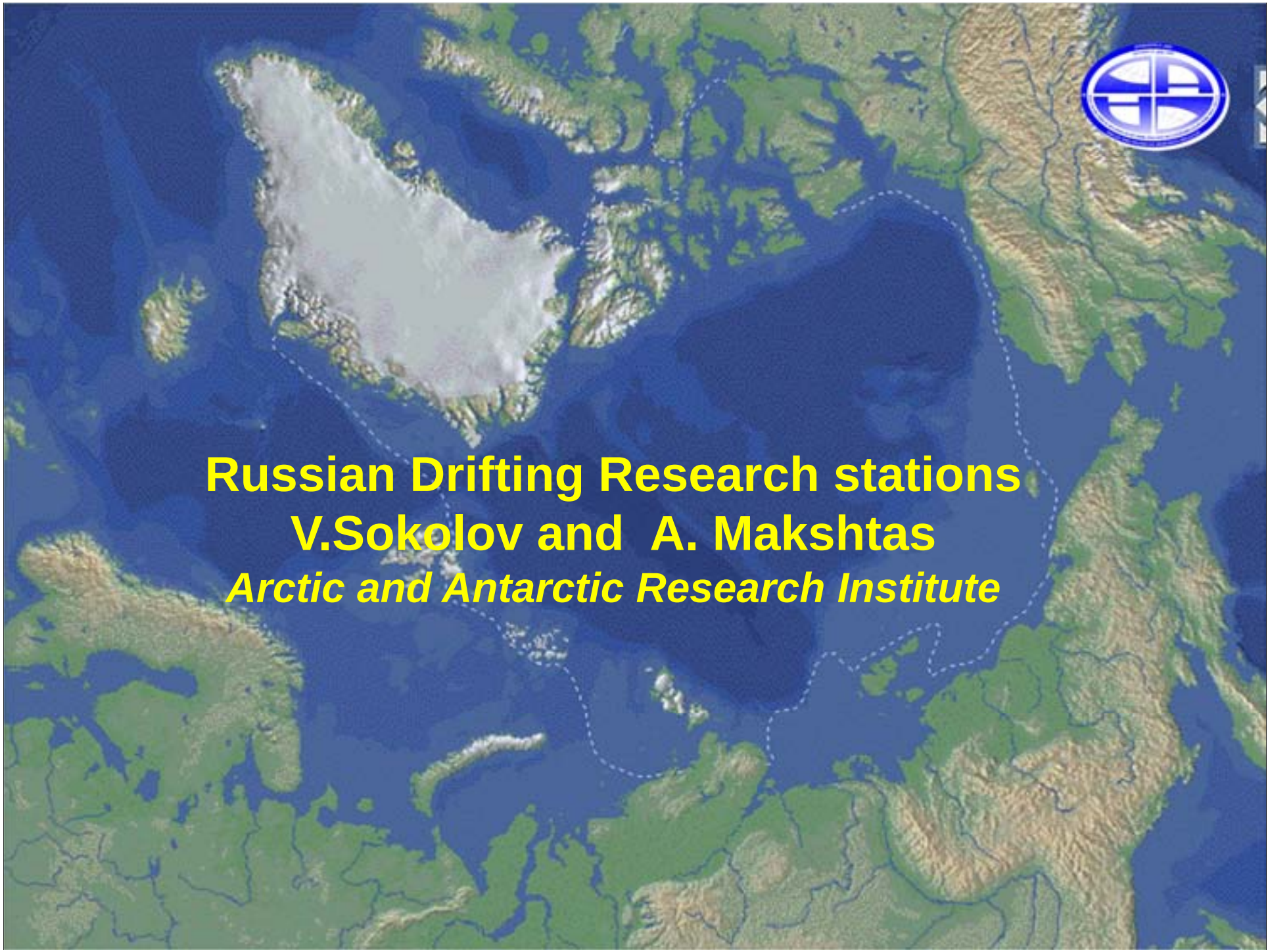
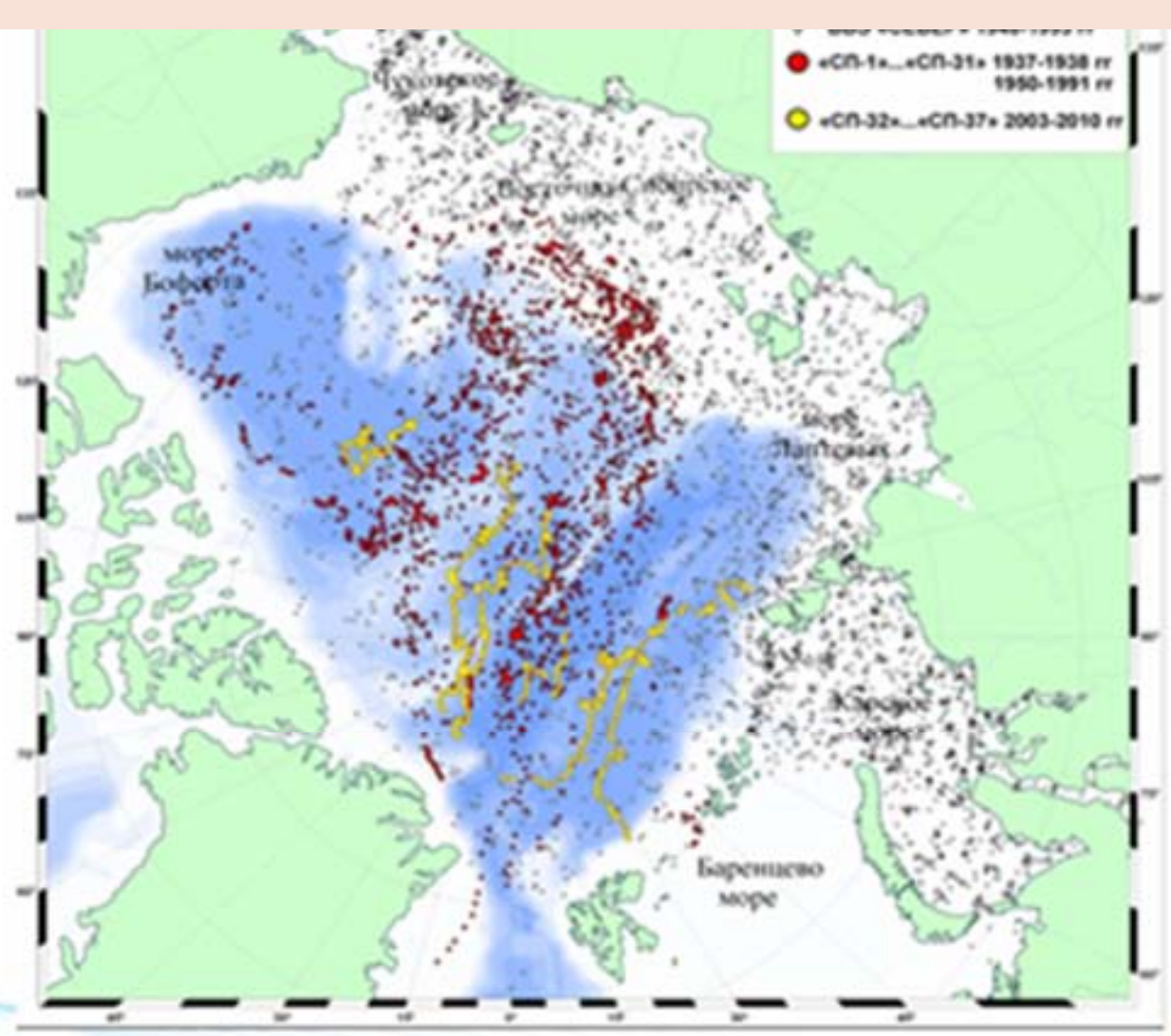


Russian Drifting Research stations

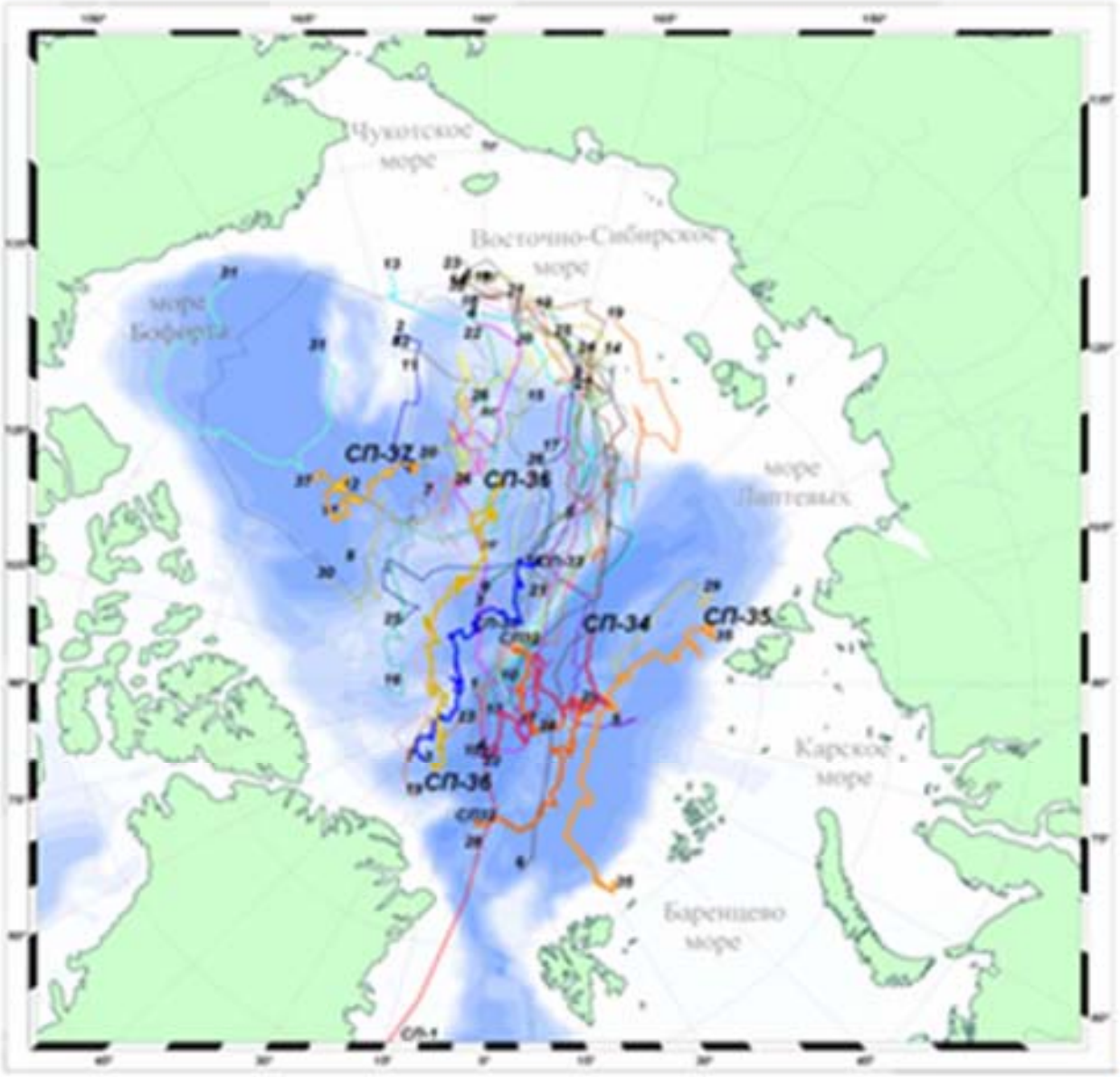
V.Sokolov and A. Makshtas

Arctic and Antarctic Research Institute

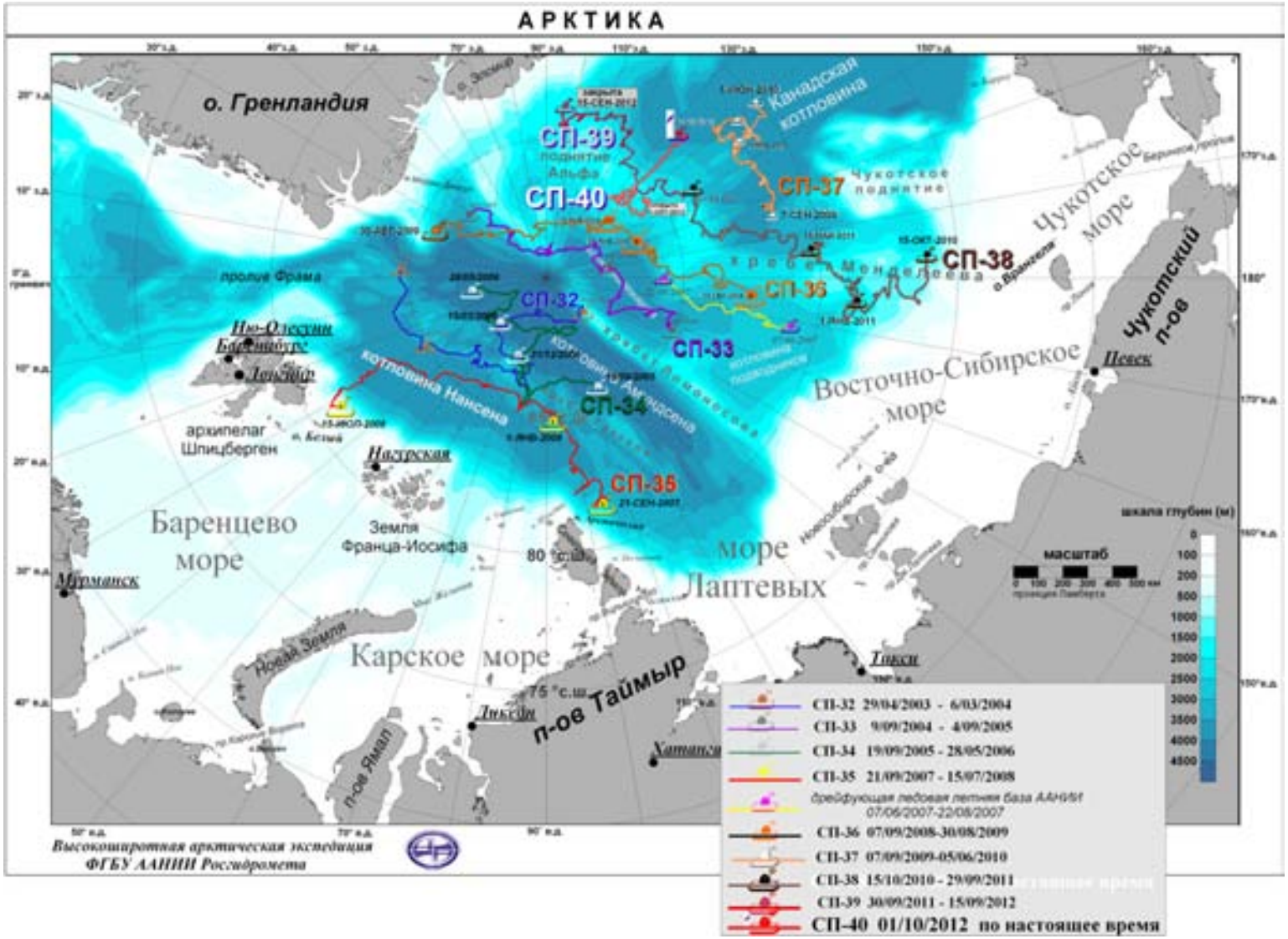
Hydrographic stations collected in the Arctic Ocean by "North Pole" Drifting research platforms and High Arctic research expedition since 1938 up to present time



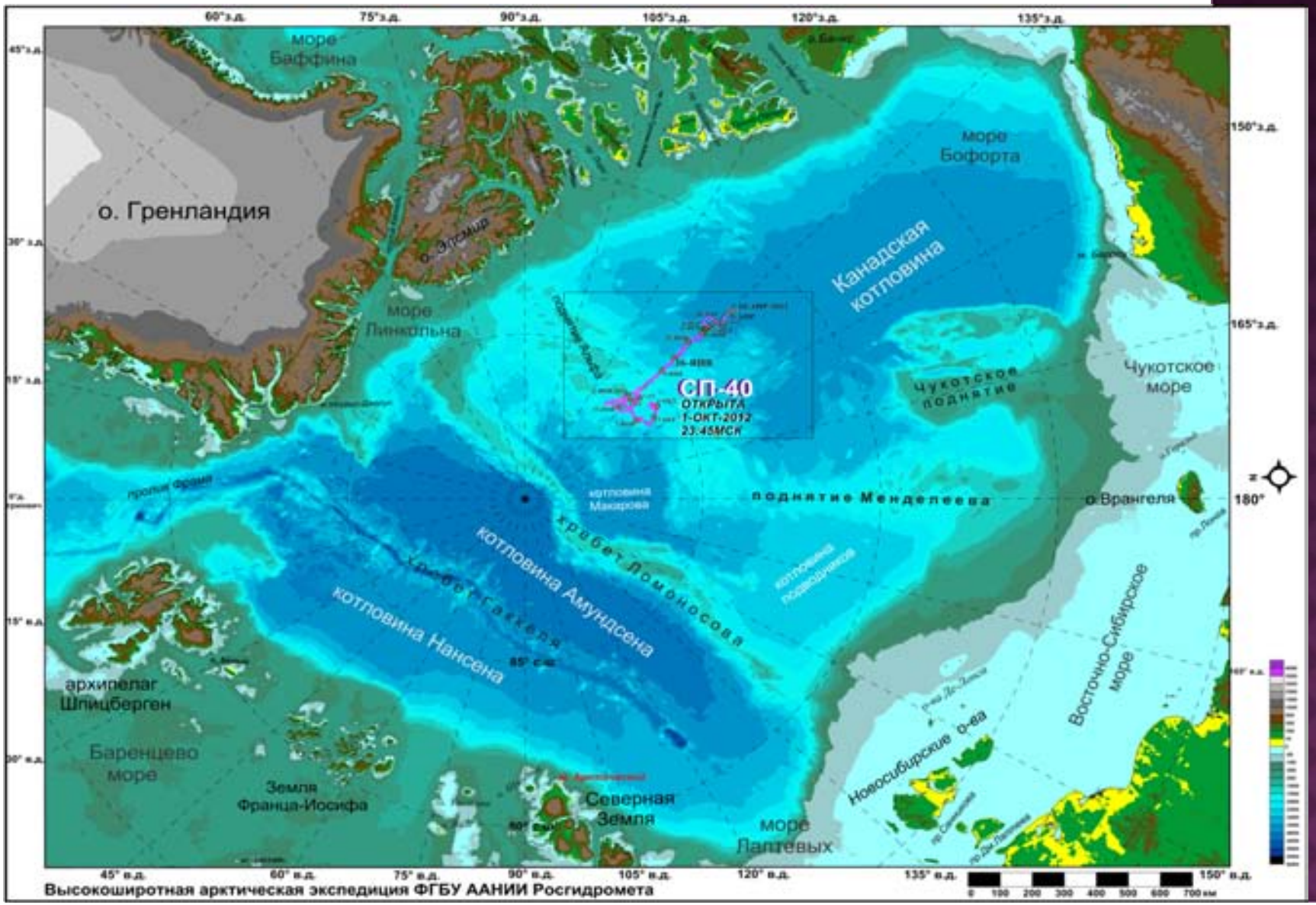
“North Pole” Drifting research platforms drift tracks (1937 -2010)



