

# Impact of climate fluctuations on Subpolar regions of European Russia: Results from international collaborative research

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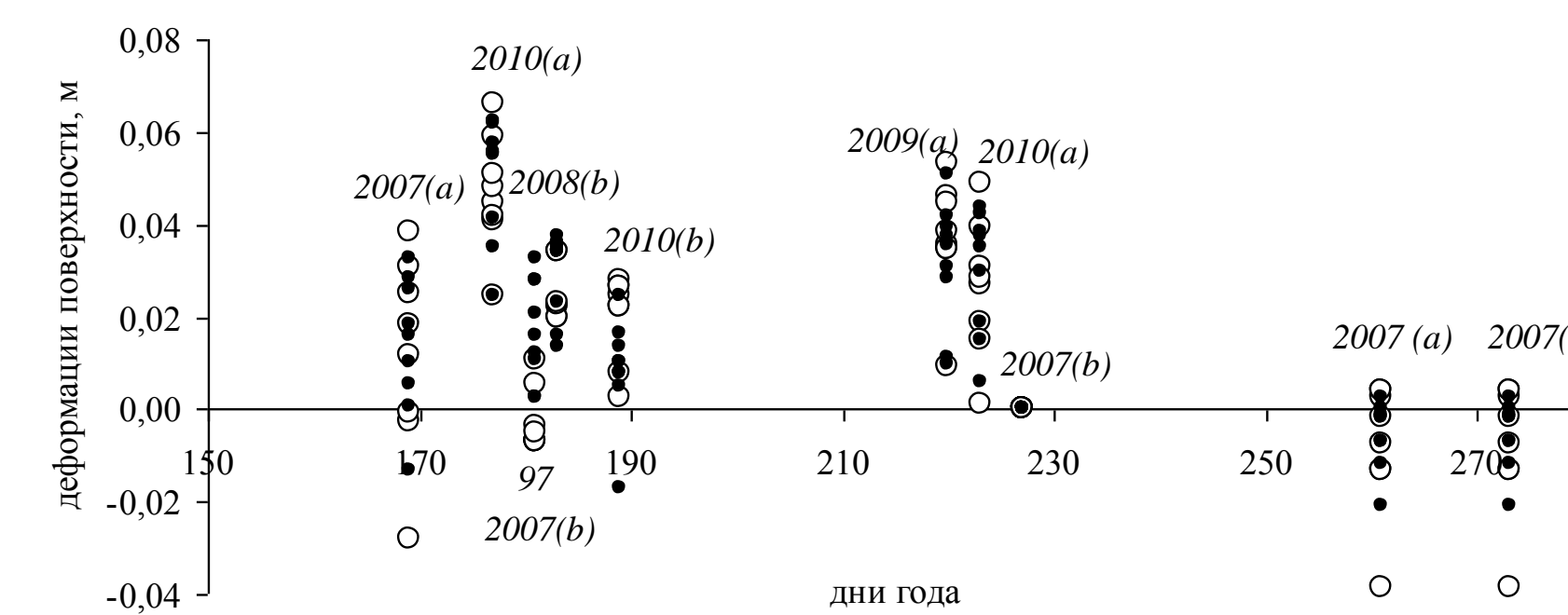
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3rd ALOS Research Announcement (RA) «The vegetation cover dynamic of North-East European Russia in ecological gradients by radar and optical data» (PI 546) (2010-2012) (IB-JAXA, JAPAN)

The information of more successful international projects at field of climate changes are presented below

RFBR-CRDF Global (RUB1-2985-SK-10) «Climate change effects on vegetation, wildlife, and thermokarst in the Russian Arctic» (2010-2012) (IB – University of Wisconsin-Madison, USA)

