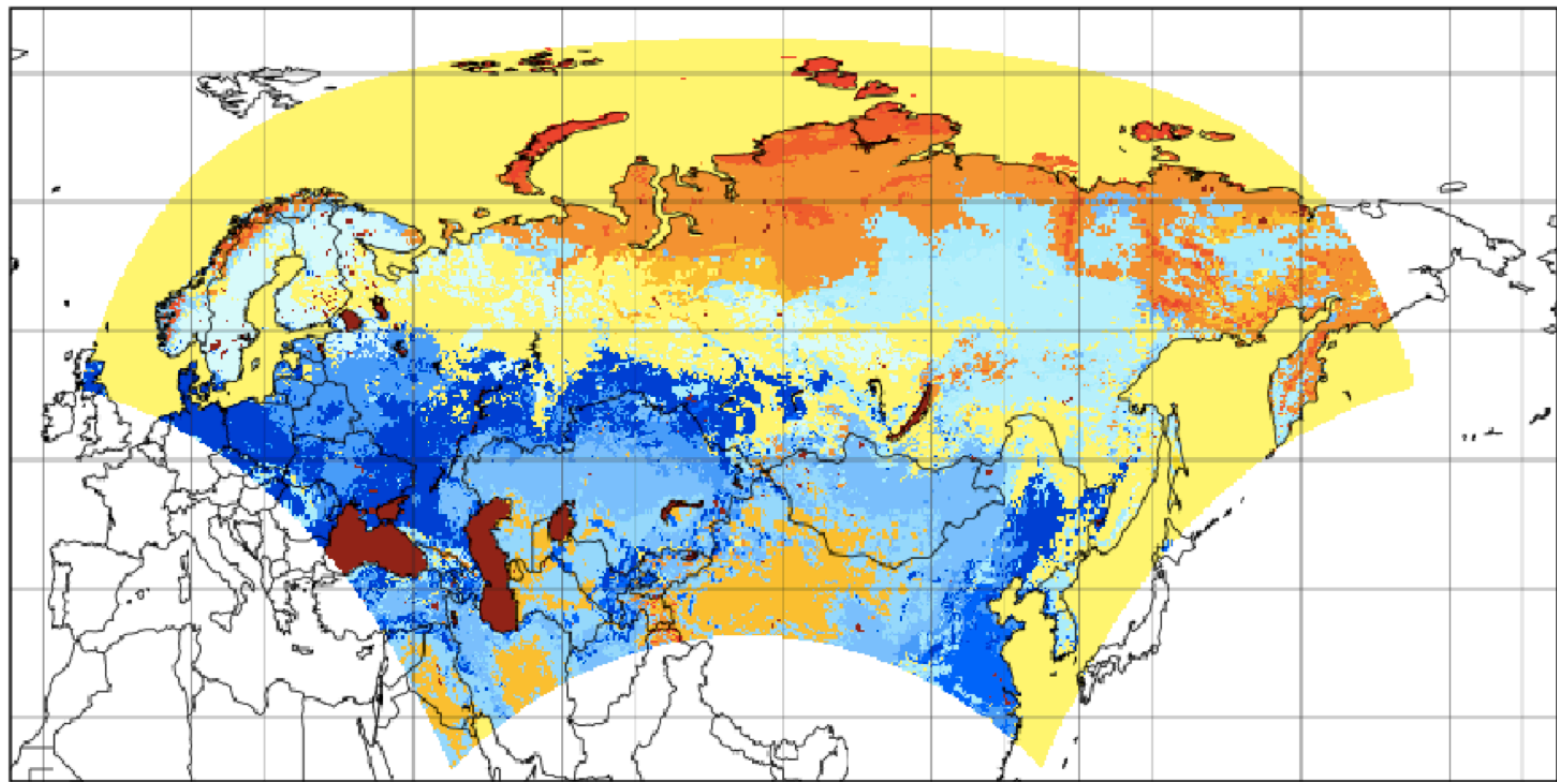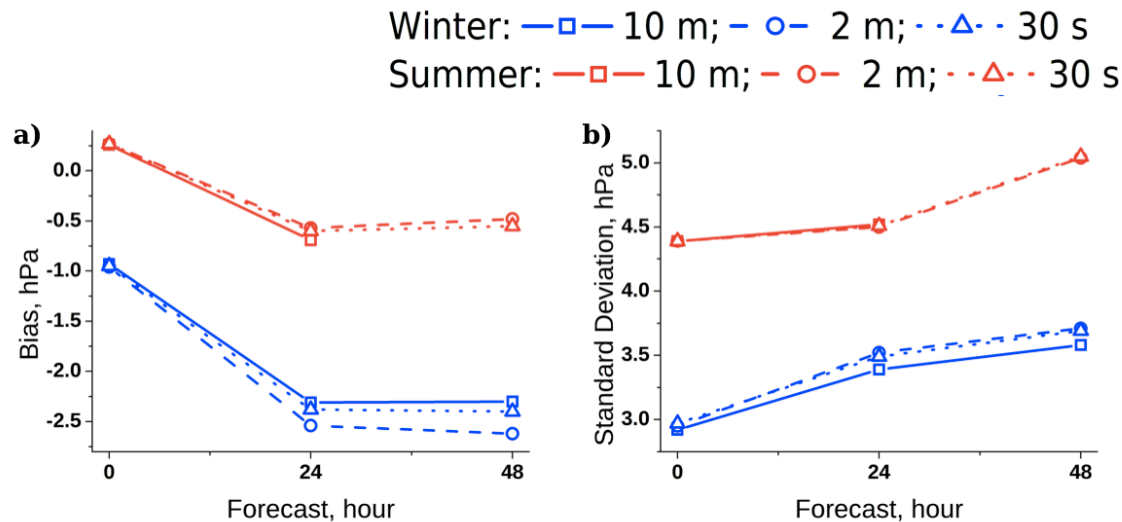
HGT M (meters MSL)