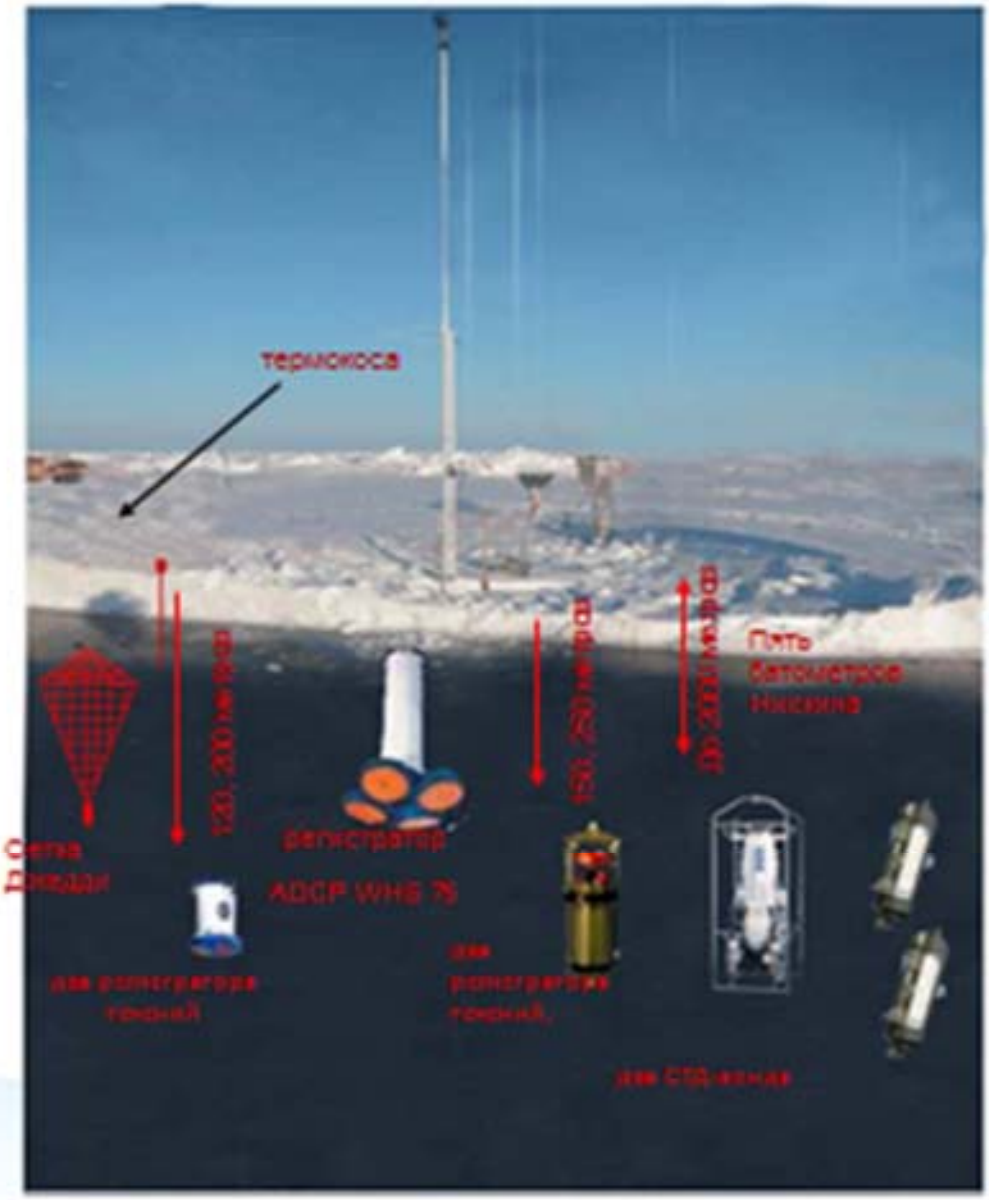
Russian drifting research stations “North Pole” in 2003-2013



CURRENT POSITION OF “NP-40 DRIFTING RESEARCH STATION

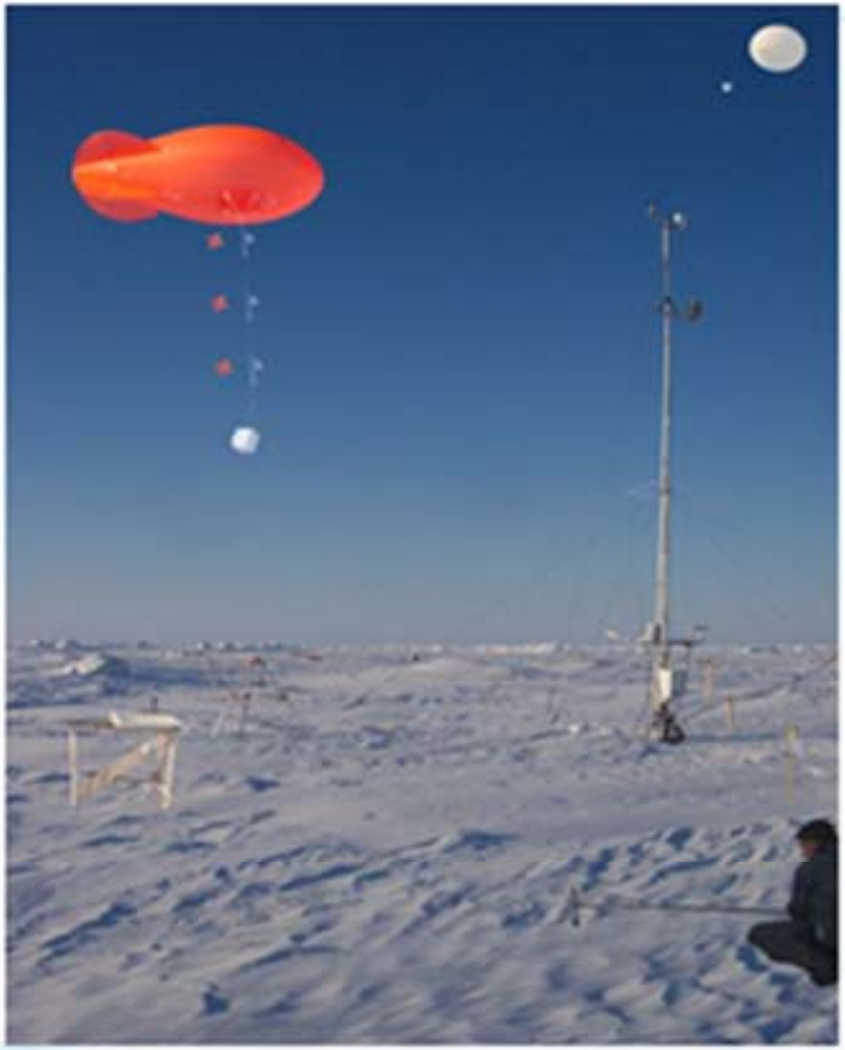


“North Pole” Oceanography studies



- Ocean deep sounding
- Sub-ice ocean layer studies
- Current measurements in upper 500 m layer
- Bottom sediments studies
- Acoustic sounding of whole water column

“NP” Atmosphere Studies



WMO standard measurements

TOTAL Ozone and
UV-radiation measurements

Gradient temperature and
Humidity measurements

Atmosphere sounding

Surface spectral albedo
measurements

Balloon measurements in
boundary 0-2000 m atmosphere
layer

Gas components content
in atmosphere studies

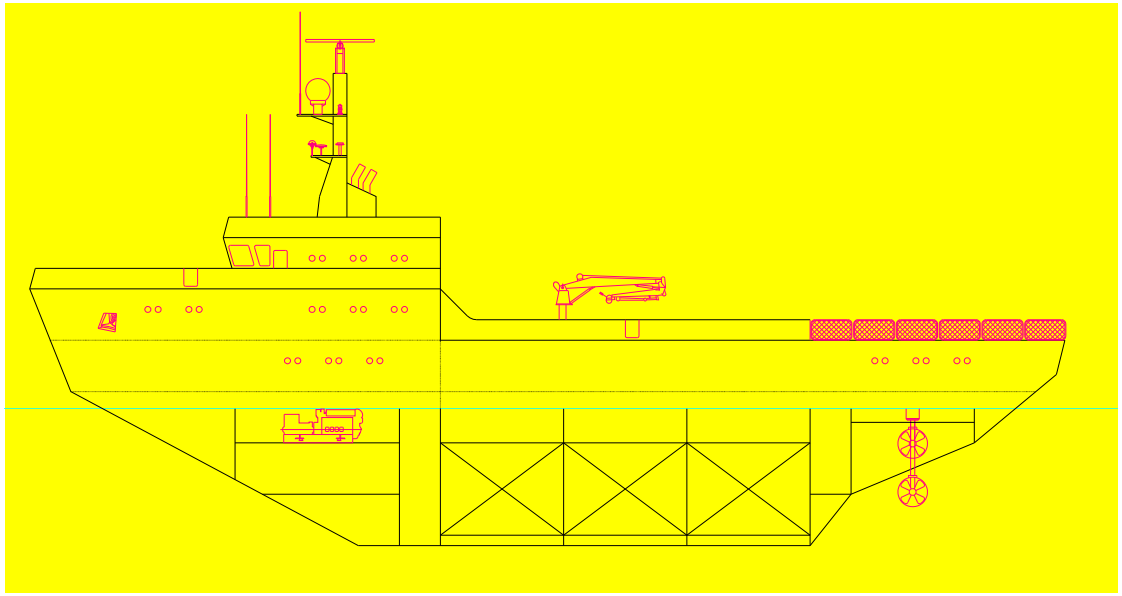
“NP” ICE CAMP CONSTRUCTION

“AARI ICE CAMP” AS IT WAS IN AUGUST, 13-TH OF 2007

“NORTH POLE” FUTURE DEVELOPMENT

To be able to continue scientific research on higher latitudes under the conditions of warming climate, Russia has to develop new technologies and it was suggested that Russia as soon as possible should start developing a self-propelled, ice- strengthened floating platform for scientific research. At this moment the project has a 1,7 billion rubles (app €42 million) price tag at the beginning..

ADVANCED PLATFORM PONTOON TYPE FOR DRIFTING RESEARCH IN THE ARCTIC OCEAN

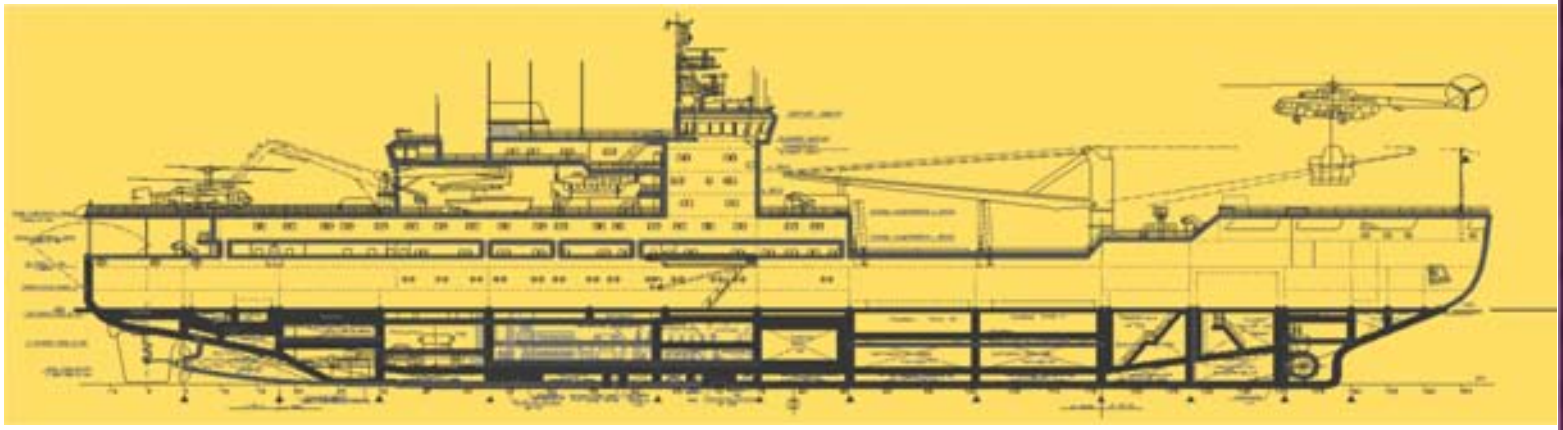


Displacement (т)	4500
Length (м)	60
Width (м)	20
Board hight (м)	12
Draft (м)	8
Power (кВт)	825

Crew - 9
Research team up to 24
Helicopter desk
Moonpool
Large capacity tanks and holds
Stowable propeller unit

NEW AARI'S RESEARCH AND SUPPLY VESSEL "AKADEMIK TRESHNIKOV"

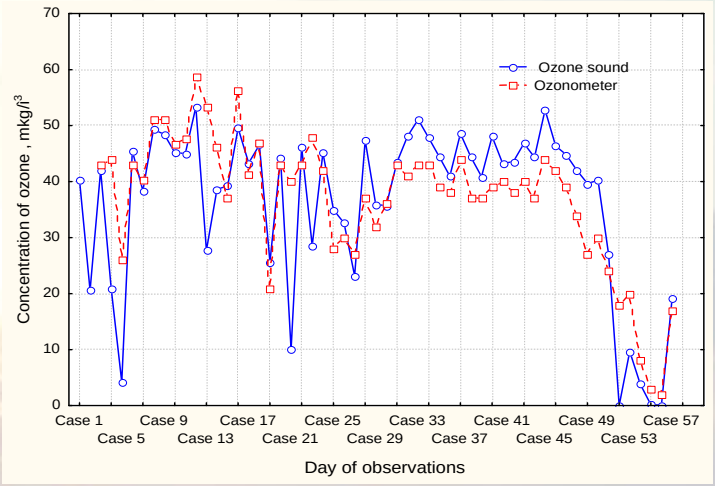
Length max – 133.57м;
Width max – 23м;
Board height – 13.5м;
Draft (in total displacement)– 8.5м;
Total displacement – 16900т.



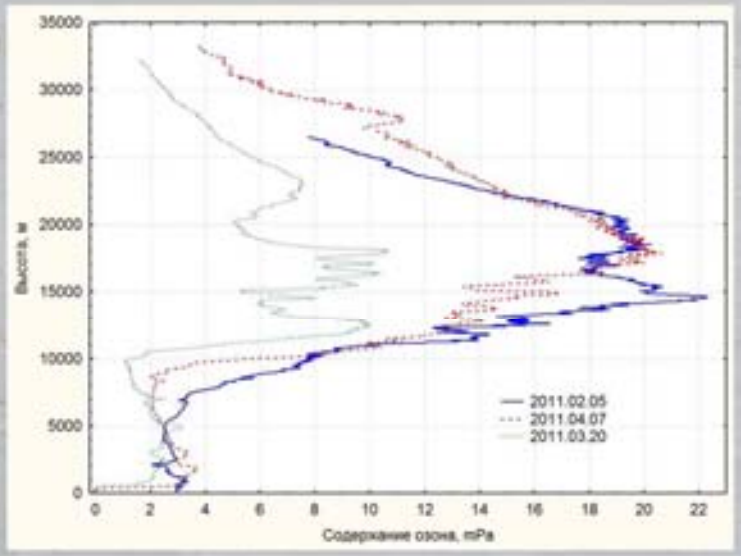
METEOROLOGY

Ozone studies at the drifting stations “North Pole”

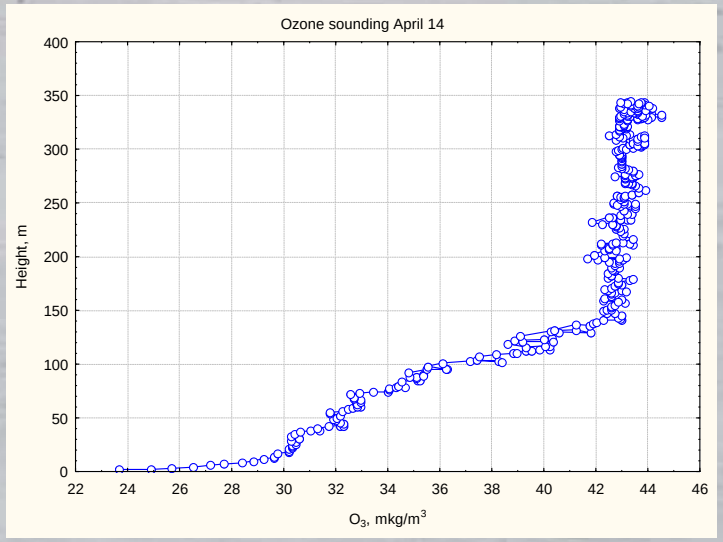
Launching of ozone sound at drifting station “North Pole 38”



Concentration of ozone in atmospheric surface layer in spring

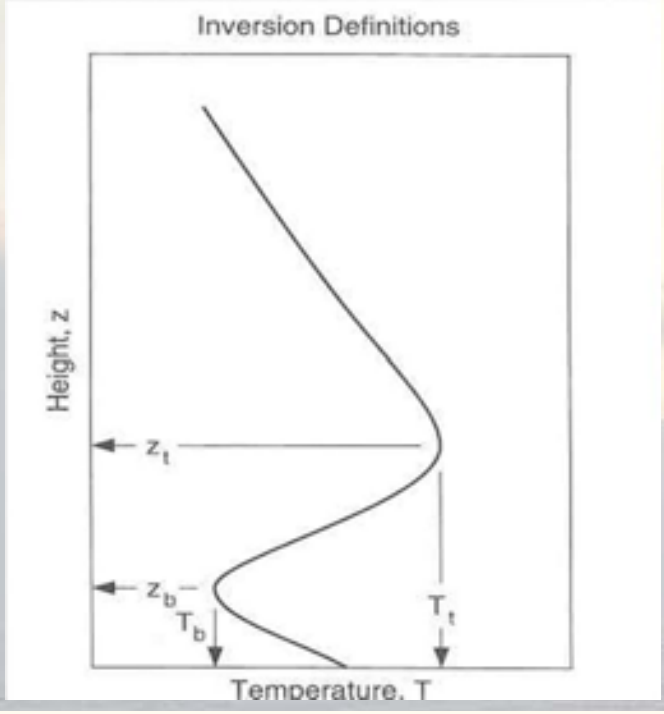


First instrumental evidence of “Ozone hole” in the Central Arctic (March 2011)

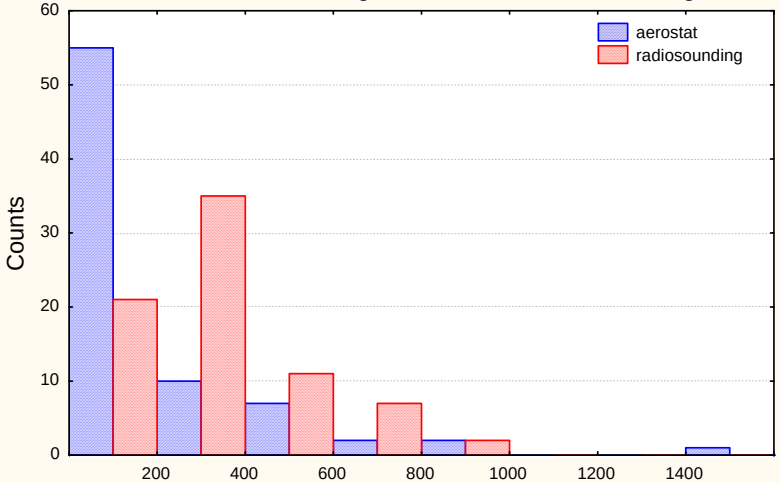


Vertical distribution of ozone concentration in atmospheric boundary layer in spring

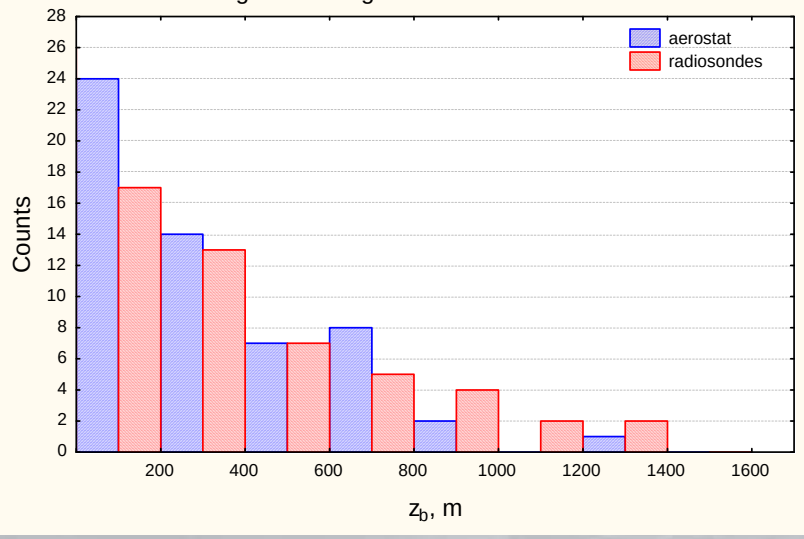
Study of low level inversions in the Central Arctic



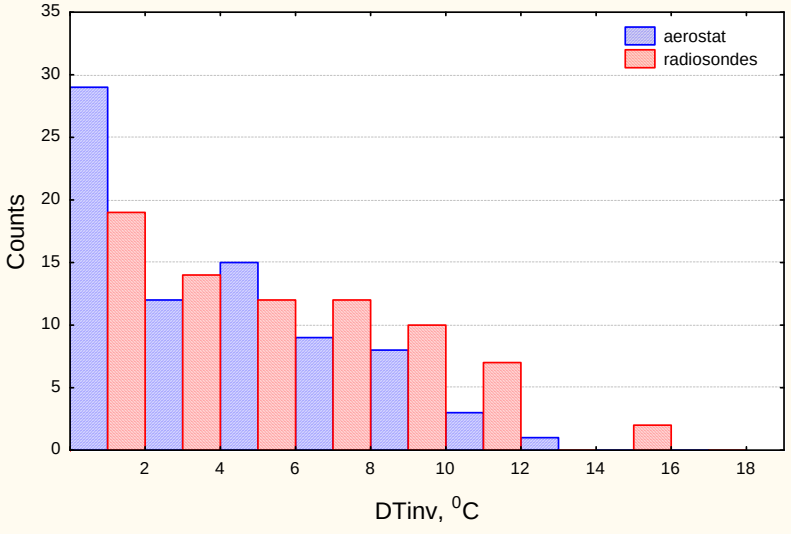
Distribution of inversion depths (DHinv) on the drifting station North Pole-38 according to radio and aerostat soundings.