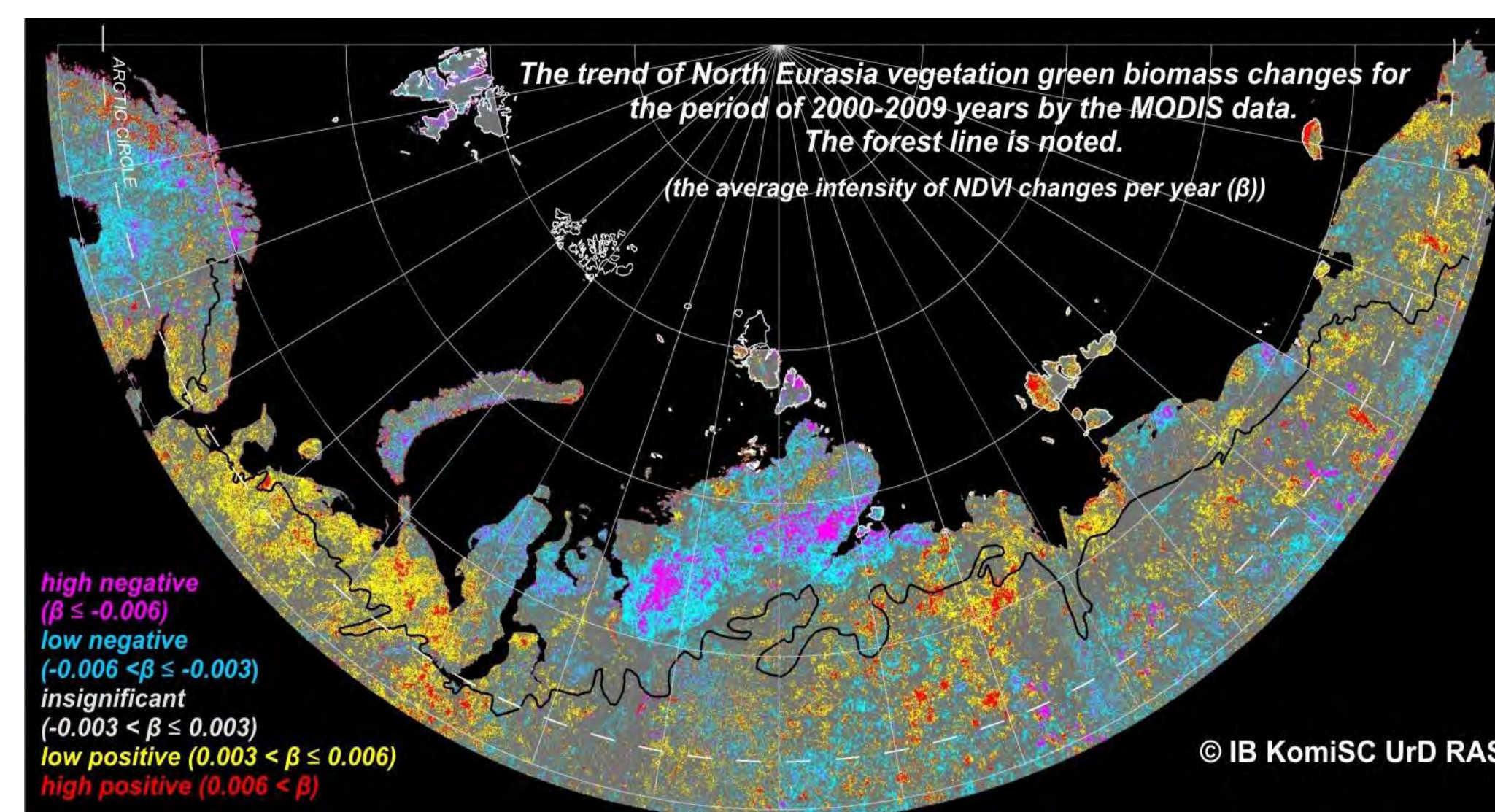
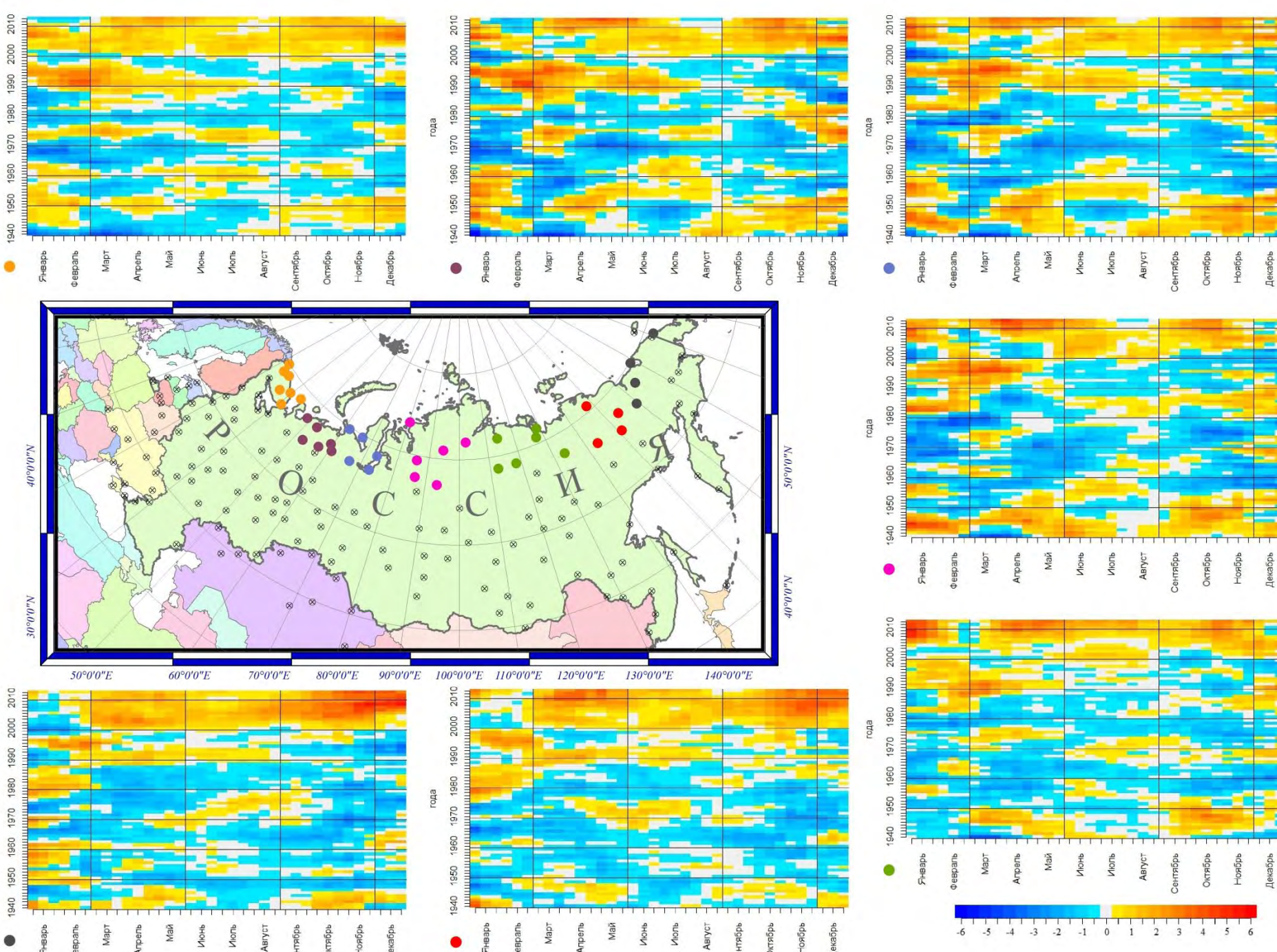
The meteorological database for North Eurasia region was developed (<http://ib.komisc.ru/climat/>). In present time the data of 168 metostations are presented with daily average parameters of temperature and precipitation with average length 100 years observations (near 1881-2010). The posterior analyses of database for project region demonstrate presence expressed trends of average annual temperature and precipitation value growth for period of last 50-years. The main temperature growth is related with winter and spring months mainly, while at summer period the average temperature is reduced



