EMS Annual Meeting Abstracts,
Vol. 6, EMS2009-445, 2009
9th EMS / 9th ECAM

9TH EUROPEAN CONFERENCE ON Applications of Meteorology
9th EMS Annual Meeting
High resolution meteorology - applications and services

Trends of abiotic damage in forest ecosystems in Germany at regional scale under SRES A1B, B1

O. Panferov (1), C. Doering (2), A. Sogachev (3), J. Merklein (1), and B. Ahrends (2)

(1) University of Goettingen, Department of Bioclimatology, Goettingen, Germany (opanfyo@gwdg.de, 0049 551 399619), (2) University of Goettingen, Soil Science of Temperate and Boreal Ecosystems, Goettingen, Germany (bahrend@uni-goettingen.de), (3) Wind Energy Division, Risø National Laboratory for Sustainable Energy, Technical University of Denmark, Roskilde, Denmark (anso@risoe.dtu.dk)

Current climate projections indicate that the ongoing climate change may cause an increase of frequency of weather extremes (Leckebusch et al., 2008), which can result in wide area abiotic and consequent biotic damage events (e.g. drought and following insect attacks) within forest ecosystems. The type and degree of damage depends not only on the strength of a primary driving force itself (e.g. wind speed) but also on complex interactions between combinations of effecting agents with above- and belowground forest structure characteristics. The present study investigates the projected trends of abiotic risks factors and their combinations on coniferous and deciduous forests during the 21st Century under conditions of SRES scenarios A1B and B1. The downscaling of ECHAM5-MPIOM by the regional climate model (CLM) to the spatial resolution of 0.2° x 0.2° with daily time-steps is used for the analysis of future climate extremes and their combinations. With these input data the small-scale modeling with coupled process based sub-models (Jansen et al., 2008) was carried out for Solling region, (Central Germany) calculating the water and energy balance of spruce and beech forest ecosystems on cambisols and podzols with BROOK90 (Federer et al. 2003) and wind loading on trees with 3D ABL model SCADIS (Panferov and Sogachev, 2008). The risks of drought or wind damage for a certain forest stand result from combinations of soil water characteristics, static and gust wind loads, which in turn depend on current above- and belowground tree structure and on soil texture. The actual soil water content and forest structure depends on climate-soil-vegetation interactions in previous years. Therefore, differences of microclimatological conditions in the remaining stand after changes in forest structure are taken into account. Model outputs are aggregated to 30-years periods and compared to "present" conditions of 1971-2000. The results demonstrate an increment of abiotic risks towards 2100 caused by changes in precipitation pattern and increase of mean air temperature and wind speed. The A1B scenario is characterized by higher risks probability than B1. Besides these general trends the degree and temporal pattern of risks show complex dependence on climate-soil-tree structure combination which indicates the necessity of coupled modelling approach for risk assessment.

The study was financed by BMBF within the frames of joint project "Decision Support System - Forest and Climate Change" (DSS-WuK) and by Science and Culture Ministry of Lower Saxony (program KLIFF). We gratefully acknowledge this support.

Federer, C. A., Vörösmarty C., Feketa, B. (2003): Sensitivity of annual evaporation to soil and root properties in two models of contrasting complexity. J. Hydrometeorology, 4, 1276-1290.

Jansen et al. (2008): Anpassungsstrategien für eine nachhaltige Waldbewirtschaftung unter sich wandelnden Klimabedingungen-Entwicklung eines Entscheidungsunterstuetzungssystems „Wald und Klimawandel" (DSS-WuK). Forstarchiv 79:131-142.

Leckebusch G., Weimer A., Pinto J.G., Reyers M., Speth P. (2008): Extreme wind storms over Europe in present and future climate: a cluster analysis approach. Meteorol. Z., 17:67-82.

Panferov, O. and Sogachev, A. (2008): Influence of gap size on wind damage variables in a forest, Agric. For. Meteorol., 148: 1869-1881.