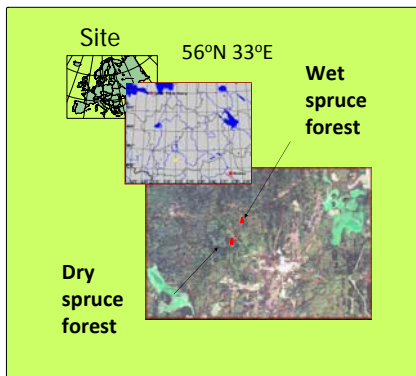
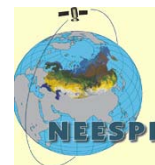


Carbon Dioxide Fluxes in European Russia

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Measurements of carbon balance of boreal ecosystems in the southern taiga of European Russia have been conducted using eddy covariance technique since 1998. The method allows to continuously quantify Net Ecosystem Exchange (NEE) of CO₂, of H₂O and sensible heat fluxes between forest and the atmosphere with high time resolution. Simultaneously measured atmospheric meteorological parameters allow to derive the response of CO₂ and H₂O fluxes to changes of environmental conditions.

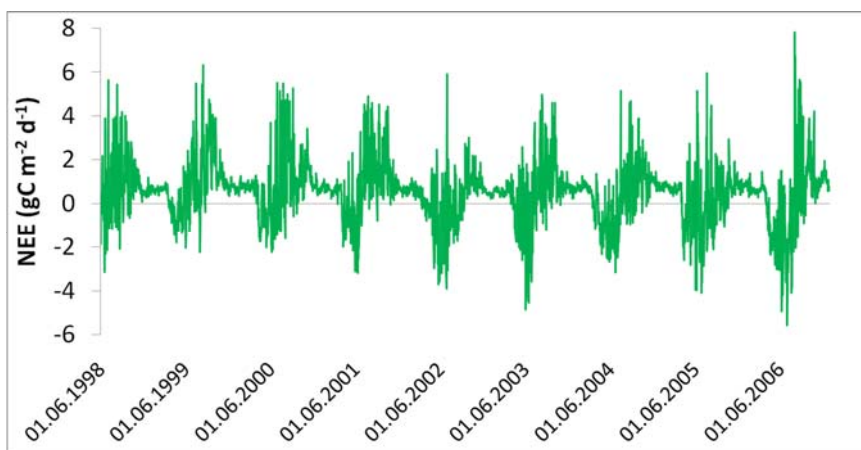
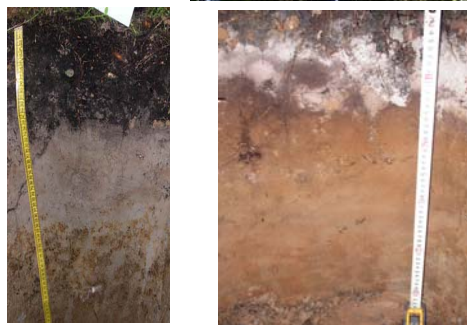
The studies have been conducted in the Tver Region, Russia (Central Forest Biosphere Nature Reserve, 56N, 33E) using a 29 m high tower in low-productive wet spruce forest (*P. Sphagnum* forest, WSF), using a 44 m high tower in high-productive dry spruce forest (CSF), and a small 6 m tower in ombrotrophic bog.

Climatic conditions at Central Forest Biosphere Reserve

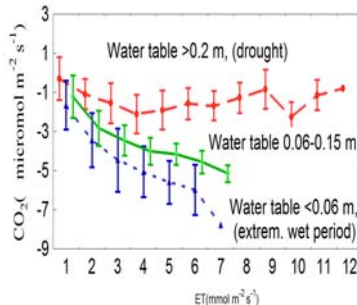
Temperature, °C	
Absolute max	22.0 (1938)
Annual mean	3.7
Absolute min	-25.2
Average min	-9.6
Average July temperature	16
Average January temperature	-8.6
Precipitation, mm	
Annual mean	629
Growing season	
Days > 5 °C	170
Days > 10 °C	127
Fire-storm/drought frequency (yr)	
	9-15/15-20



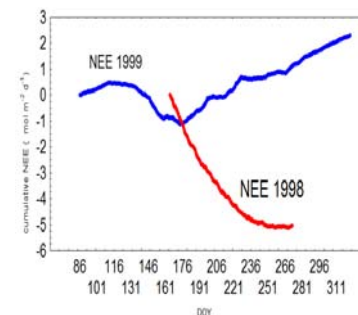
Wet spruce forest Dry spruce forest



Measured NEE CO₂ at the wet spruce forest site in 1998 - 2006 years



Relationships between H₂O and CO₂ fluxes under different water level conditions. Bog. 1998-2000 years



Cumulative NEE at the bog site in 1998-99 years

Vegetation and soil properties at experimental forest sites

Land cover	Total (km ²)	246
	Forest (%)	81
	<i>Picea abies</i>	39
	<i>Pinus sylvestris</i>	9
	Small-leaved	32
	Wetland	17
	Grassland	<1
Soil type	podzol/Gley/peat	
Aboveground biomass (t ha ⁻¹)		50-60
Soil carbon		68-250
Leaf area index		5

Results:

Our data confirm that there are strong interseasonal and interannual variability of CO₂ fluxes between the atmosphere and the forest ecosystem.

The data indicate a strong seasonality of NEE, with the maximum in spring and in the first part of summer. Interannual differences in cumulative NEE depend on the magnitude of CO₂ uptake in spring and in the beginning of summer. Annual NEP correlates well with weather extremes in the spring and in the beginning of summer.

Seasonal and interannual weather variability has a pronounced impact on the magnitude and also on the signs of CO₂-fluxes.

The measured multi-year average NEE fluxes were +2000 and -1440 kg C ha⁻¹ yr⁻¹ for WSF and DSF, respectively. The observations indicate that WSF was a weak source while DSF was a weak sink for atmospheric CO₂ during the observation period.

The sign and the mean of carbon dioxide fluxes between the surface of the bog and the atmosphere depend on humidity conditions during the green season. When the water balance is negative the ombrotrophic bog becomes a source of carbon for the atmosphere.