Series of interferometric pairs of satellite images ALOS/PALSAR (2007-2010) were used for calculation of the intensity of seasonal and interannual changes of the earth's surface area at eastern part of Bolshezemelskaya tundra. The satellite data results were compared with ground

instrumental measurements on Circumpolar Active Layer Monitoring plot (CALM). The differences in the values of the seasonal changes of the earth's surface for years with contrast temperature characteristics (2007 and 2010) allow considering degree of transformation of thawed layer of permafrost under climatogenic seasonally effects.

UrD RAS scientific program «Reaction of ecosystems of the European North and Western Siberia cryolithozone to climatic fluctuations of the last tens of years» (12-C-4-1018) IB - Siberia Department RAS (2011-2014)



The temporal series of Terra-MODIS satellite images (for a period of 2000-2009) were used for estimation of zonal distribution and selection of statistically significant natural positive (19.9% of treeless area) and negative (23.5%) trends of the maximal annual NDVI index fluctuations in treeless ecosystems of North Eurasia in condition of the recent climate changes. The selected trends of increasing the aboveground green vegetation community's biomass spatially belong to East Siberia (Taimyr Peninsula). The increase of this parameter is mainly related to the rise in total projective cover and biomass of shrubs at areas with permafrost soils and is observed at model plots. By means of the comparative analyses of time-series satellite data, we quantitatively estimated annual vegetation changes at model plots according to the longitudinal gradient. Most selected plots demonstrated a synchronic increase in the maximal NDVI index for 2007 vegetation period. For the other years, correlation between them was lower. For the Arctic ecosystems of the Bolshevik Island (Novosibirskie Islands, Laptev Sea), the NDVI index increase was at its maximum to the end of study period; high correlation (-0.92) with the sea ice area was also observed there.

«Estimation of carbon balance in North Russia: past, present and future (CARBO-NORTH)» (EU Sixth Framework Programme, Contract No: 036993) (2007-2010) (IB-University Kuopio, Finland)