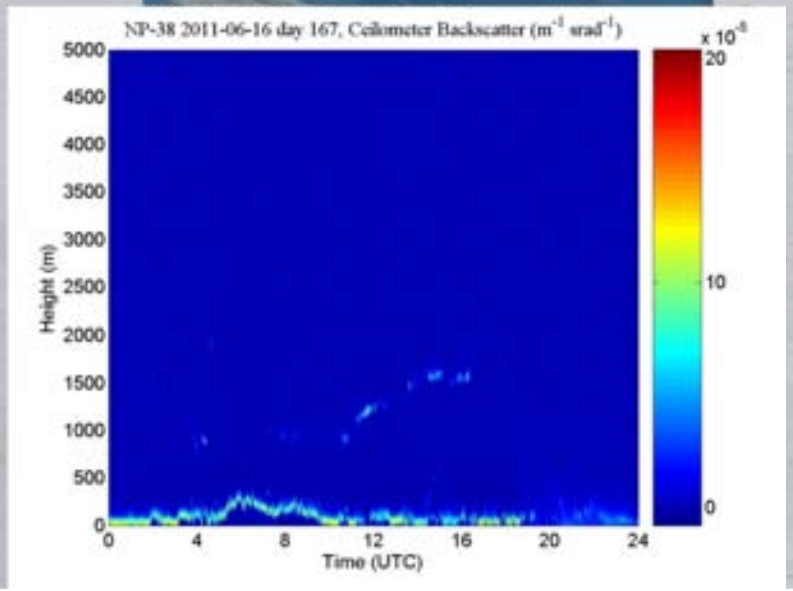
Distribution of inversion base heights (z_b) according radio and aerostat soundings at drifting station "North Pole-38" .

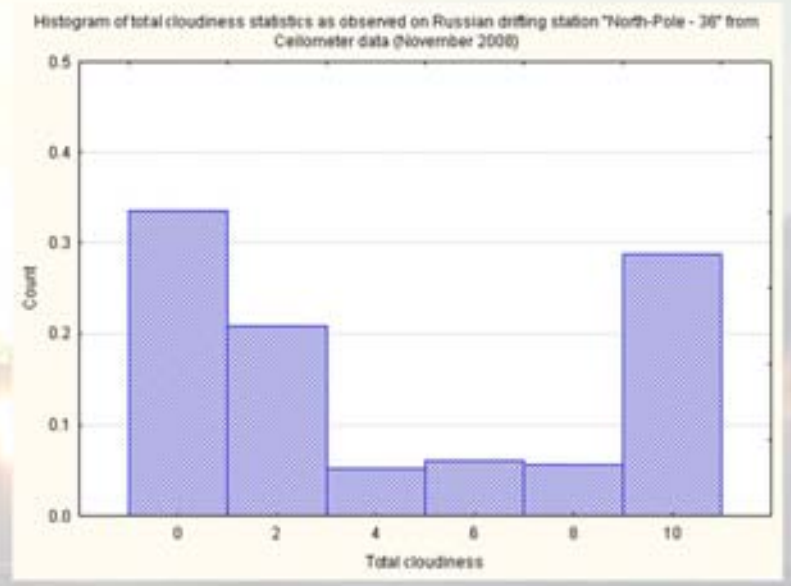


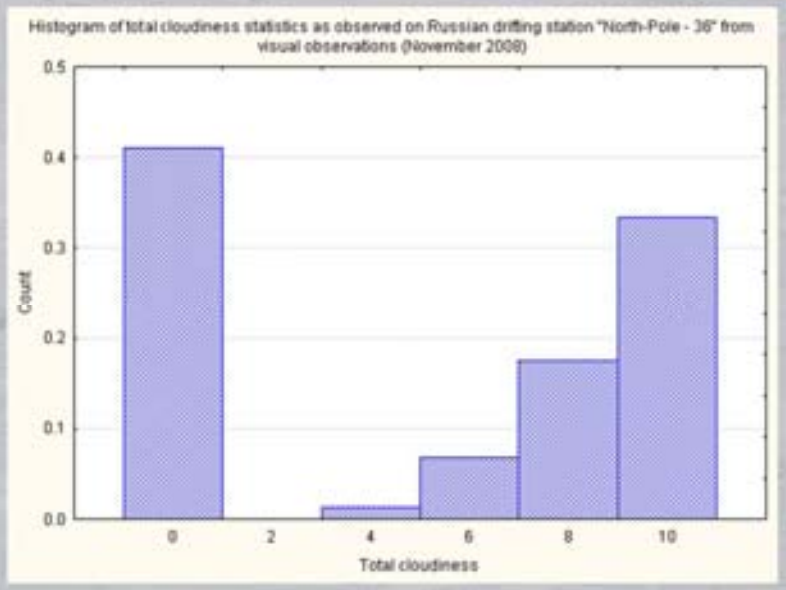
Distribution of temperature change trough inversion (DTinv) according to radion and aerostat soundings at drifting station "North Pole-38"



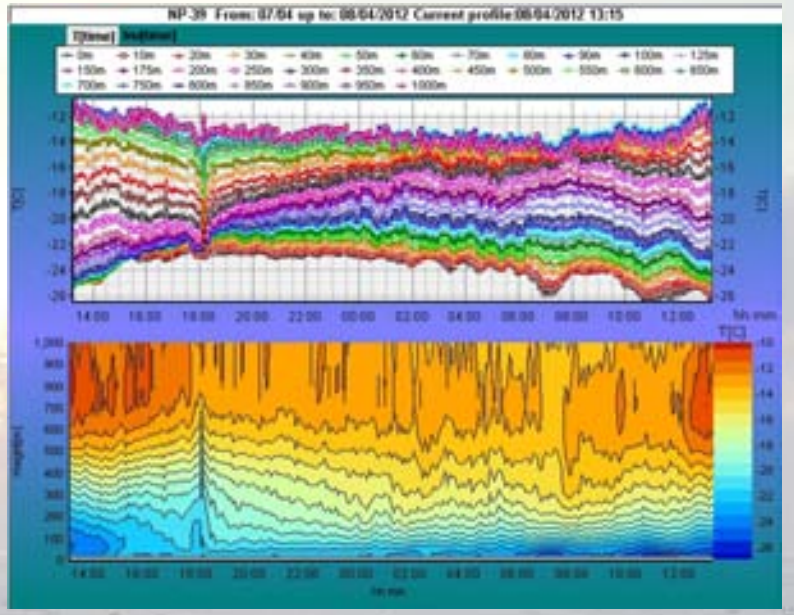
Total cloudiness, estimated from Ceilometer data and visual observations (November 2008)

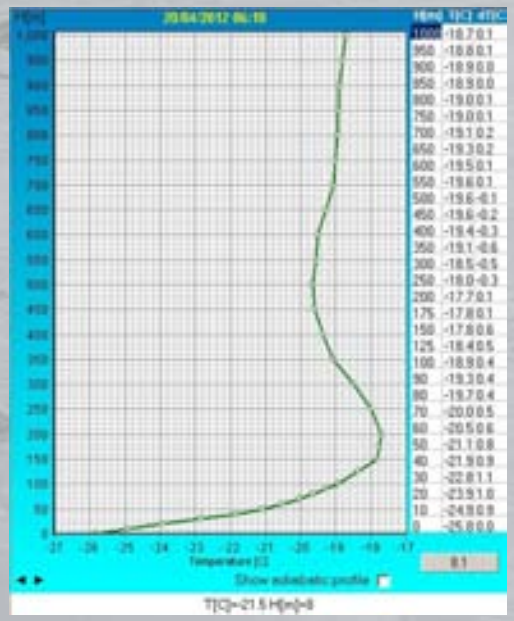


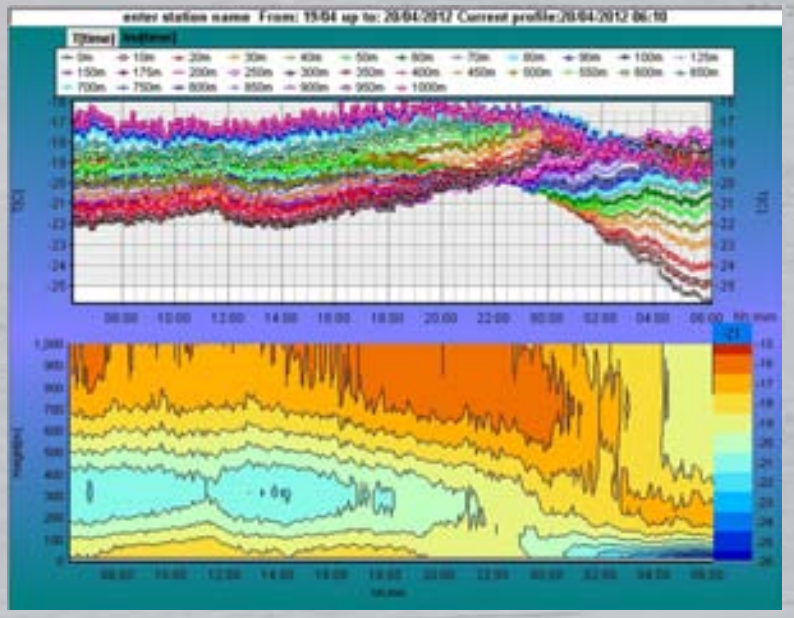




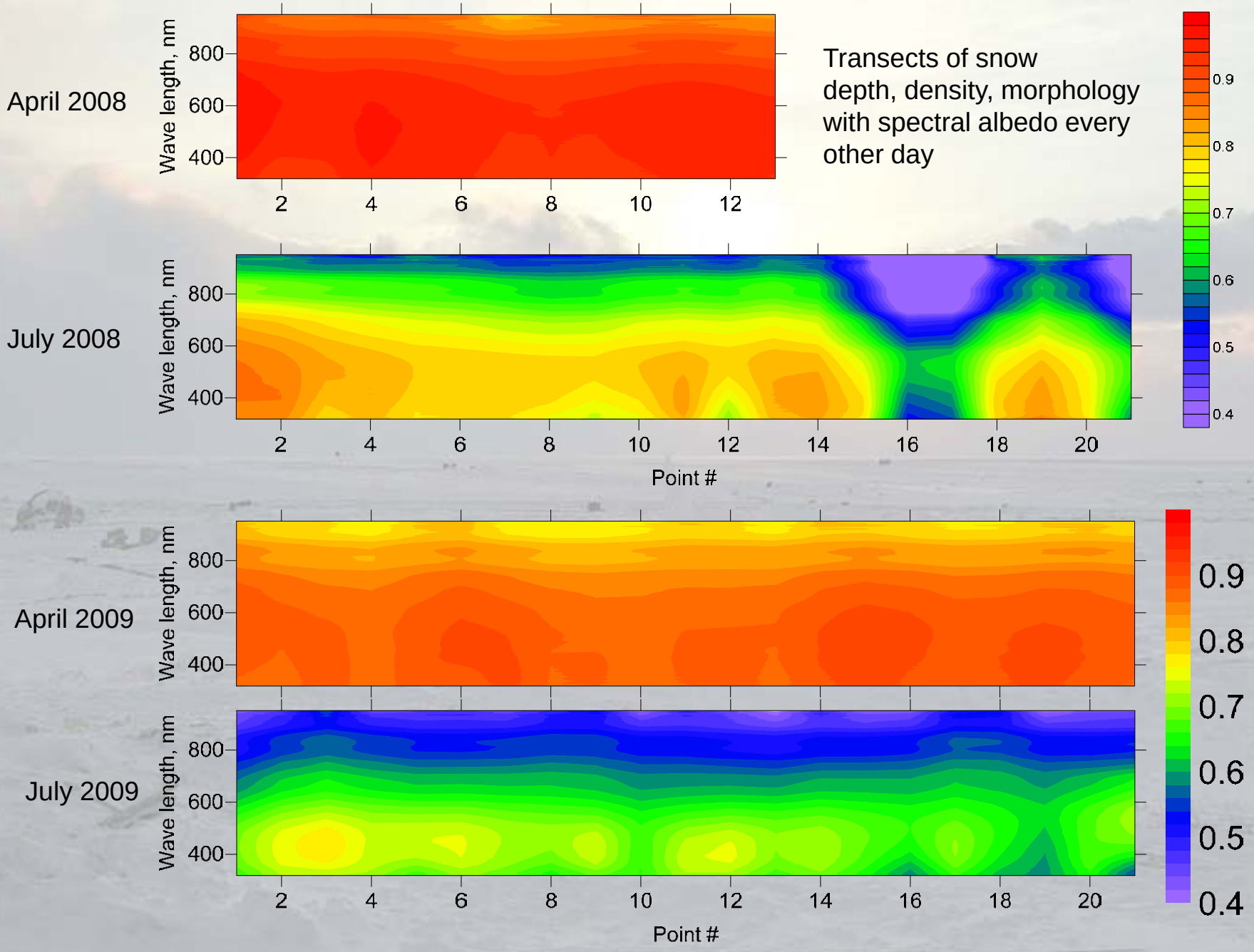
Microwave profiler at the drifting station “North Pole 39” (March 2012): new approach to investigations of boundary layer structure at drifting stations “North Pole”





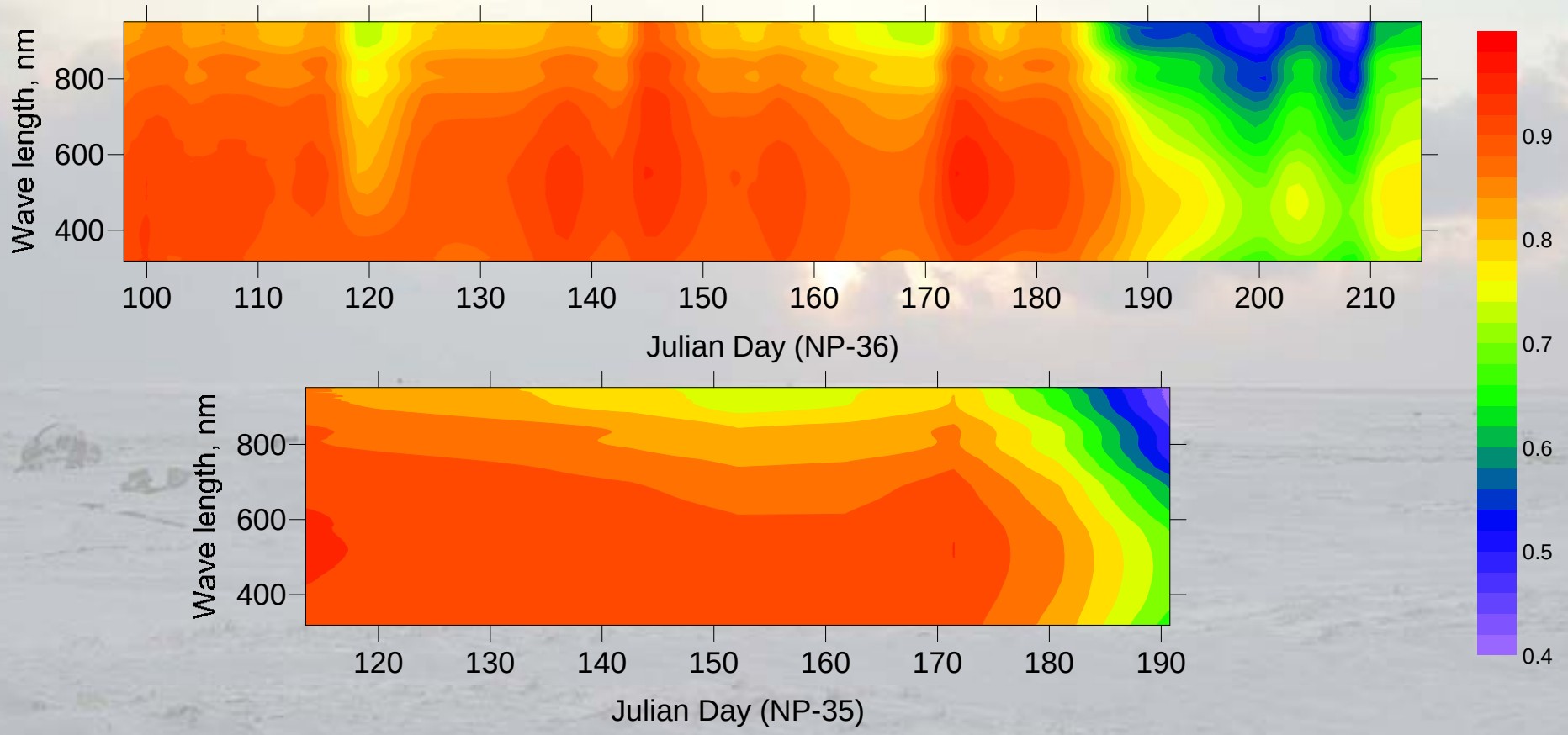


Spatial variability of spectral albedo on the drifting stations “North Pole-35, 36”.