Domain

LANDUSE: DOMINANT CATEGORY

LU_INDEX (category)

Results

Winter: —□— 10 m; – o – 2 m; ··△·· 30 s
Summer: —□— 10 m; – o – 2 m; ··△·· 30 s

Figure 4. Quality of the sea level pressure forecast value:
a) bias,
b) standard deviation.

Figure 5. Quality of the air temperature at 2 m forecast value:
a) bias,
b) standard deviation.

Sensitivity of WRF ARW forecasts to choice of land use maps

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Abstract

Currently, automated calculation of numerical weather forecasts for the Western Siberia up to 48 hours using WRF ARW model is organized in Siberian Regional Hydrometeorological Research Institute (http://sibnigmi.ru). Model developers provided some set of options for model configuration for some region. In particular there is a choice of land use map. A typical set of land use maps provided by the model developers and is available for download on the site of model (http://www.mmm.ucar.edu/wrf/users/), includes U.S. Geological Survey (USGS) land use maps with horizontal resolution 30'', 10 m, 5 m, 2 m and land use maps from Moderate Resolution Imaging Spectroradiometer (MODIS) with horizontal resolution 30''. Both USGS and MODIS land use maps with resolution 30'' are presented in two kinds: with a category "Lake" and without it.

Western Siberia is spacious region which represented by different surface types. Resolution of maps used can have significant impact on the forecasts quality. At the same time, territory of Western Siberia is fairly homogeneous that can except necessity of high resolution map using. The purpose of our work is determining for Western Siberia dependency between forecasts quality and resolution of the land use map.

SibNIGMI forecast system (http://sibnigmi.ru)
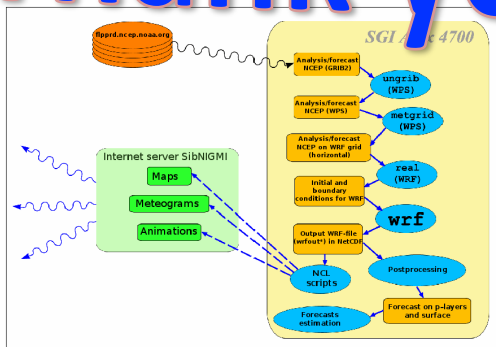
Figure 1. Scheme of SibNIGMI forecast system

The best parametrization set:

Microphysics – Thompson scheme (every time step)
Convection - (every 5 minutes)
Shortwave radiation – Dudhia scheme (every 10 minutes)
Longwave radiation – rrtm scheme (every 10 minutes)
Boundary layer – YSU scheme
Surface layer – Monin-Obukhov scheme
Soil – Noah landsurface model
Dumping of vertical movement in upper 7 layers at the time step
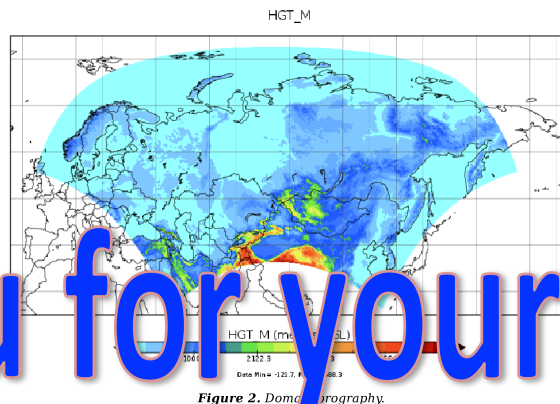
Domain