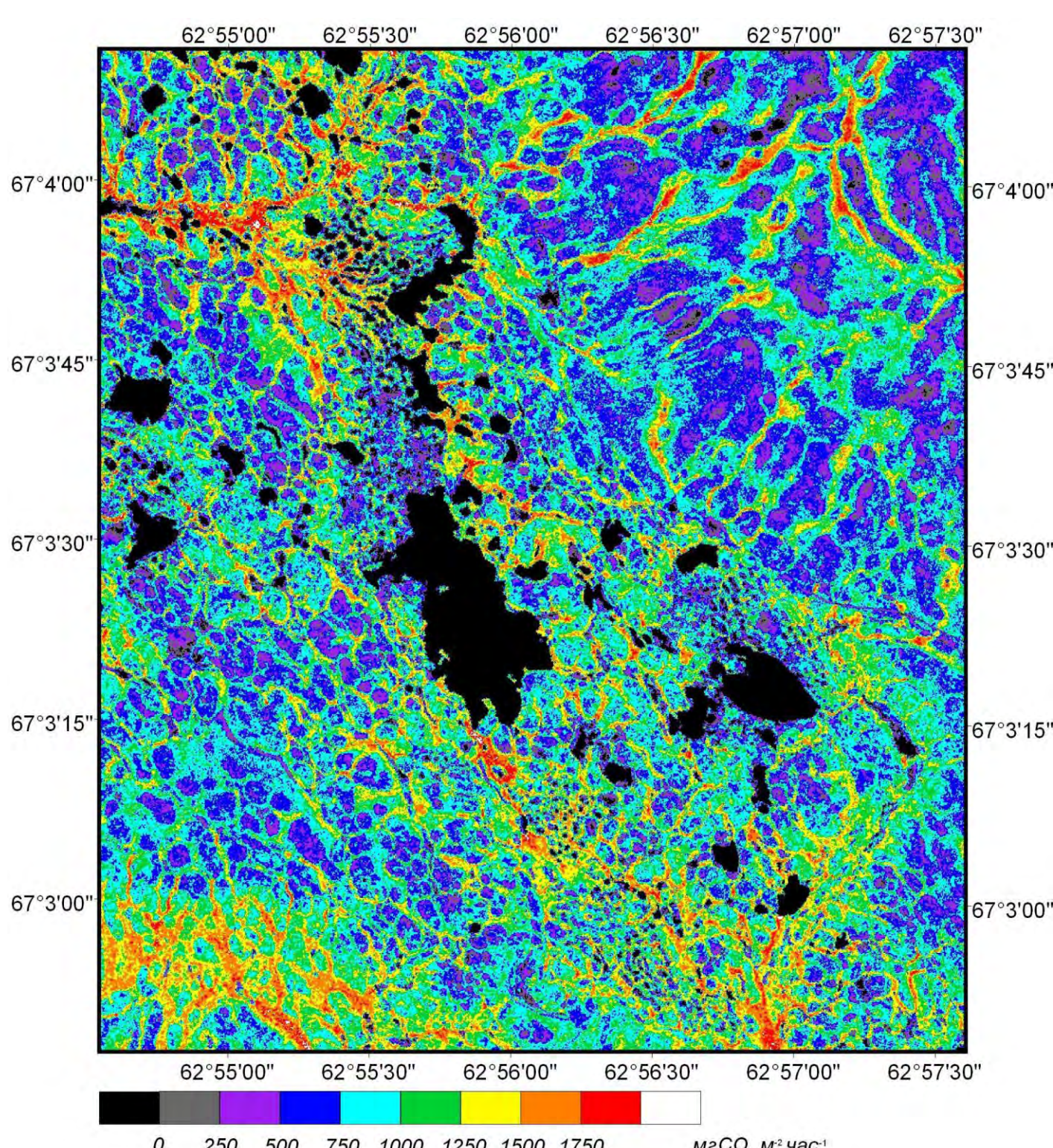


Fig. Fragment of Gross Primary Production map of tundra ecosystems on the simulating plot (QuickBird 10:56 6.7.2007)