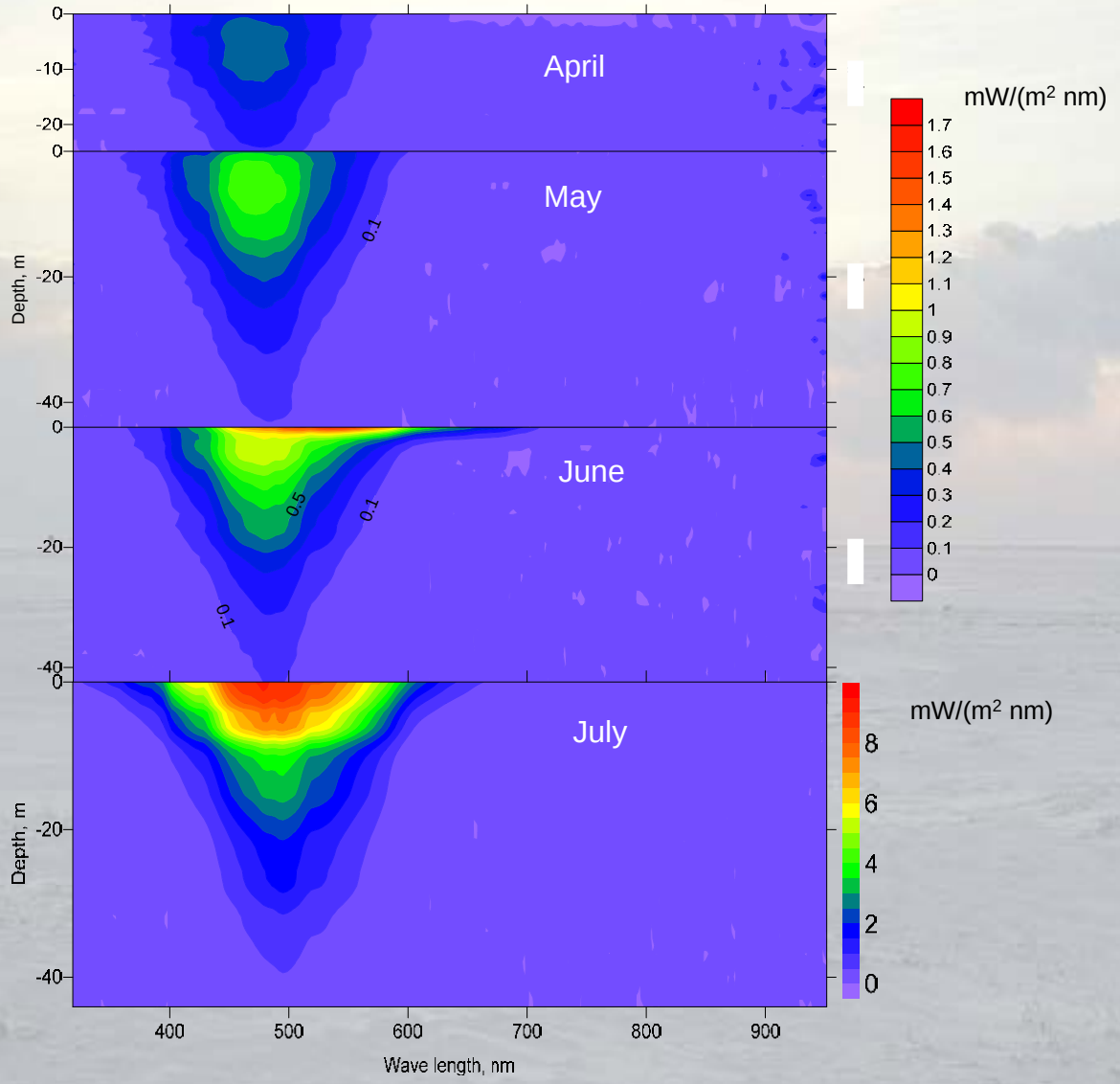


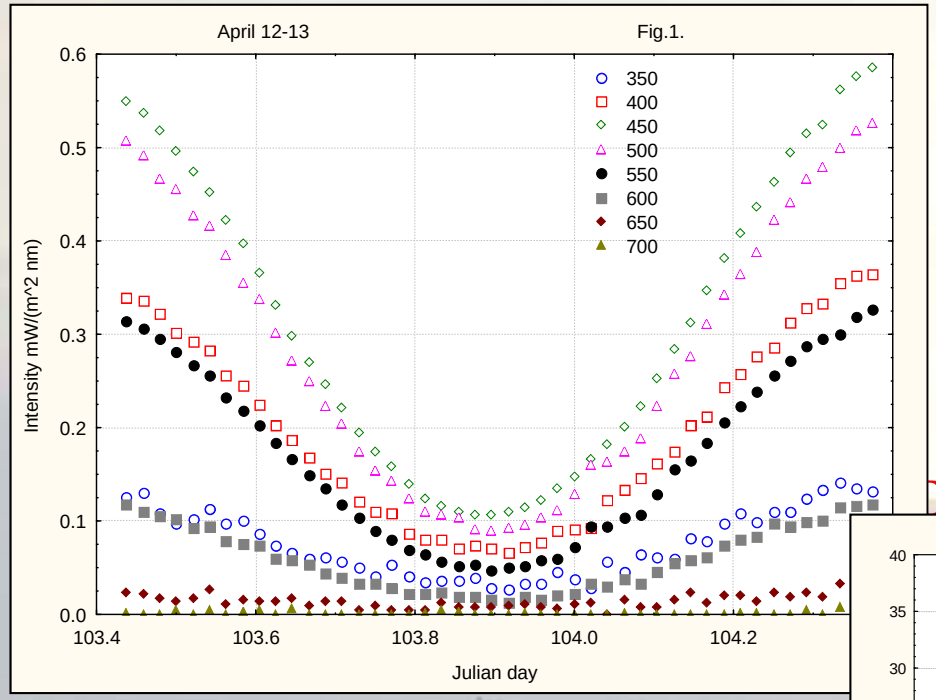
Transects of snow depth, density, morphology with spectral albedo every other day

Transect average spectral albedo for day 98 to 215 (NP-36) and day 115 – 191 (NP 35)



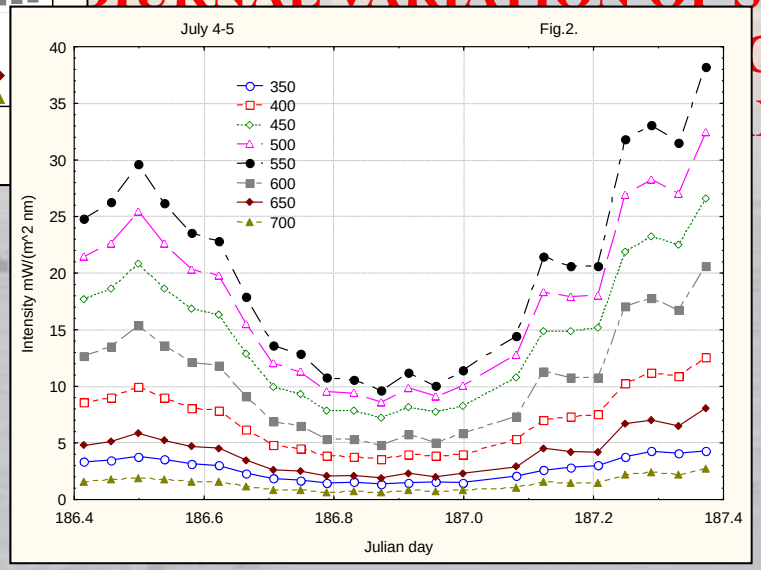
Redistribution of solar radiation in the ocean upper layer





0.02 – 0.09 W/m^2

DIURNAL VARIATION OF SOLAR
G
ND JULY



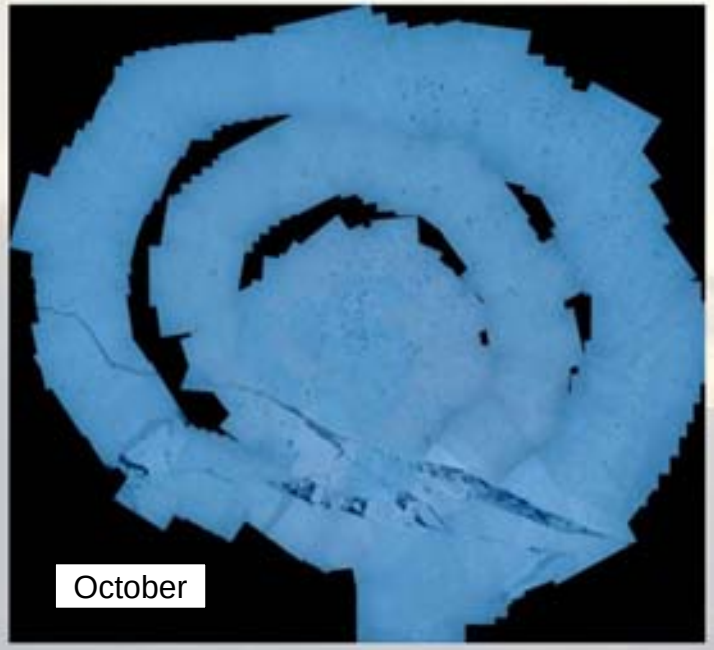
2.15 - 7.23 W/m^2

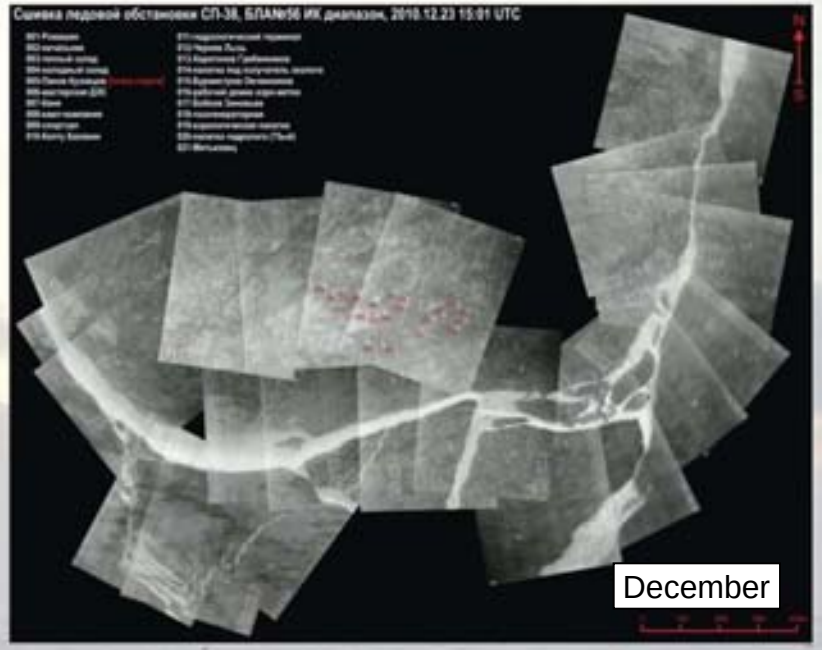
SEA ICE

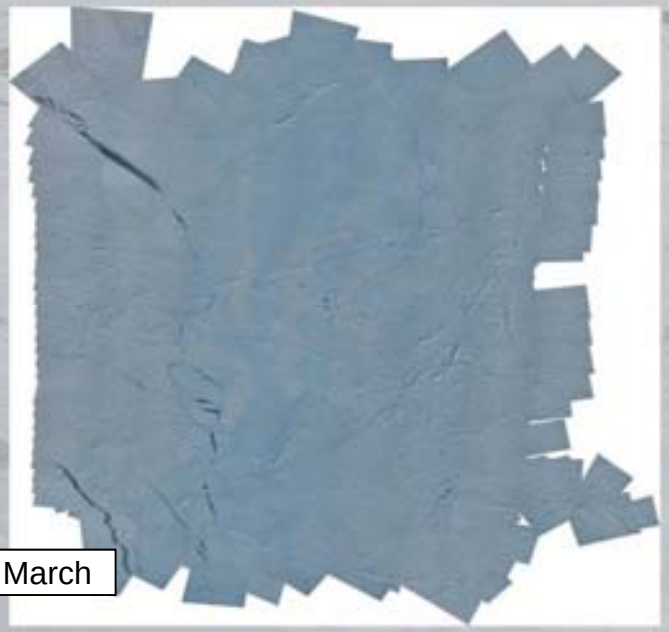
UAS – THE NEW INSTRUMENT FOR STUDY OF SEA ICE COVER

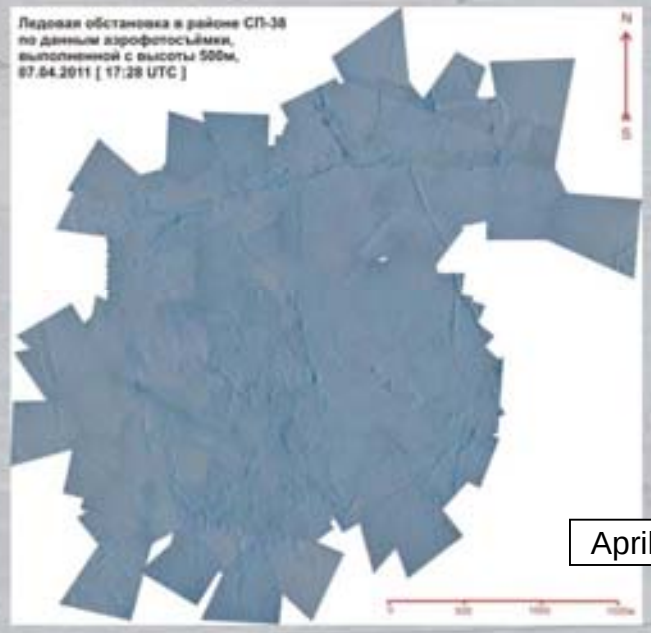
Weight – 3.5 kg, wingspan – 1.4 m, range of flight speed 60 - 100 km/h, altitudes - 50 - 3000 m.

Sea ice floe of drifting station “North Pole 38” in winter

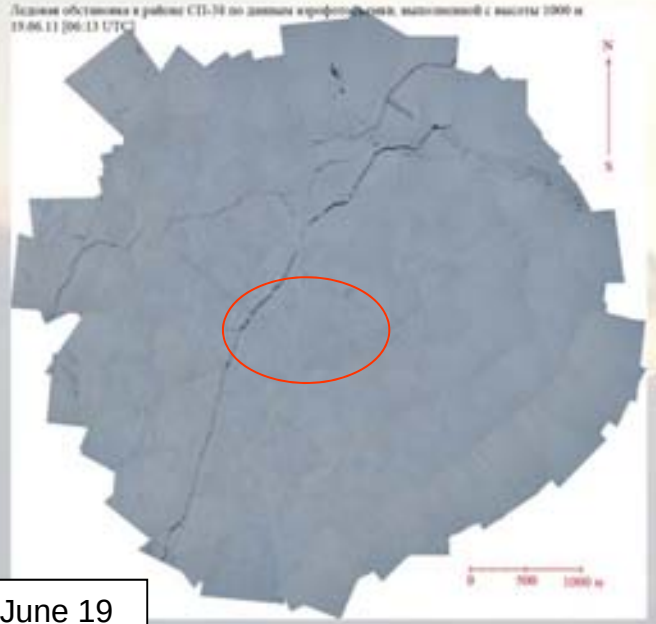




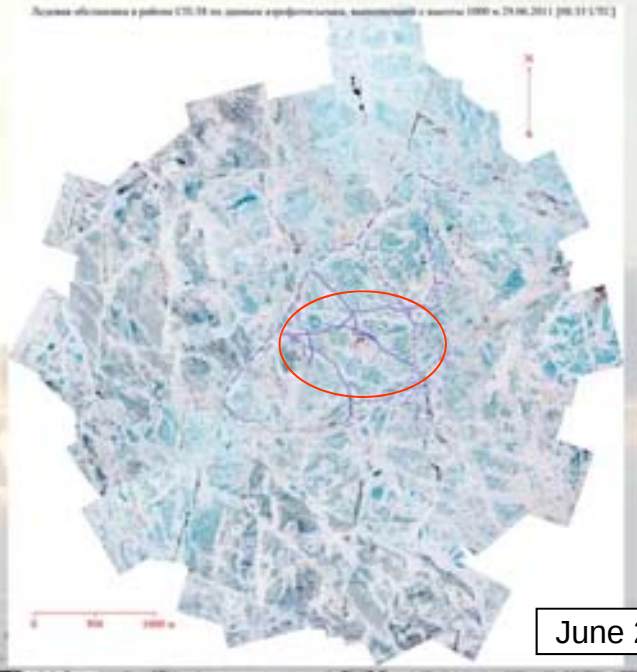




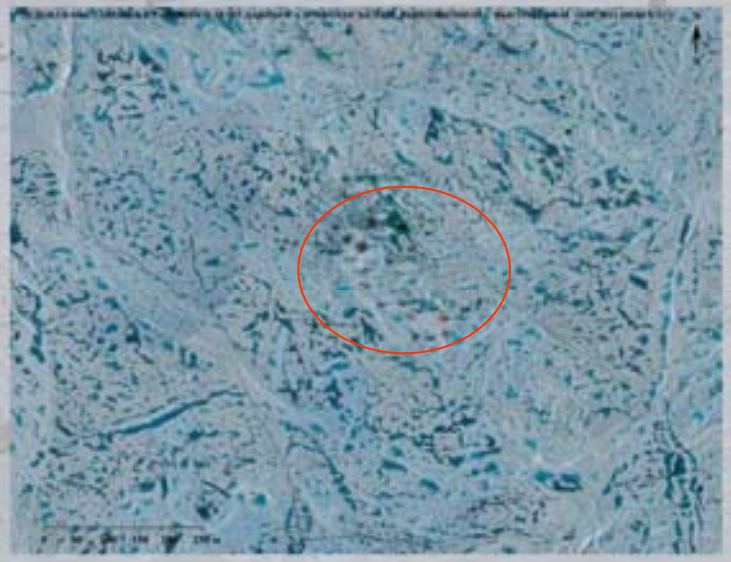
Sea ice floe of drifting station “North Pole 38” in summer



June 19



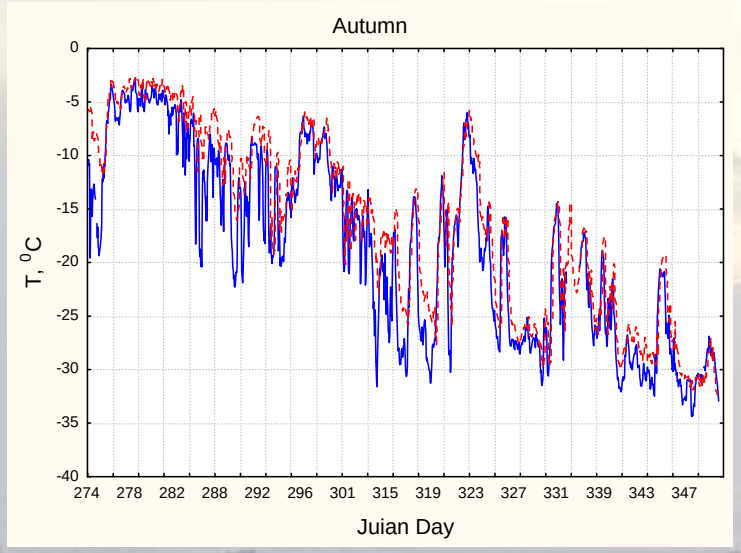
June 29

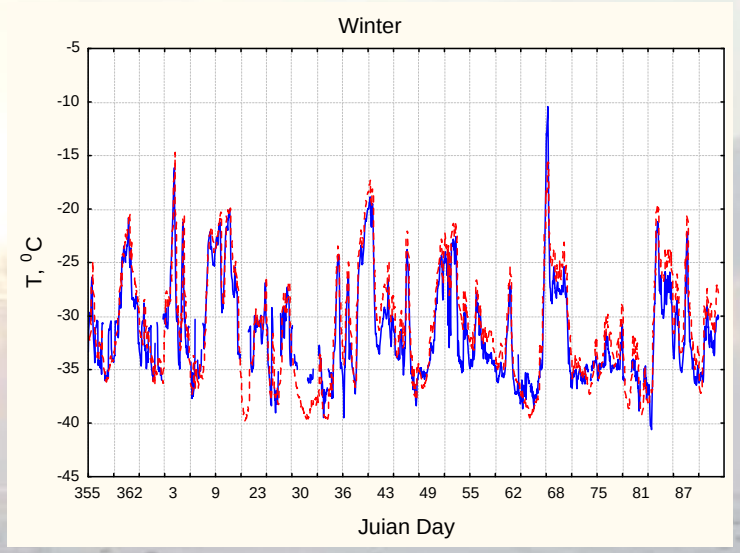


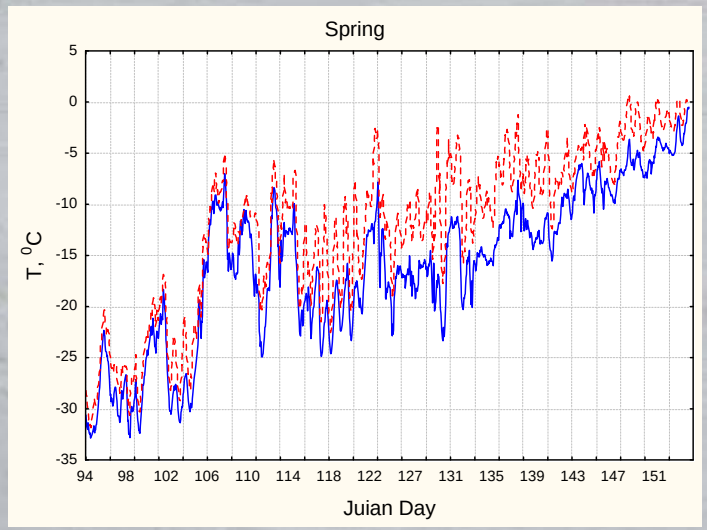
July 16

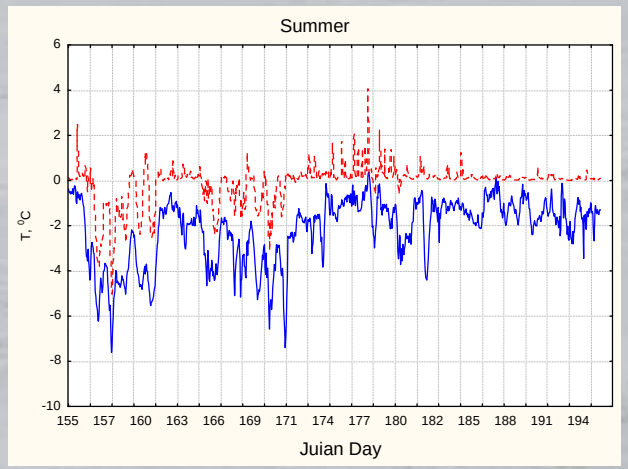
August 30

SKIN TEMPERATURE OF SNOW-ICE COVER, MEASURED WITH CONTACT SENSOR (RED) AND CALCULATED WITH DATA FROM IR-RADIOMETER (BLUE)

