

Influence of the extreme weather events on carbon fluxes in southern European taiga

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Fig. 1. Geographical location of the CFSNBR.

- **Central Forest State Natural Biosphere Reserve (CFSNBR)** (56° 26' - 56° 31' N и 32° 29' - 33° 29' E);
- temperate moderately continental climate;
- the limestone terrace on the southern slope of the Valdai Hills - not covered by Valdai glaciation
- watershed of the largest rivers of the Russian Plain (Volga, West Dvina, Dnepr);
- Quaternary deposits formed by uniform loamy material of Moscow (Riss) moraine deposits, partly covered by fluvio-glacial deposits of Valdai moraine;
- transition zone from south taiga to mixed coniferous-broadleaved forests;
- low anthropogenic transformation.

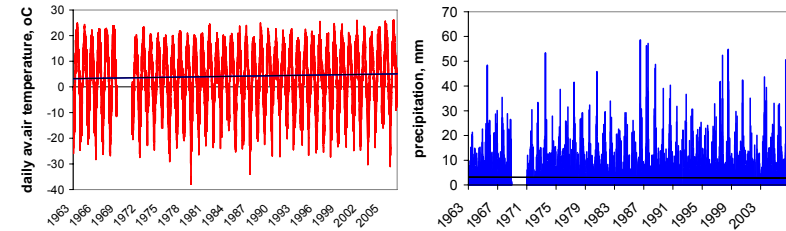


Fig. 3. Daily average air temperature and precipitation in CFSNBR. The observations have shown low trends of air temperature and precipitation.



Wet spruce forest

Dry spruce forest

Fig. 2. Eddy covariance measurements in CFSNBR.

Eddy covariance measurements have been provided in two types of forest ecosystems of southern European taiga - in the *Piceetum Sphagnum* forest (wet spruce forest -WSF) and in the complex spruce forest (dry spruce forest -DSF). The eddy tower in WSF of 29 m height has been erected in 1998 year in a 150-yr-old spruce forest of *Sphagnum-Vaccinium myrtillyis* type. Average height of this forest is 20-25 m. Stand is composed from spruce (*Picea abies*), birch (*Betula pubescens*) and rare pine (*Pinus sylvestris*). The soil has a deep peat horizon (20-80 cm).

The second eddy tower of height 44m was established in October 1999 year in high-productive spruce forest with a large admixture of deciduous species. The depth of humus horizon does not exceed 5-10 cm. The soil with a better drainage and a higher fertility compared to DSF led to the development of complex spruce (53%) stand with birch (5%) and aspen (6%) (*Populus tremula*) in the first stand layer and broadleaf species (elm (6.4%) (*Ulmus glabra*), maple (18%) (*Acer platanoides*), lime (3%) (*Tilia cordata*)) in the subordinate layer. The herb layer is formed from *Milium effusum*, *Festuca altissima*, *Pulmonaria obscura*, *Aegopodium podagraria*, *Mercurialis perennis*, *Glechoma hederacea*, *Hepatica nobilis*, *Asarum europaeum*. Heights of the first, second and third stand layers are 30-33, 20-25 and 10-15 m, respectively. The vegetation around the eddy towers is rather mosaic, which is related with the complex micro-relief and variations of soil moisture.

Conclusion

Under the low trends of air temperature and precipitation the extreme weather events are main factors determinative NEE in southern European taiga

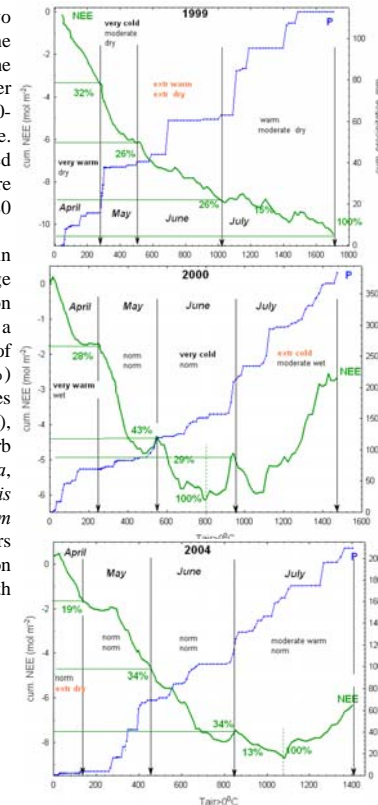


Fig. 4. Response of the cumulative daily NEE ($\text{mol CO}_2 \text{ m}^{-2} \text{ period}^{-1}$) at the WSF for April-July period to cumulative sum daily $T \text{ air} > 0^\circ \text{C}$ (ΣT , grad period^{-1}).

A - 1999, B - 2000, C - 2004.

Green line = NEE (negative values of NEE represent uptake of CO_2); blue line = cumulative sum precipitation (mm period^{-1}); green number = ratio of monthly sum NEE to maximum negative cumulative sum NEE over all April-July period (%); vertical arrows = temperature ranges of months.

Higher (wet) and lower (dry) thresholds monthly precipitation indicate as 90%÷95% and 10%÷5% -ile P events correspondence; very heavy (very wet) and very lower (very dry) thresholds P indicate as >95% and <5% -ile correspondence, moderate wet and moderate dry thresholds P indicate as 75%÷90% and 10÷25-ile correspondence; extreme thresholds indicate P as upper/lower 99.7% or 0.03% -ile;

Higher (warm) and lower(cold) thresholds mean monthly temperature indicate as 90%÷95% and 10%÷5% -ile T events correspondence; very higher(very warm) and very lower (very cold) thresholds T events indicate as >95% and <5% -ile correspondence, moderate warm and moderate cold thresholds T indicate as 75%÷90% and 10÷25-ile correspondence; extreme thresholds T indicate as upper/lower 99.7% or 0.03% -ile.

Climatic norm thresholds (norm) indicate as 25÷75-ile P and T events.