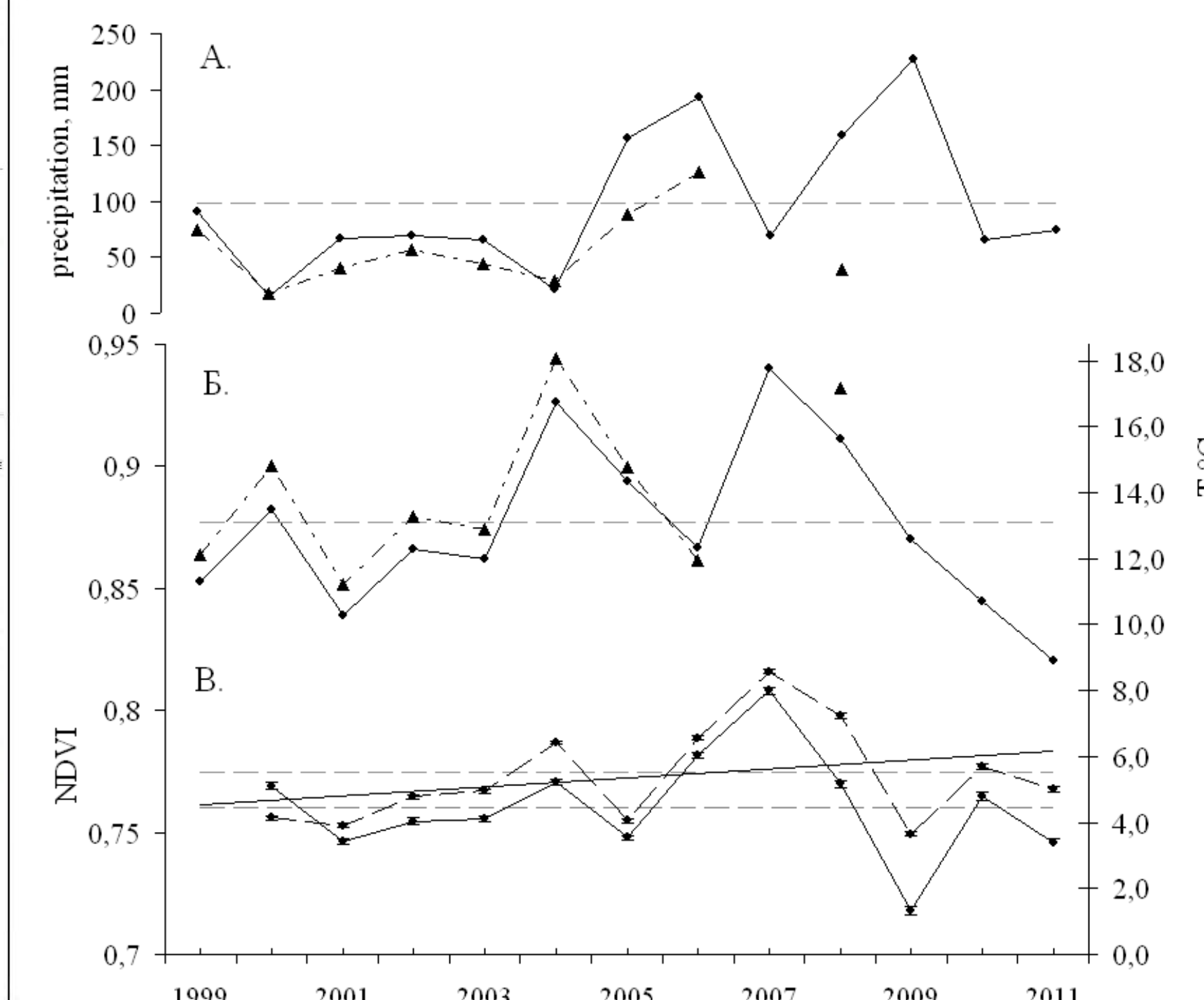
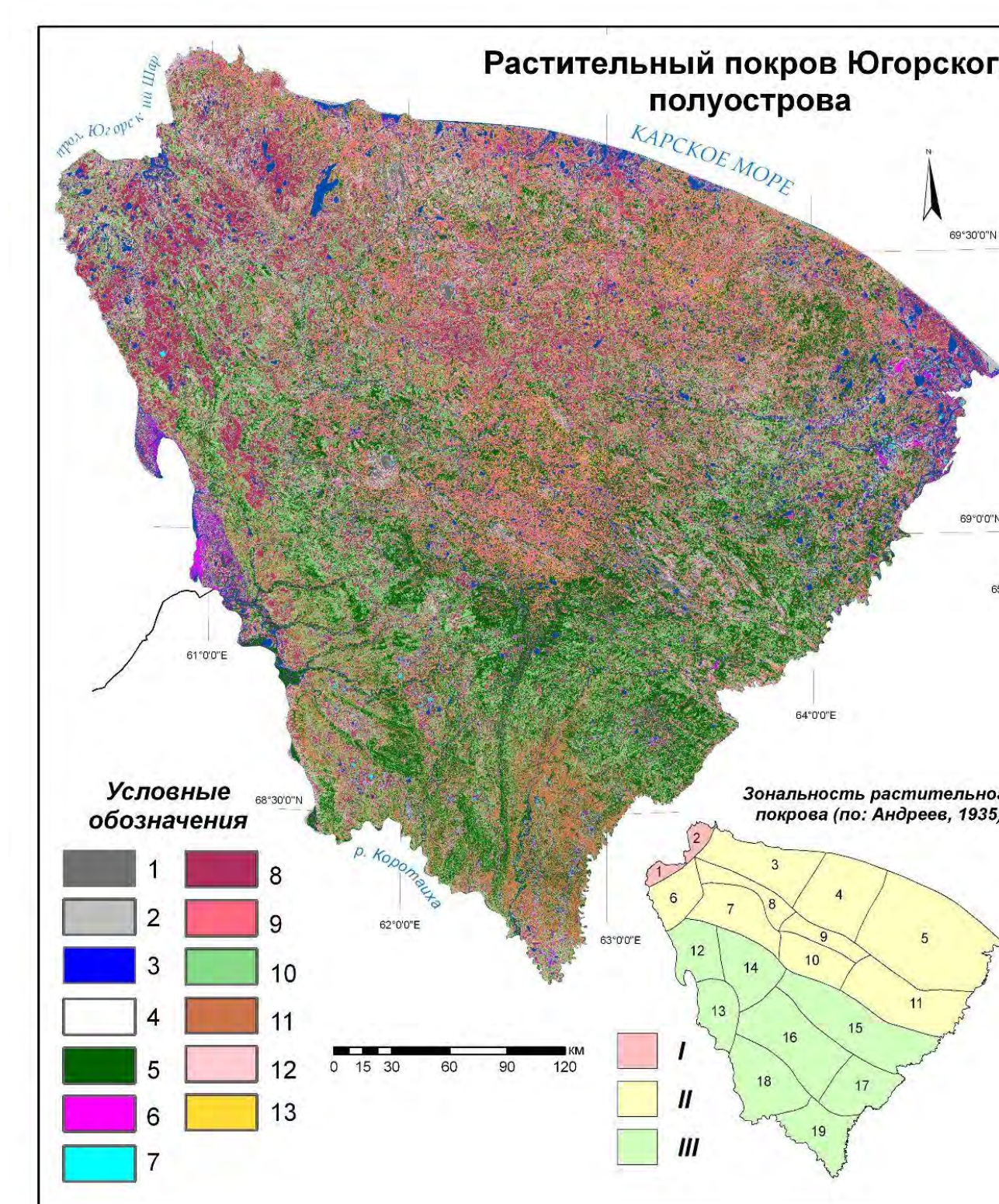