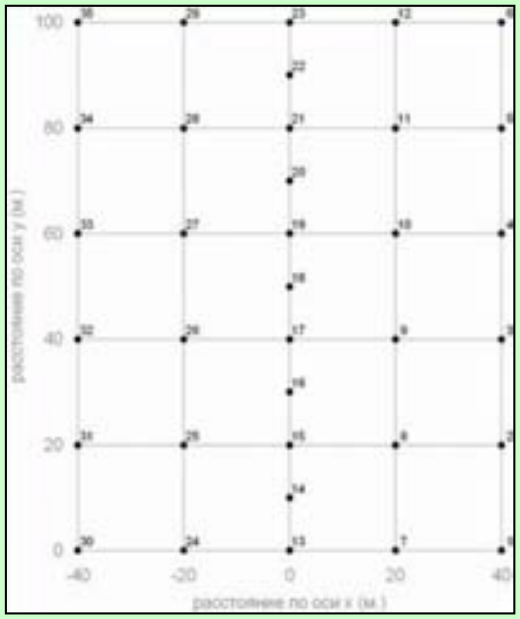


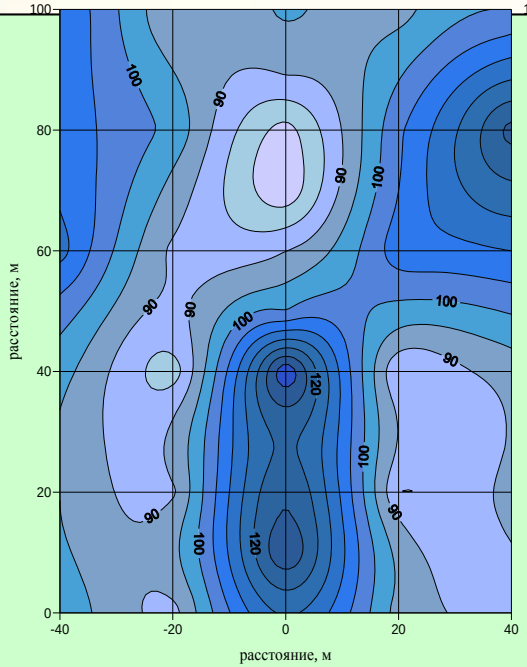




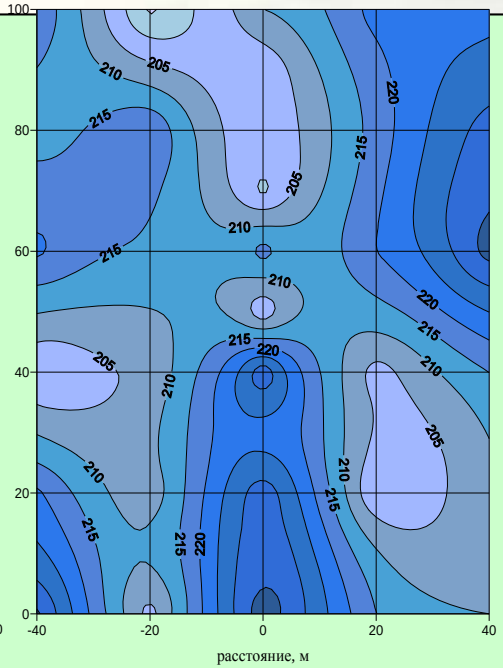


Results of ice thickness measurements (NP-36)

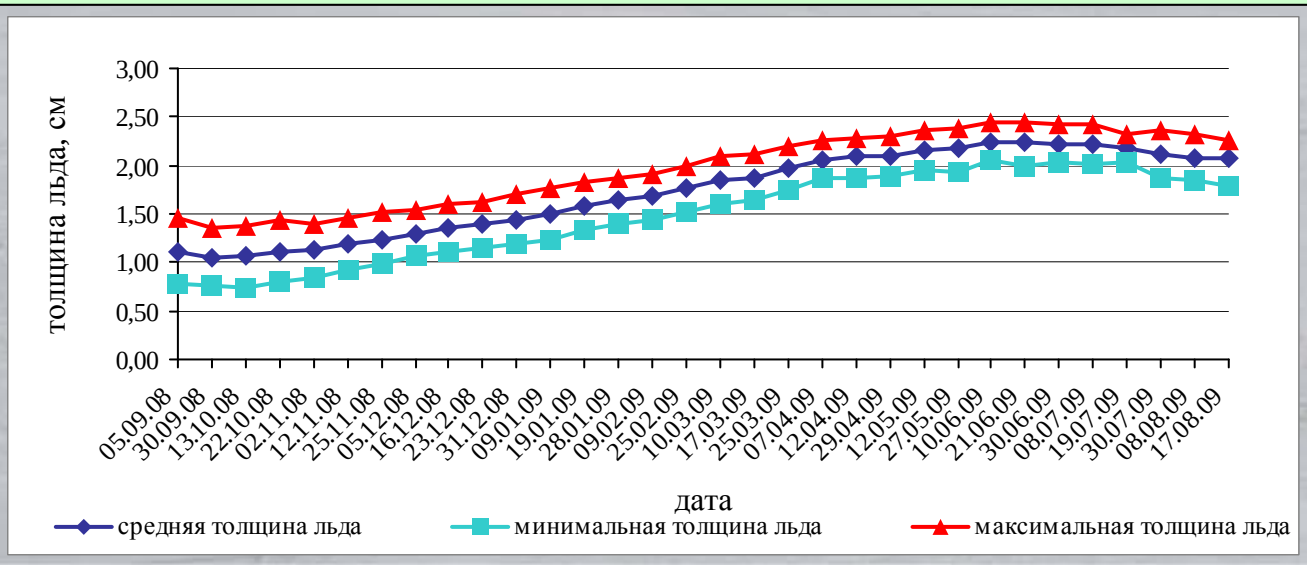




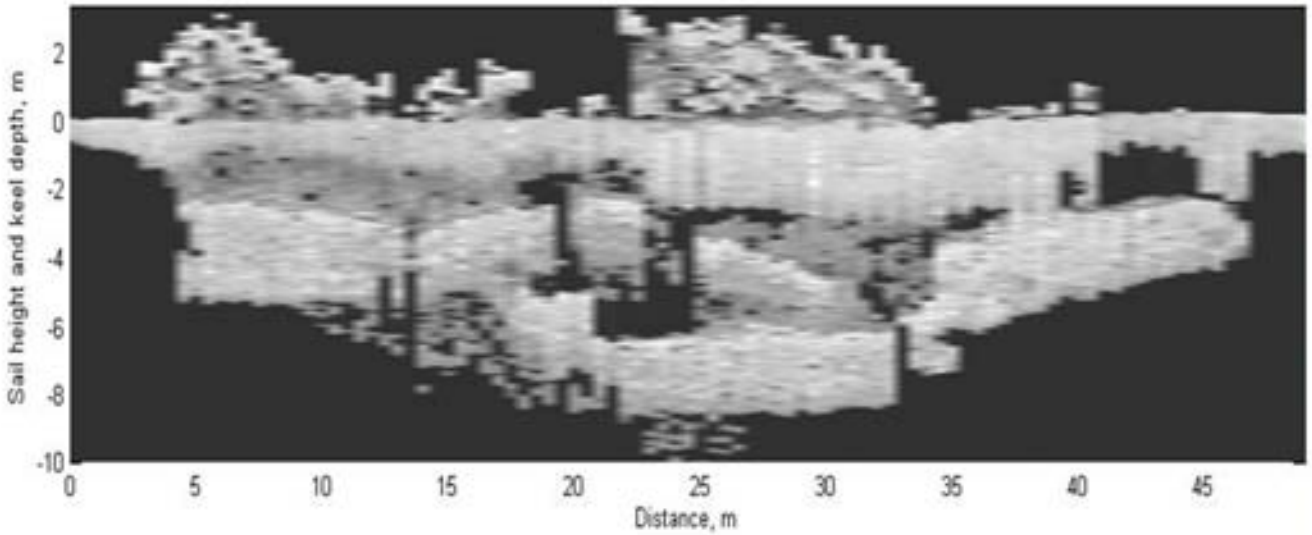
ледомерная съемка 30.09.2008 г.



ледомерная съемка 27.05.2009 г.



Structure of ridge (“North Pole -38”, March 2011)

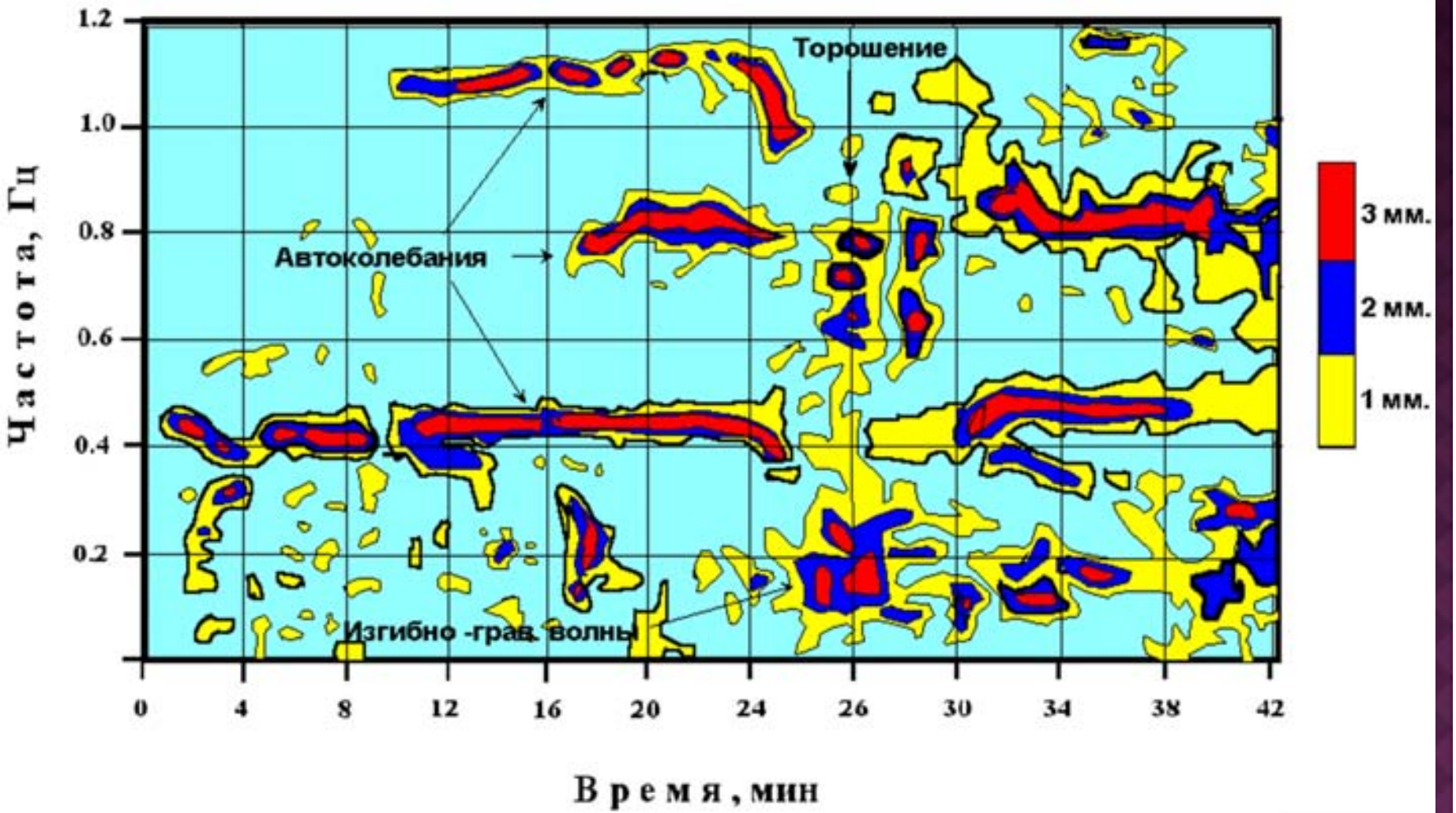


EASUREMENTS OF ICE FIELD DEFORMATION AND DYNAMIC PROCESSES

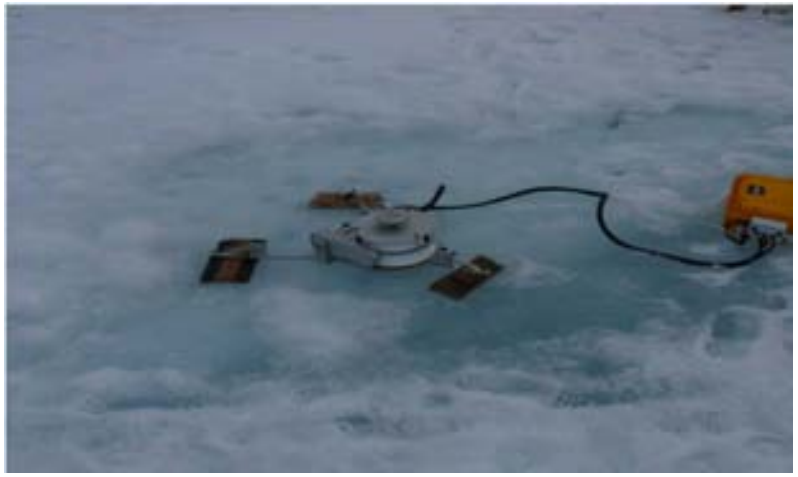
EFORMOMETERS, TILT INDICATORS, SEISMOMETERS, AND ACCELEROMETERS ON ICE

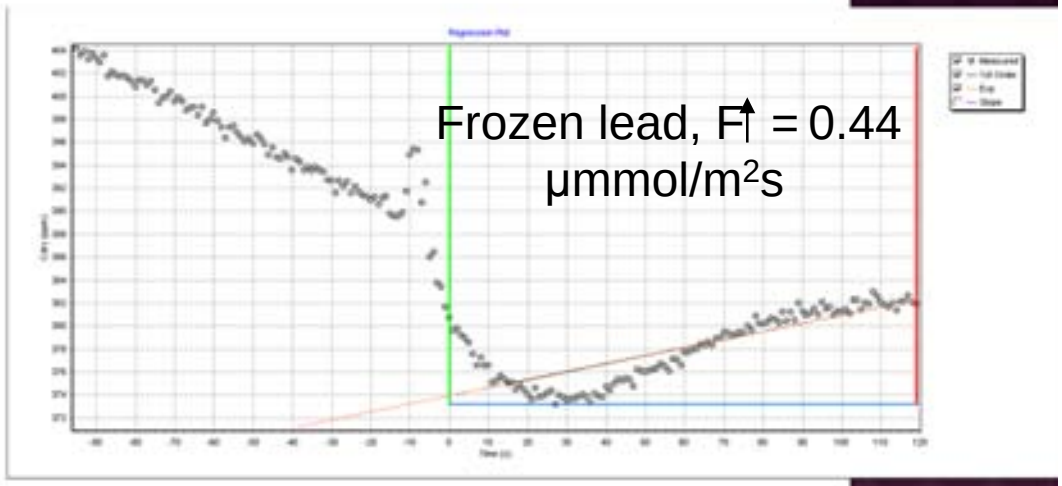
ELD)

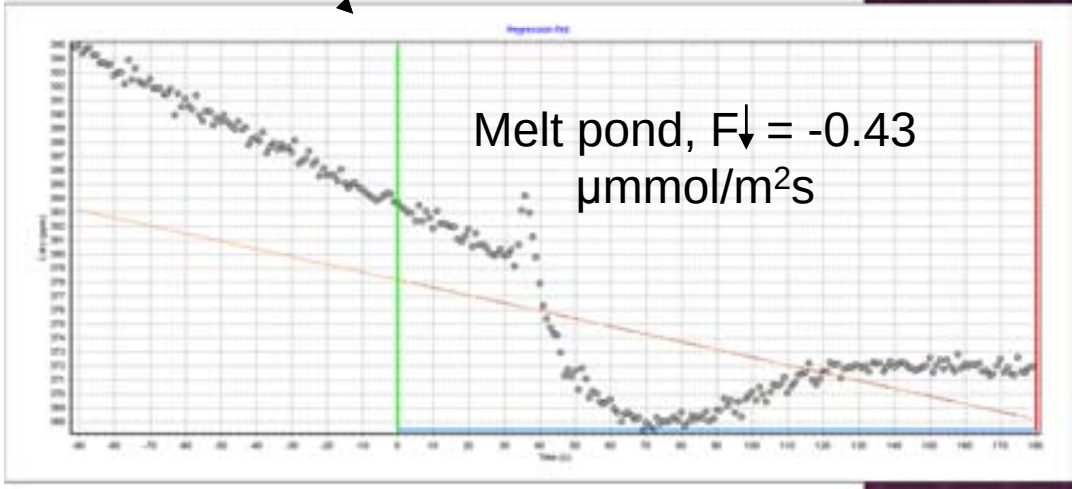
sPECTRA OF SEMI-OSCILLATIONS IN ICE FIELD



Preliminary results of direct measurements CO2 flux with automatic chamber





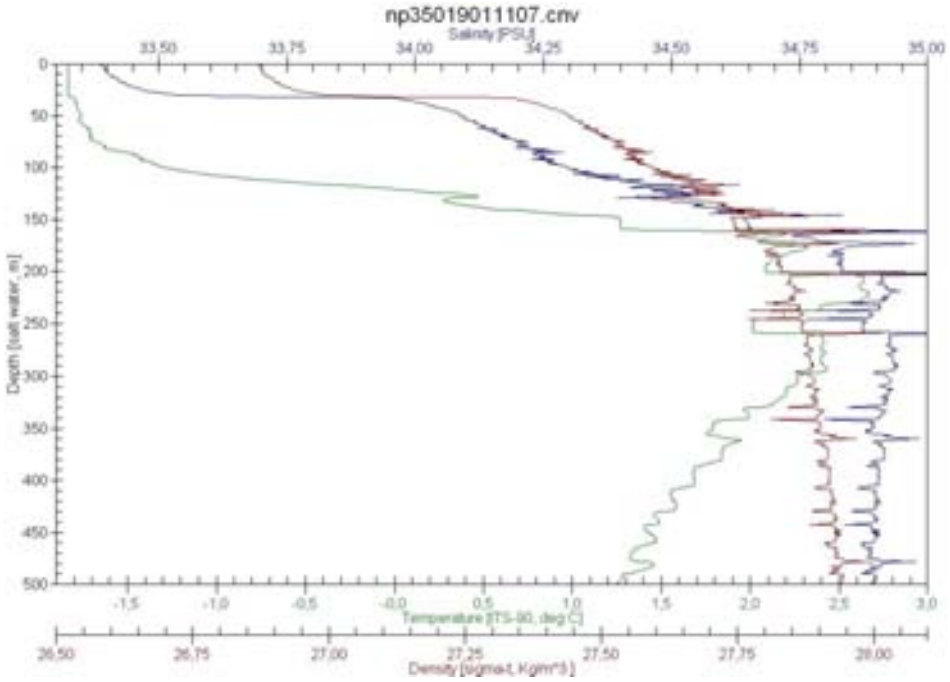


Absorption of CO2 from atmosphere by one-year ice, equal approximately to 30 mmol/m2, is the overall result of freezing and melting processes.