Figure 2. Domain orography.
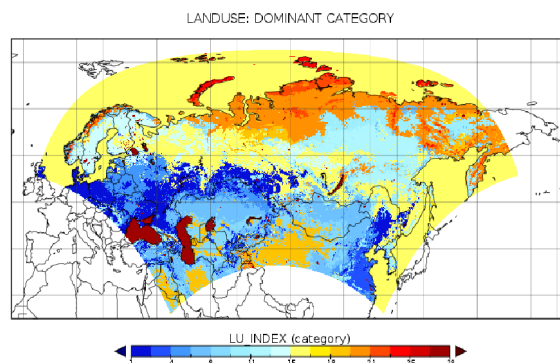
Figure 3. Land use map, dominant USGS category: 1 - Urban and Built-up Land; 2 - Dryland Cropland and Pasture; 3 - Irrigated Cropland and Pasture; 4 - Mixed Dryland/Irrigated Cropland and Pasture; 5 - Cropland/Grassland Mosaic; 6 - Cropland/Woodland Mosaic; 7 - Grassland; 8 - Shrubland; 9 - Mixed Shrubland/Grassland; 10 - Savanna; 11 - Deciduous Broadleaf Forest; 12 - Deciduous Needleleaf Forest; 13 - Evergreen Broadleaf; 14 - Evergreen Needleleaf; 15 - Mixed Forest; 16 - Water Bodies; 17 - Herbaceous Wetland; 18 - Wooden Wetland; 19 - Barren or Sparsely Vegetated; 20 - Herbaceous Tundra; 21 - Wooded Tundra; 22 - Mixed Tundra; 23 - Bare Ground Tundra; 24 - Snow or Ice

Results

Land use map's resolution: 10 m, 2 m, 30 s.
Parameters:
air temperatute at 2 m, sea level pressure, u-, v-wind at 10 m.
Statistical estimation: bias, standard deviation.

Winter: — 10 m; — 2 m; ···△··· 30 s
Summer: — 10 m; — 2 m; ···△··· 30 s
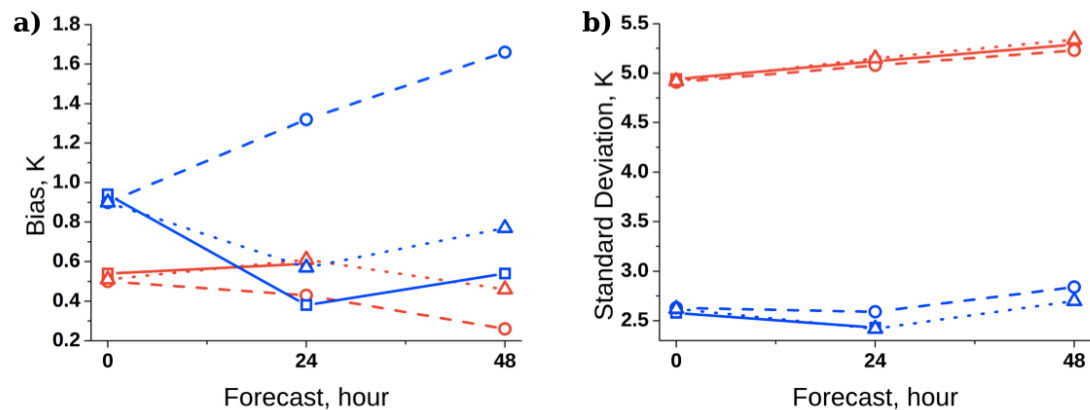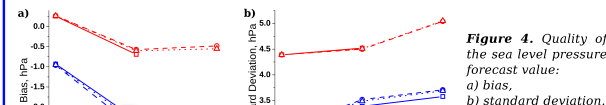

Figure 4. Quality of the sea level pressure forecast value:
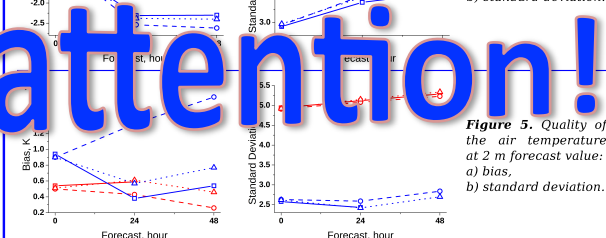a) bias,
b) standard deviation.

Figure 5. Quality of the air temperature at 2 m forecast value:
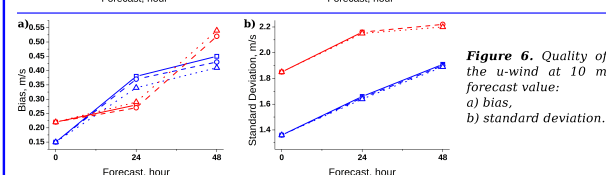a) bias,
b) standard deviation.

Figure 6. Quality of the u-wind at 10 m forecast value:
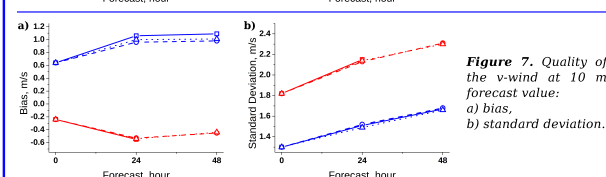a) bias,
b) standard deviation.

Figure 7. Quality of the v-wind at 10 m forecast value:
a) bias,
b) standard deviation.

Conclusion

Resolution of land use maps has a small effect on the quality of the WRF ARW forecasts.