Fig. The map of Jugorskii peninsula vegetation M 1 : 1000 000 (1.) and dynamic of average June precipitation (2.A), temperature (2.B) and maximal volume of MODIS NDVI index of Salix communities (2.B) dynamic (B) for Vorcuta and Choseda-Chard regions of Jugorskii Peninsula. The gray dotted line is average for all time period of observations.

The Landsat and MODIS data was used for vegetation mapping and analysis of vegetation climatic changes of Jygorskii peninsula. The vegetation changes were related with increased proliferation of Betula nana communities at the southern part of the territory and the promotion to the northern parts of the peninsula the community from Salix sp. The variation of spectral index NDVI for different communities depends upon weather/climate fluctuation in vegetation season of different years. The common changes trend at region related with biomass production increasing and correlated with parameters of warming and precipitation increasing especially in winter time.

Seventh Framework Programme (FP7-SPACE-2013-1) «Enabling Intelligent GMES Services for Carbon and Water Balance Modeling of Northern Forest Ecosystems (North State)» (№ 606962) IB - VTT Technical Research Centre of Finland (2013-2016)

Principal changes of forest phytocenoses at the specially protected areas of the Urals (Northern and sub-Polar Urals) for a period of 24 years according to the Landsat and MODIS satellite images. In the last decades, old-aged forests at the plain part of the Northern Urals saw stable statistically valuable trends of NDVI index decrease due to forest aging and windfalls which negatively affect the productivity of forest ecosystems (Terra-MODIS images for a period of 2000-2010). The main 'catastrophic' after-effects of windfalls and fires were followed by a slow demutation restoration of plant cover at single plots. The sub-Polar Urals had preferably positive trends of NDVI index changes. The crown density index of non-disturbed phytocenoses of larch forests and open forests at the ecotone between forest and tundra zones grew by 1-2% on average per year.