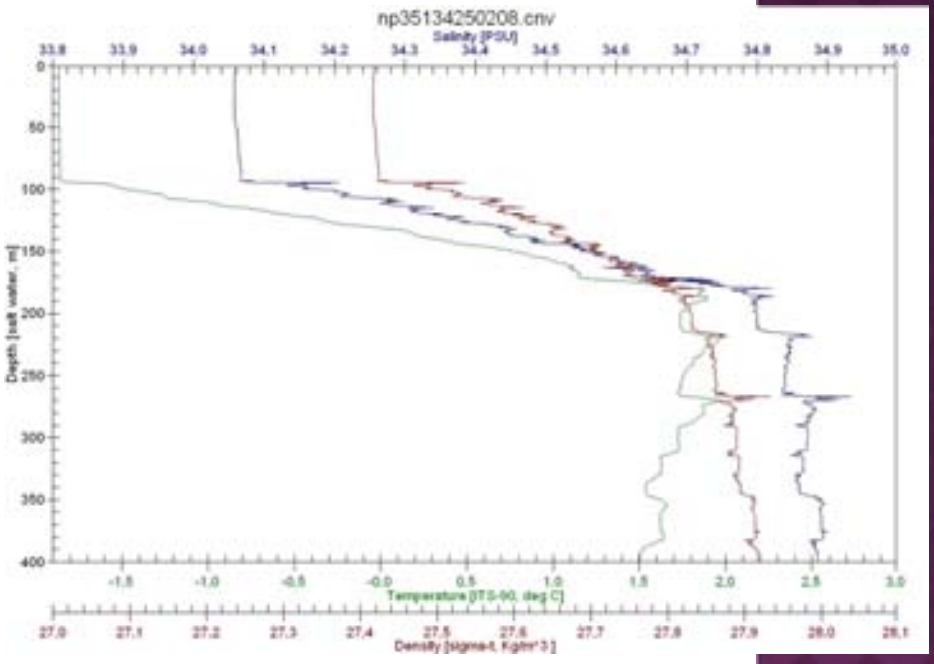
OCEANOGRAPHY

Sound “SBE 19 plus” on the way to ocean

Probe sampling by NISKIN bottles for hydrochemistry analysis



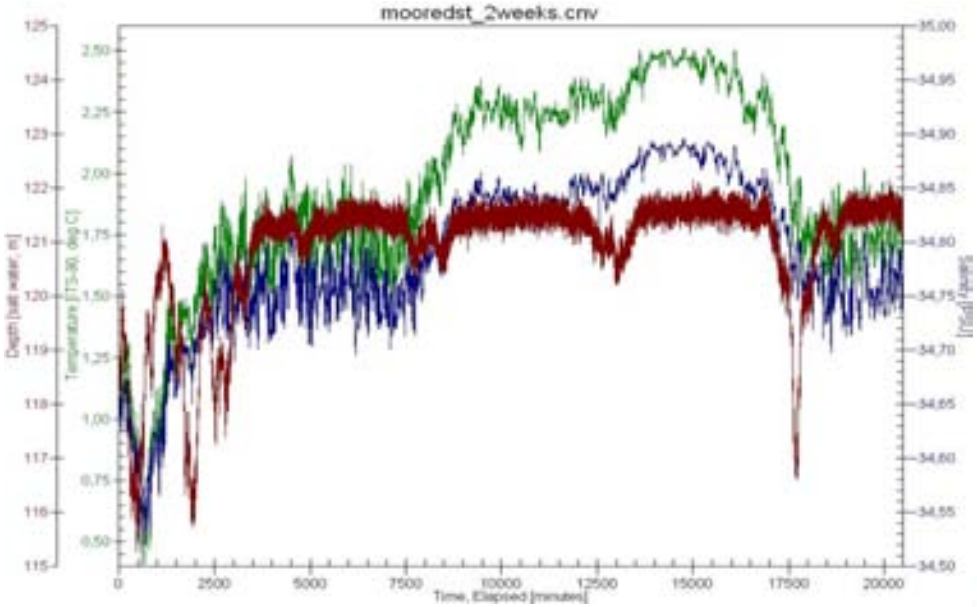
T,S – profiles in upper ocean, typical for Quasi-Homogeneous Surface Layer (QHSL) in Autumn and early Winter (November 01, 2007)



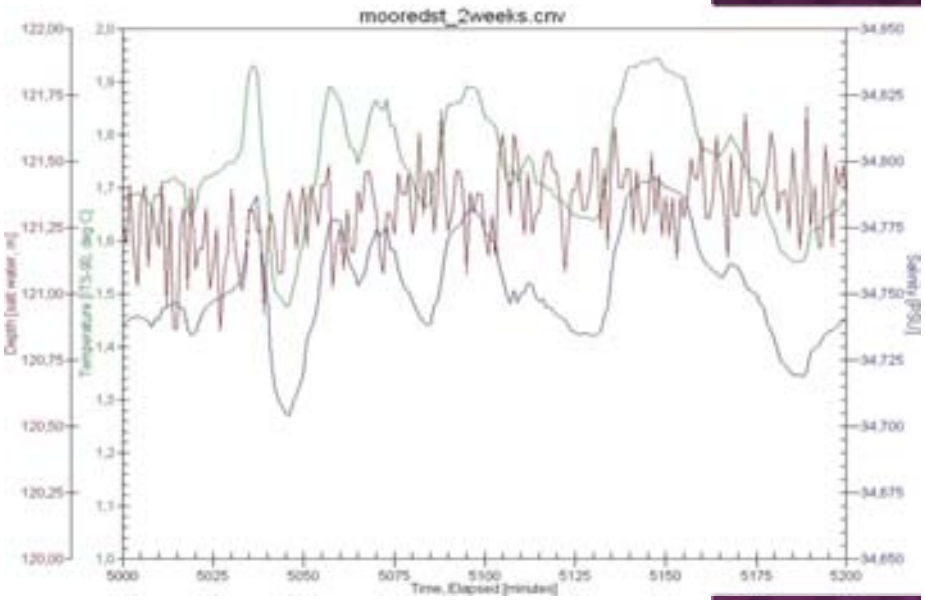
T,S – profiles in upper ocean, typical for Homogeneous Surface Layer (HSL) in Winter and early Spring (February 25, 2008)

Spatial-temporal variability of water temperature and salinity on the depth 120 meters

Period: June 3-17, 2008 Coordinates: 82 47’N, 28 25E - 81 37’N, 28 29’E

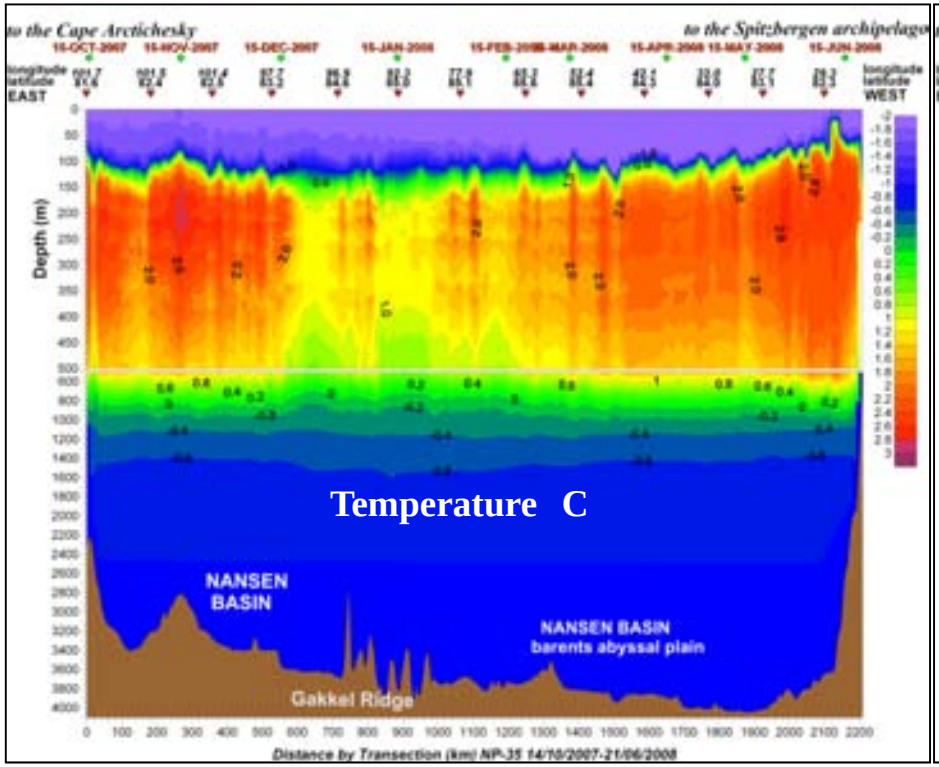


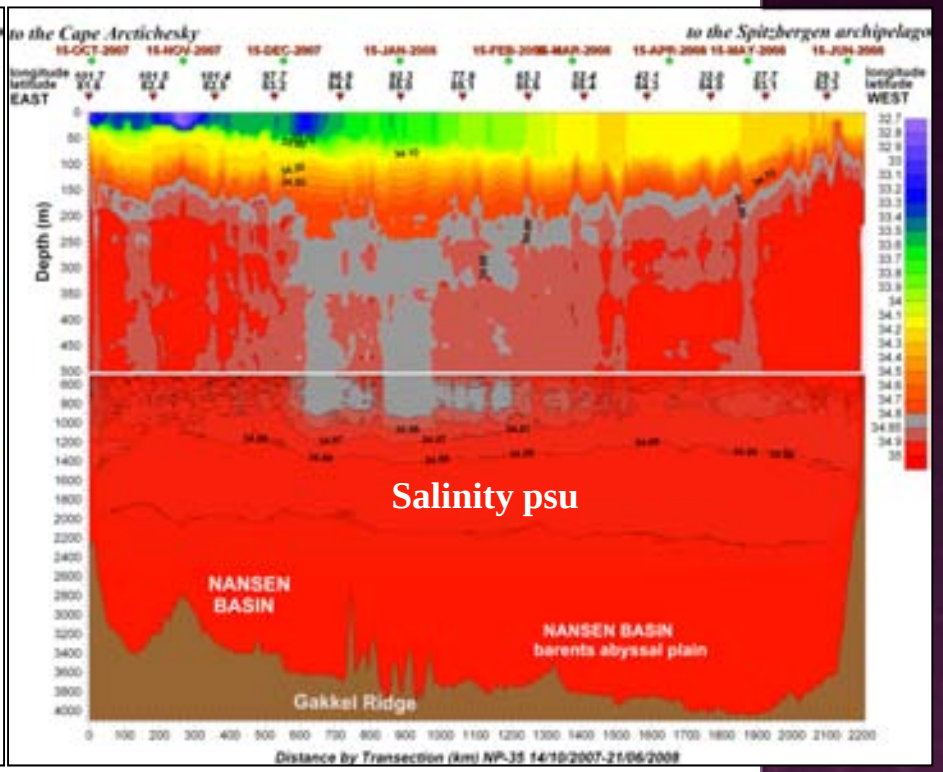
Periodicity of measurements 60 s.
Duration about 2 weeks

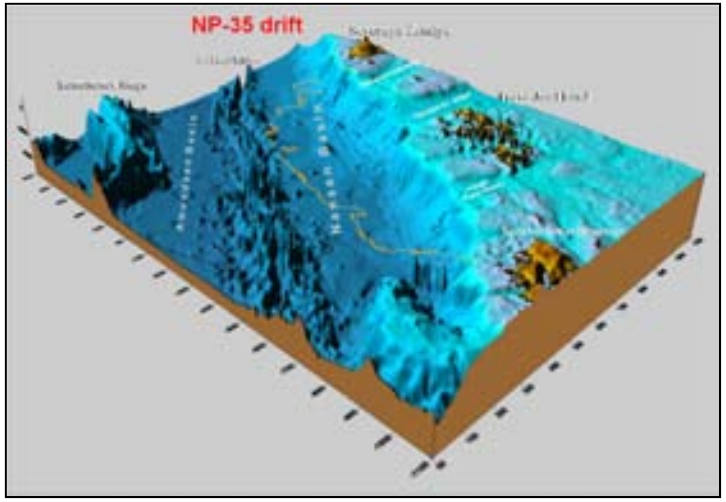


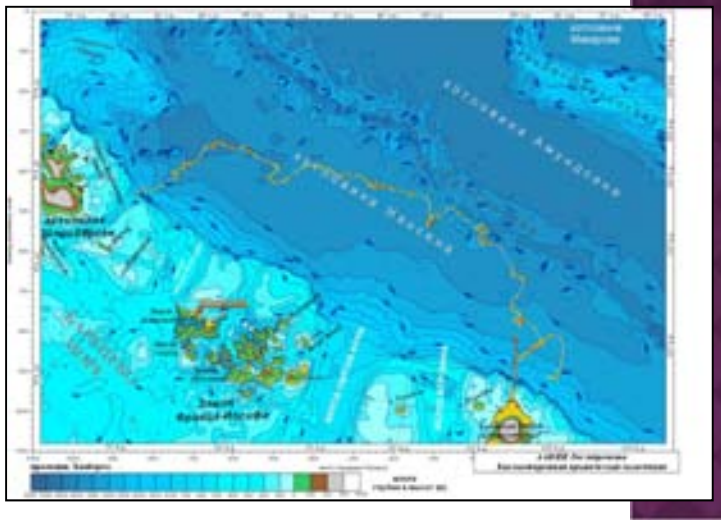
Fragment (approximately 3 hours)
ΔDmax ≈1 m; ΔTmax ≈0,45 C ; ΔSmax ≈0,08‰

Oceanographic Section NP-35

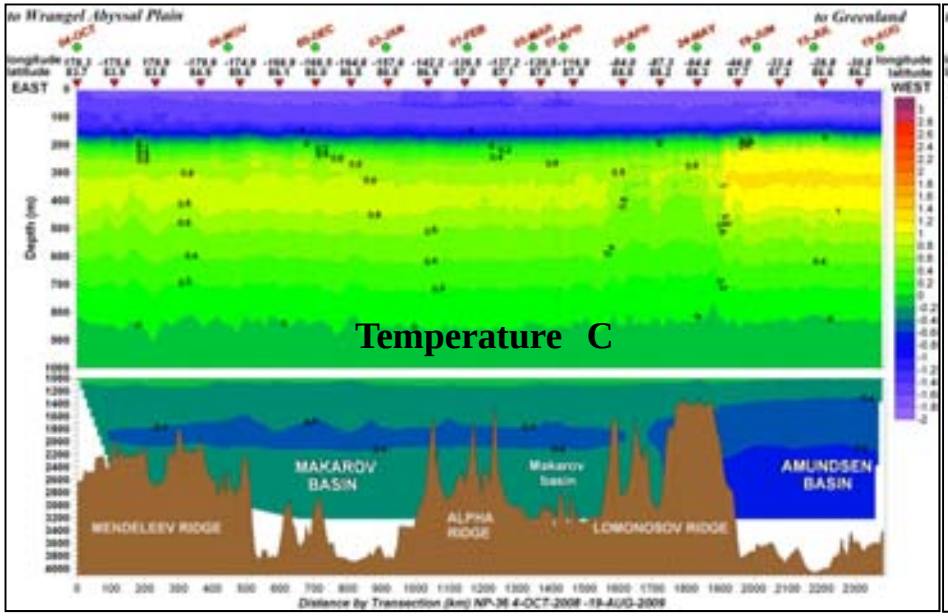


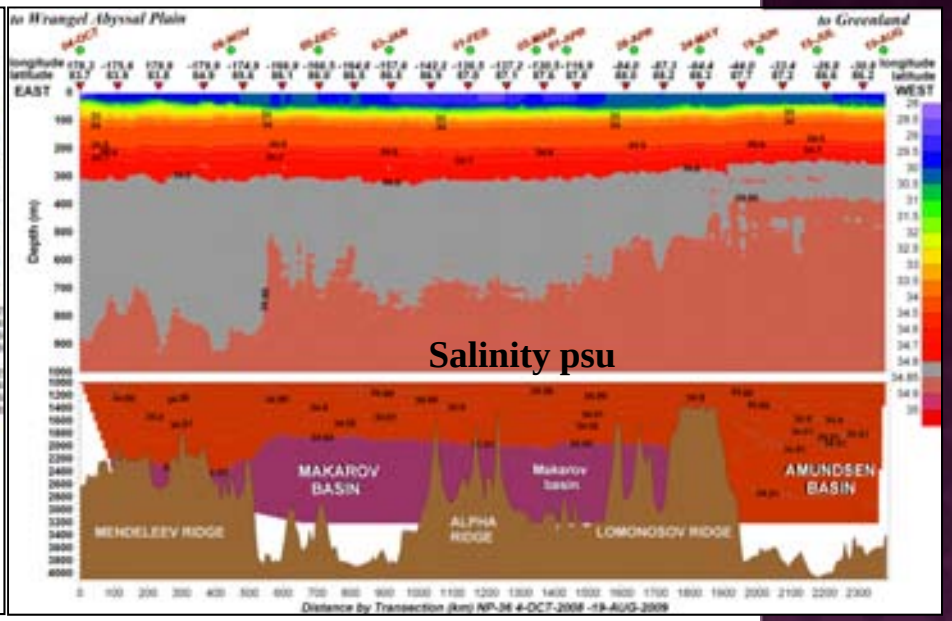


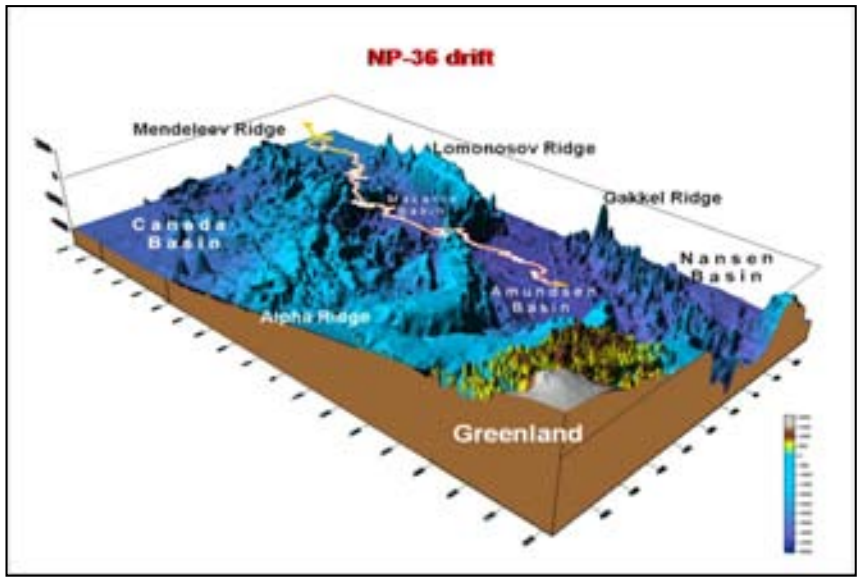


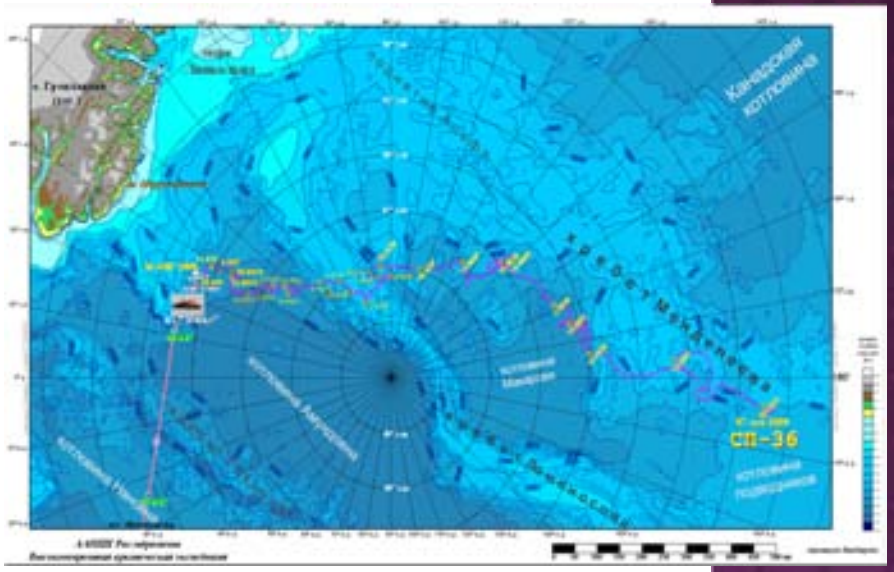


Oceanographic Section NP-36









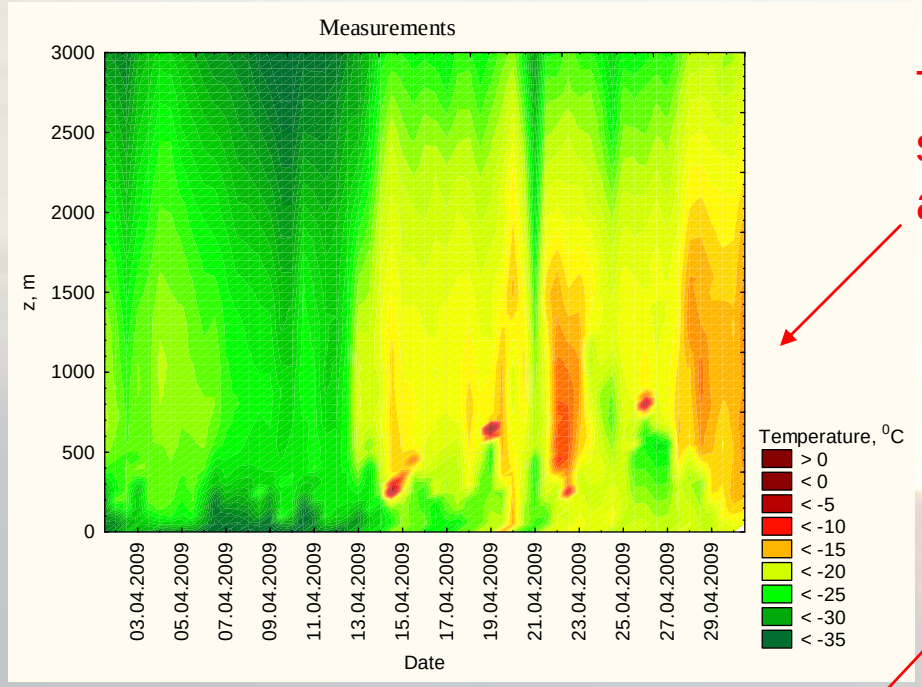
Some examples of utilization experimental data from drifting stations

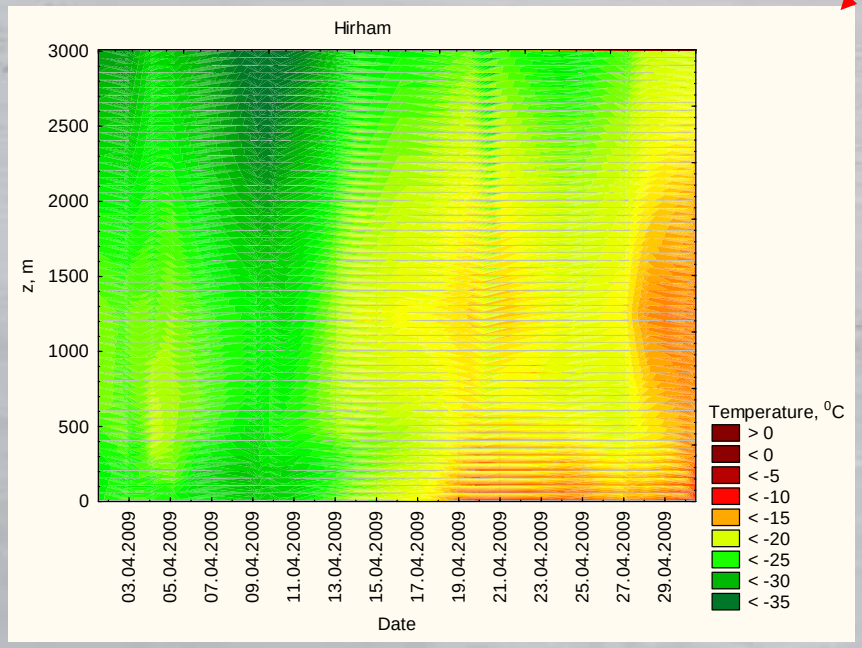
Statistics of comparison air surface temperature and total cloudiness between NP and NCEP/NCAR Reanalysis data for 2007-2008

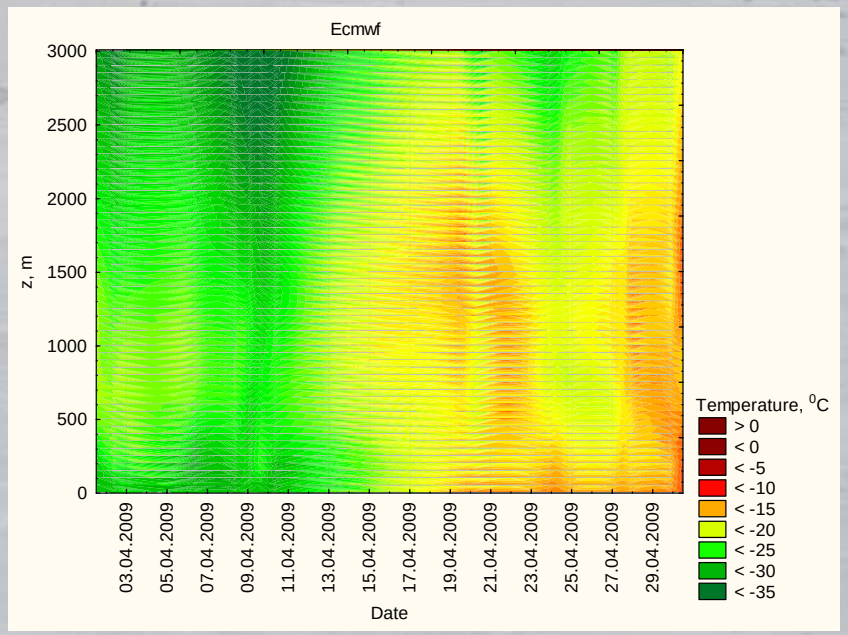
Season	T mean NP	T mean NCEP	Correlation	NCEP-NP
NP-35 (2007-2008)				
Winter	-29.4	-30.9	0.84	-1.5
Spring	-15.3	-13.2	0.97	2.1
Summer	-1.2	0.5	0.60	1.7
Autumn	-15.3	-18.1	0.89	-2.8
NP-36 (2008)				
Autumn	-17.7	-19.6	0.89	-1.9

Season	N mean NP	N mean NCEP	Correlation	NCEP-NP
NP-35 (2007-2008)				
Winter	4.2	4.0	0.48	-0.2
Spring	7.5	2.7	0.15	-4.8
Summer	9.4	4.2	0.30	-5.2
Autumn	7.9	5.0	0.34	-2.9
NP-36 (2008)				
Autumn	4.6	5.1	0.24	0.5

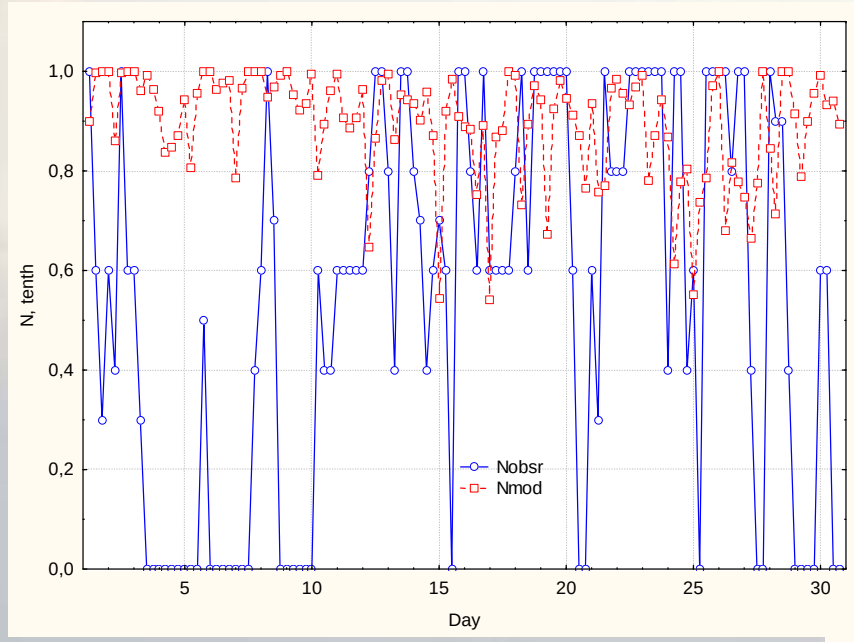
Time cross-sections of low atmosphere structure from radiosoundings, HIRHAM, and ECMVF for April 2009

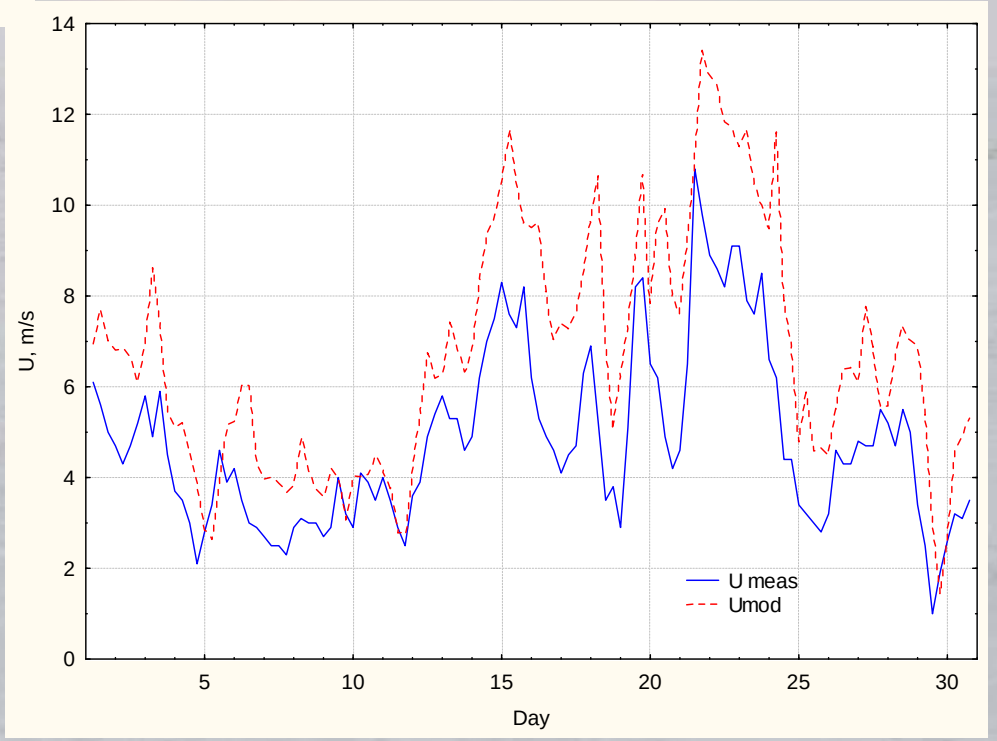




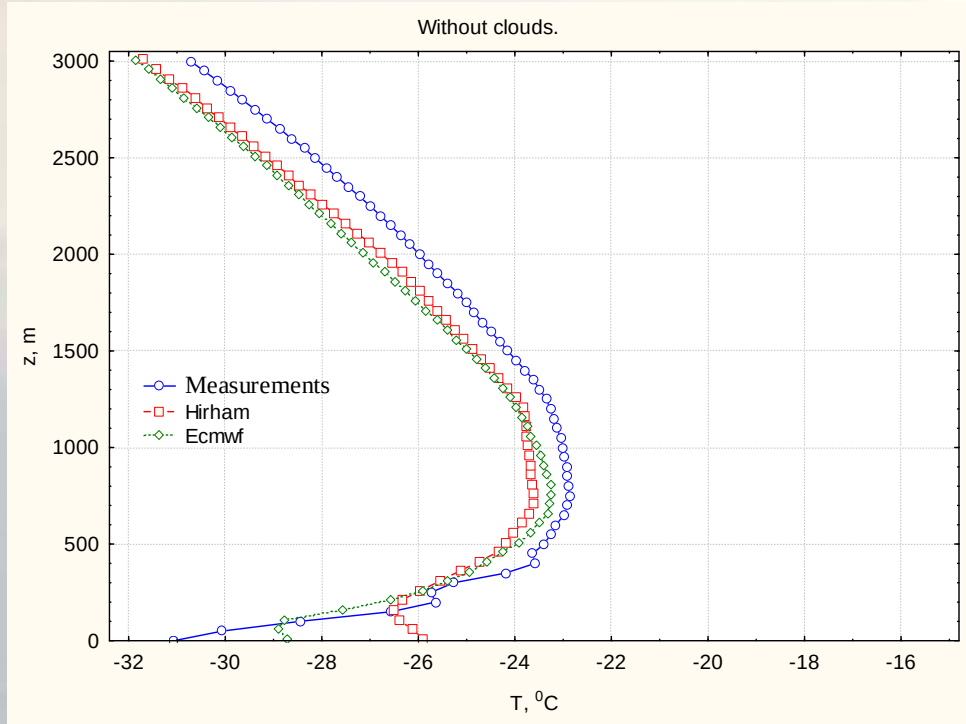


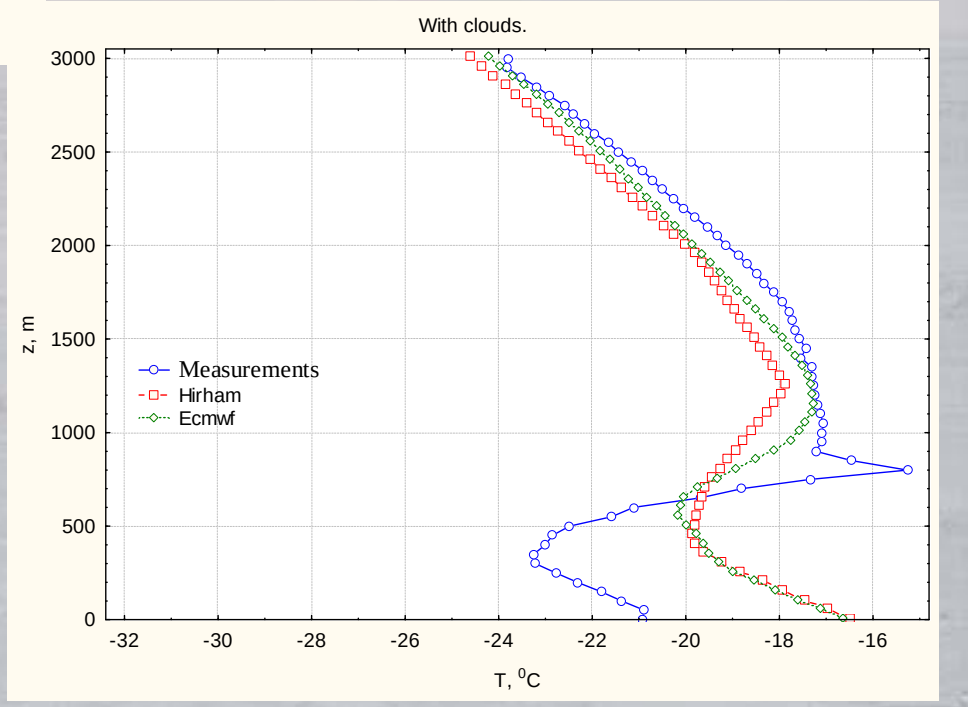
Total cloudiness and wind velocity from measurements and calculated with HIRHAM



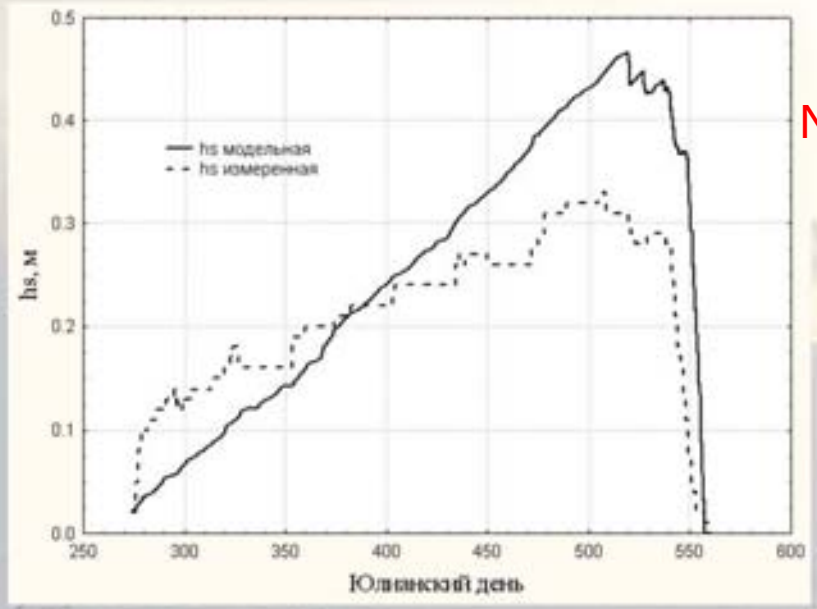


Monthly mean profiles of air temperature from radiosoundings and calculated by HIRHAM and ESMWF

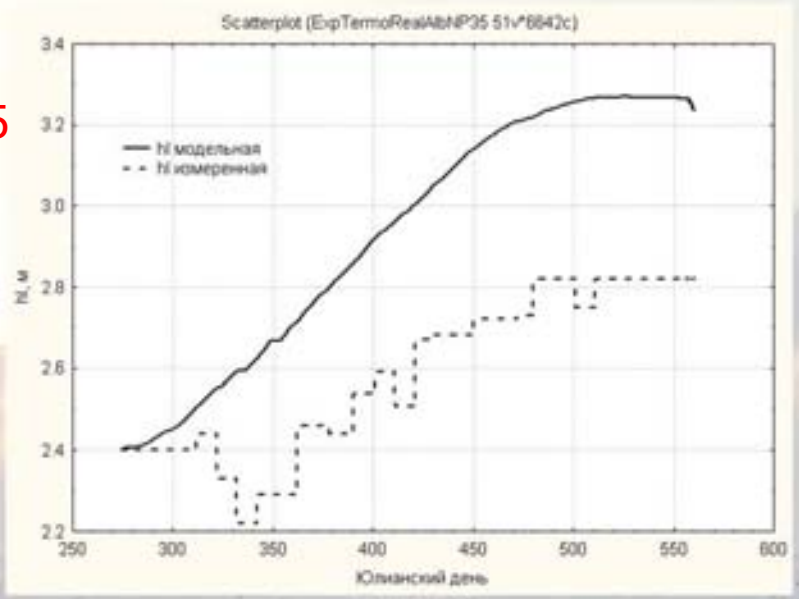


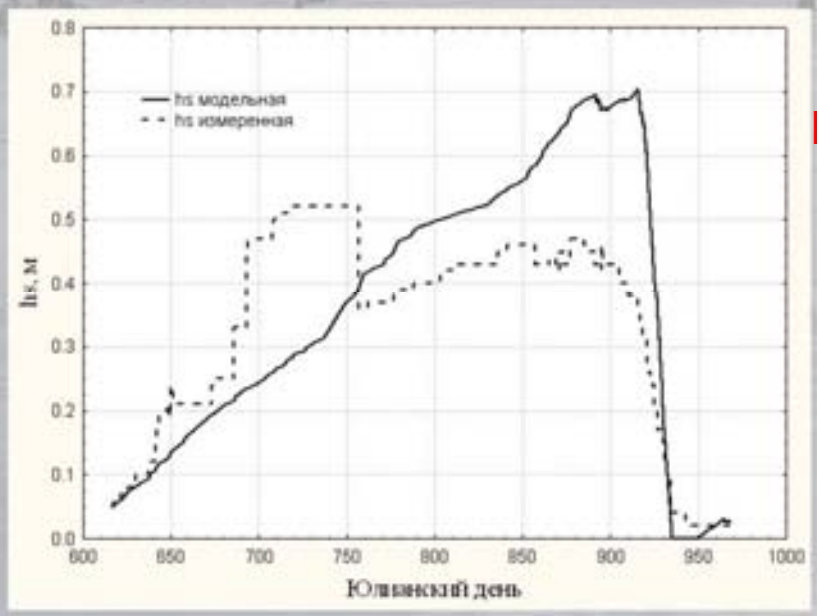


Comparison of modeled and measured snow and ice thicknesses

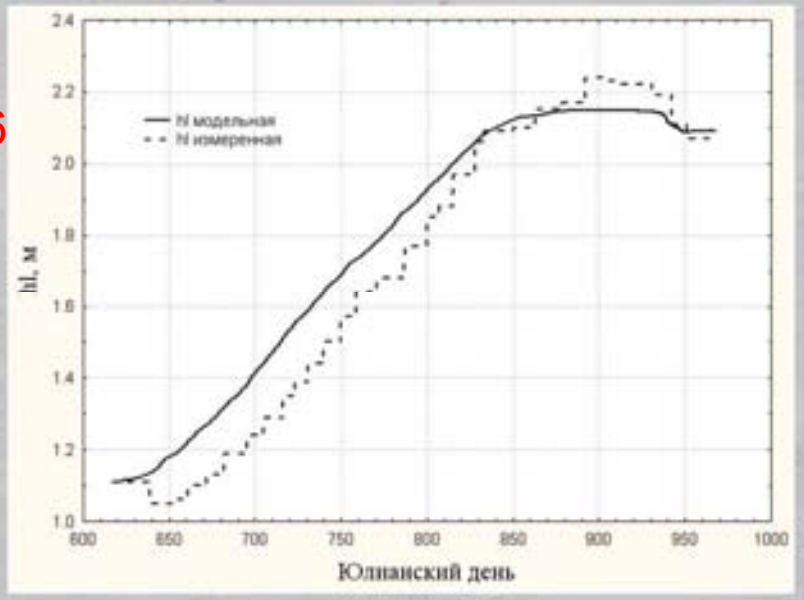


NP-35

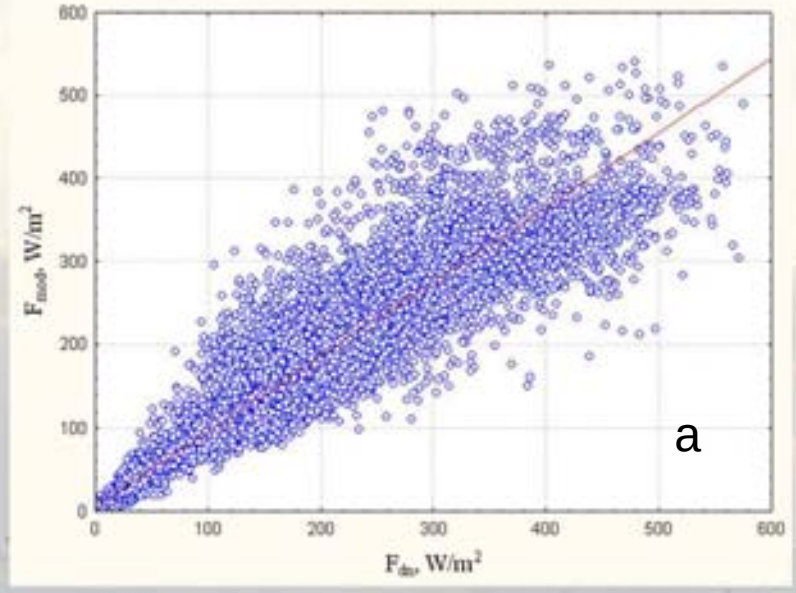


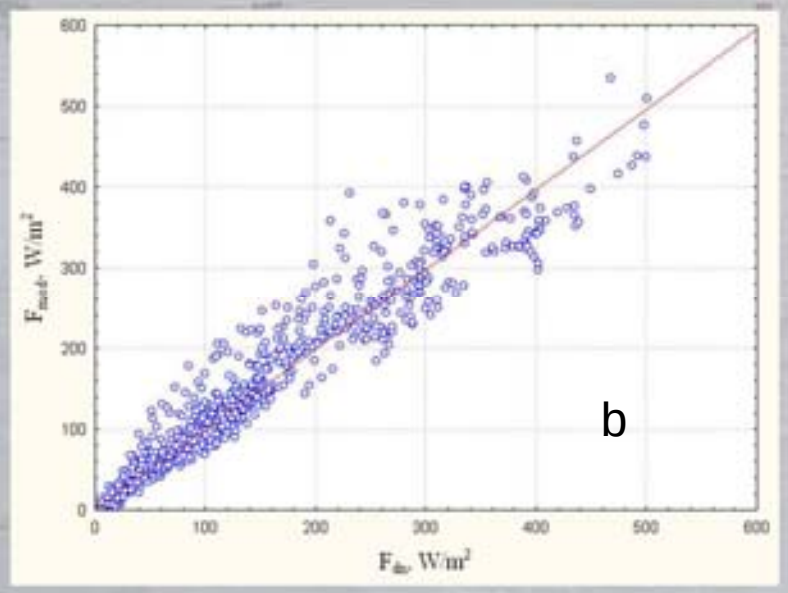


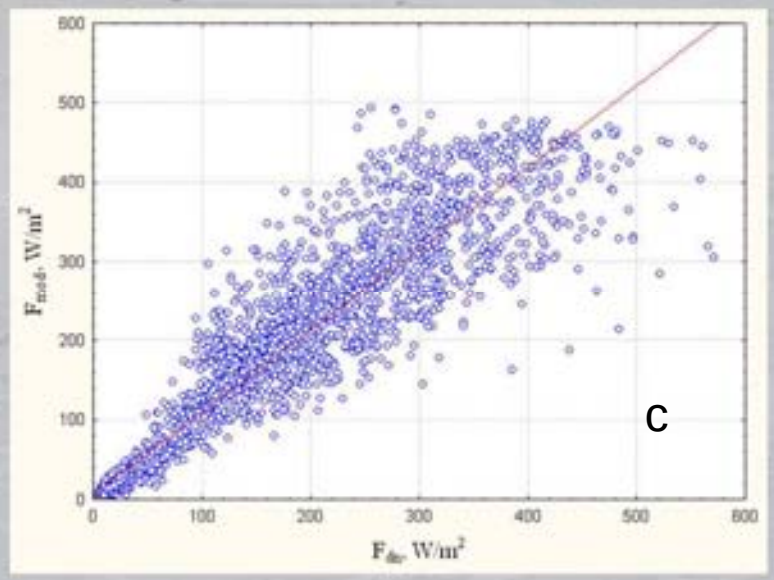
NP-36



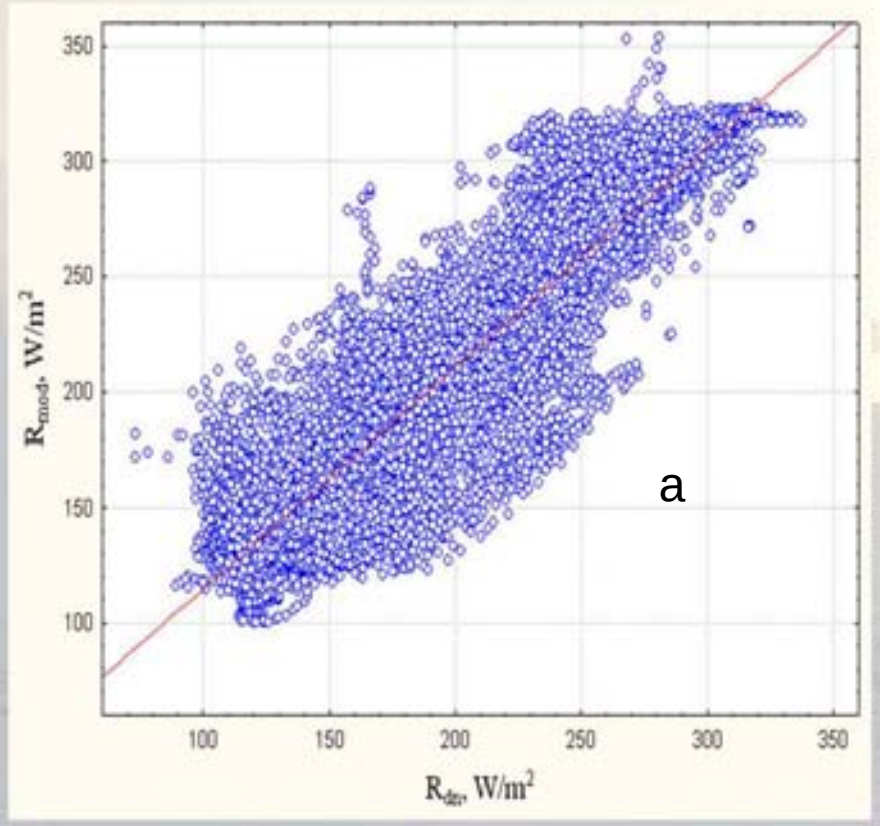
Comparison of global radiation, calculated with Zilman & Shine parameterizations, with observations for (a) all data, (b) clear sky and (c) total overcast

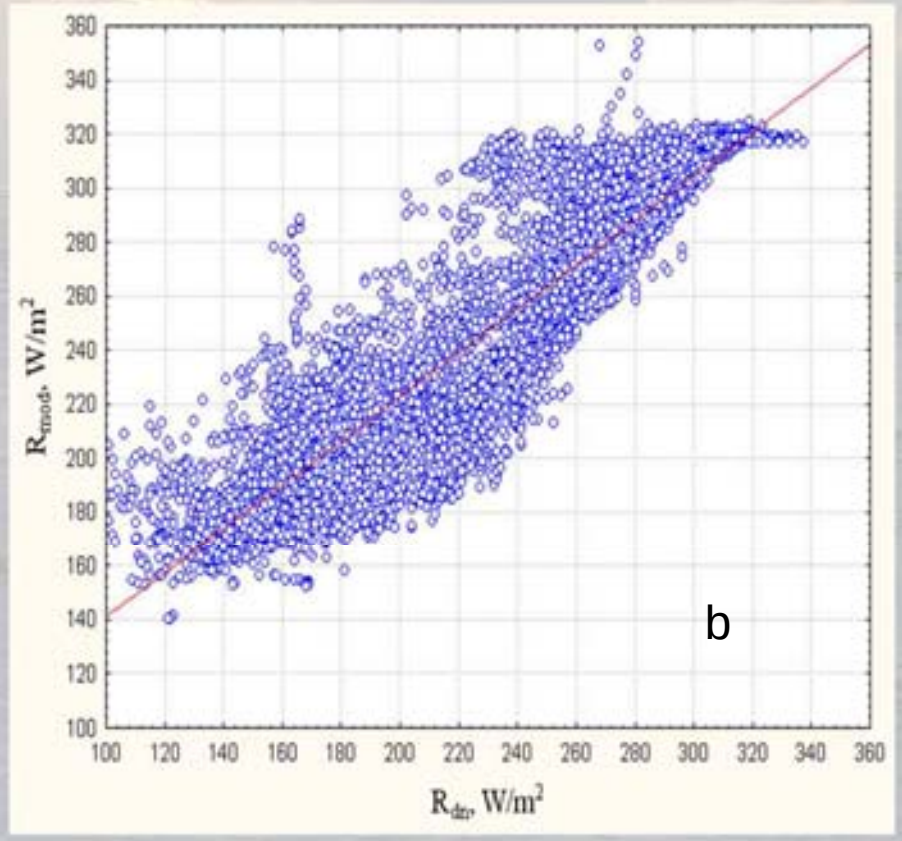




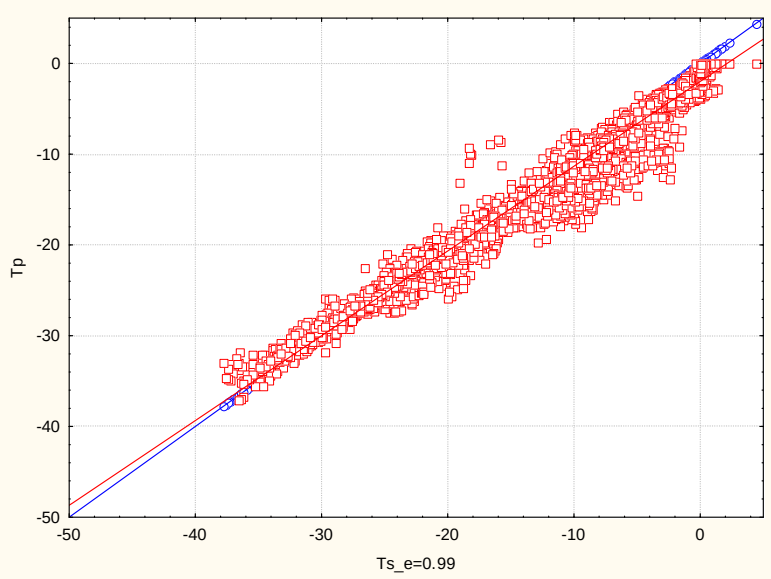


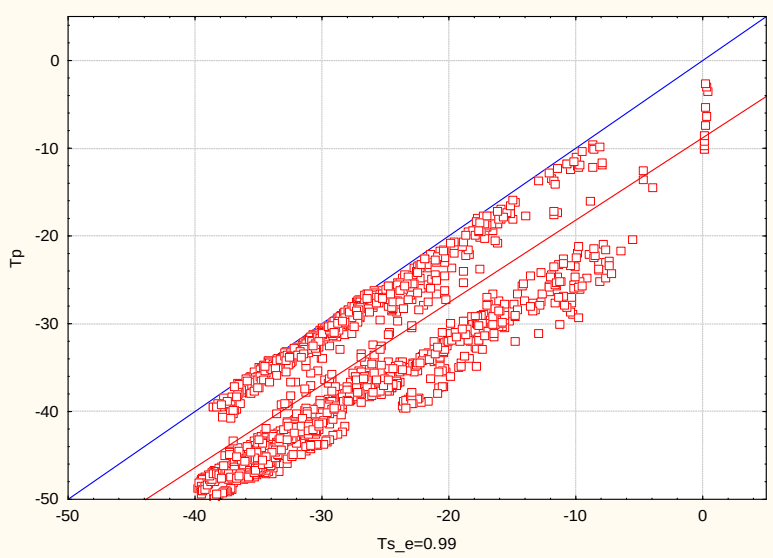
Comparison of incoming long-wave radiation, calculated with Brent parameterization, and observations for (a) all data and (b) total overcast

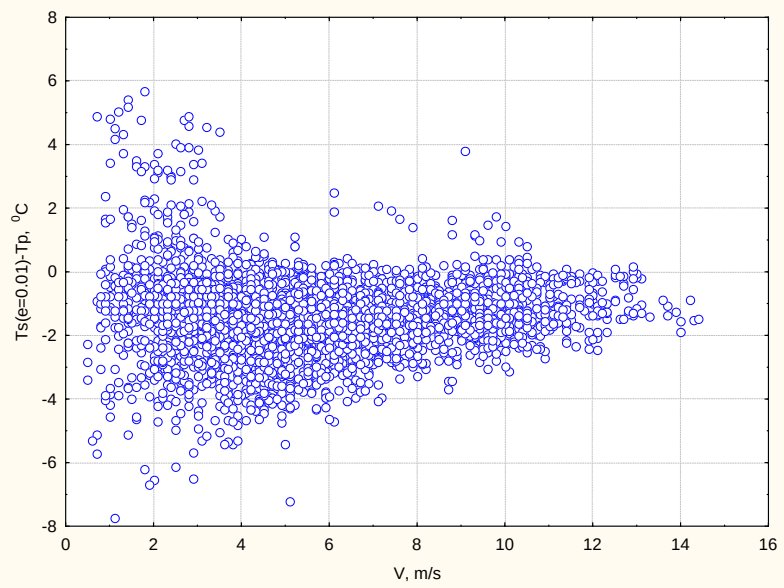


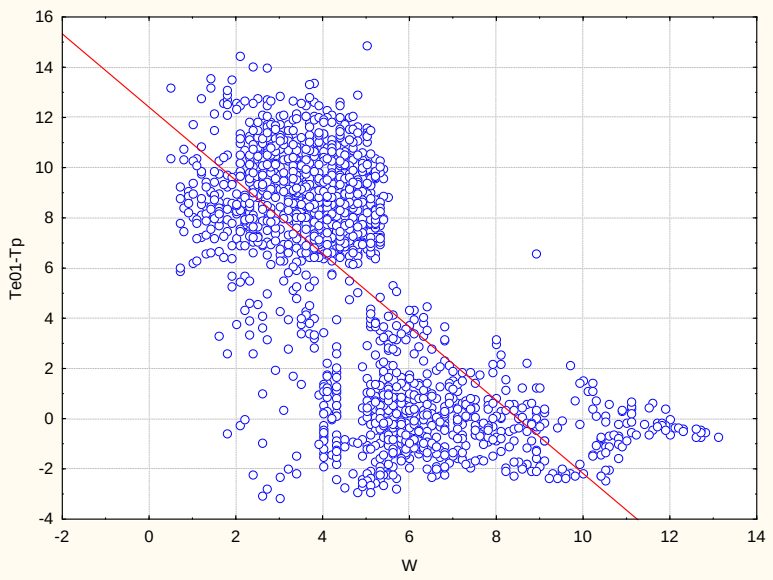


Correlation between measured and model calculations of surface temperature (top) and dependence of temperature difference on wind speed (bottom) for overcast (left) and clear sky (right) conditions

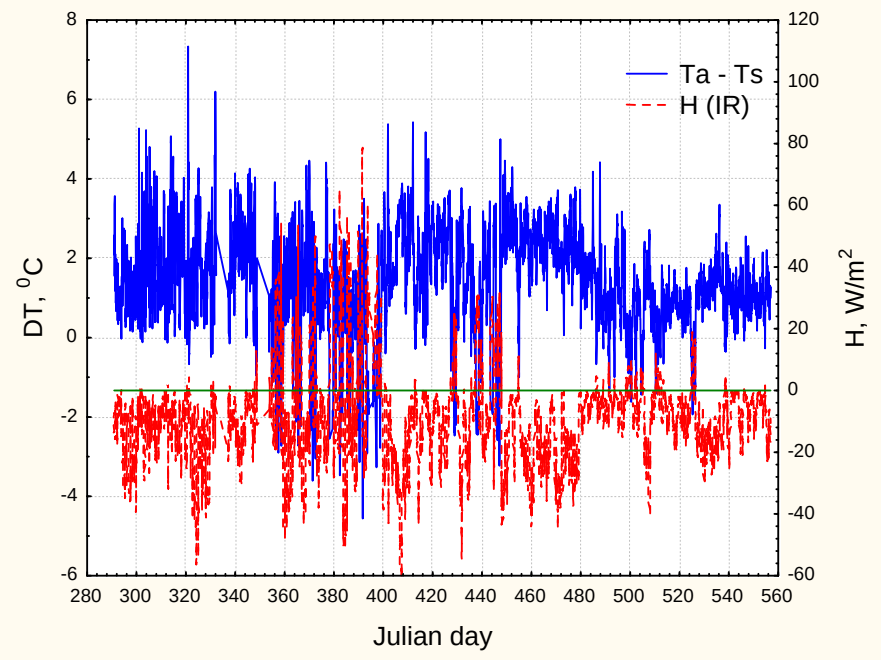


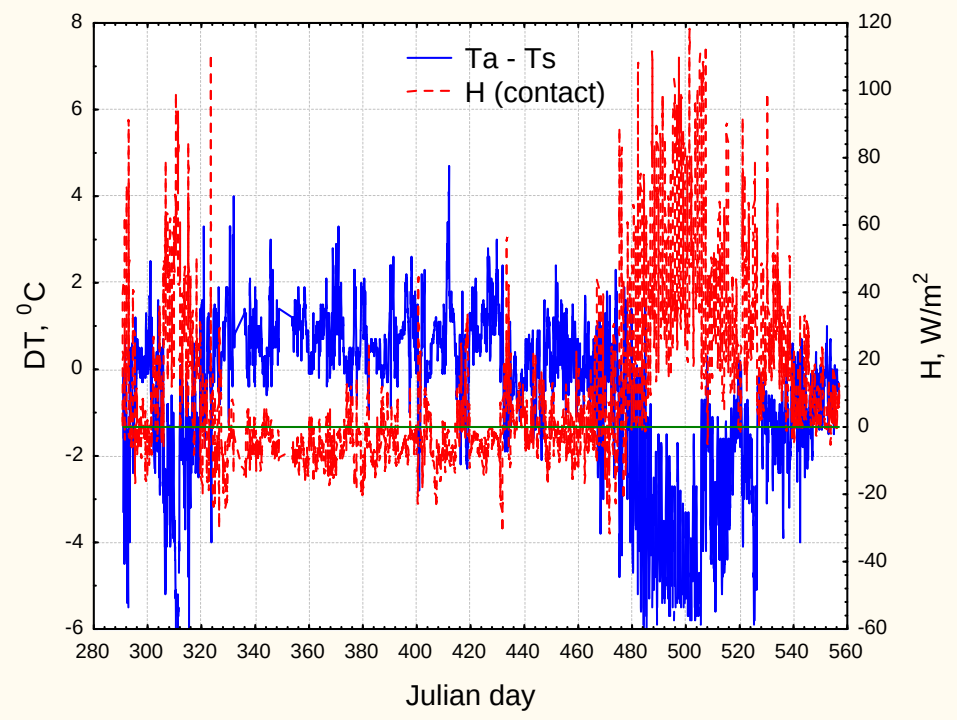






Turbulent sensible heat flux, calculated using surface temperature from IR and contact thermometer measurements





Scope of future work

1. Study of polar cloudiness

2. Detailed investigations of atmospheric surface and boundary layer.

3. Comprehensive study of atmospheric ozone (from surface to stratosphere).

4. Study of greenhouse gases concentrations (fluxes?).

5. Investigations the spatial characteristic and radiation properties of sea ice cover.