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Interactive comment on "Biotic pump of atmospheric moisture as driver of the hydrological cycle on land" *by* A. M. Makarieva and V. G. Gorshkov

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In November and December 2006 most Western European countries are witnessing anomalously high temperatures that have in some cases beaten centuries' records. In the Central European part of Russia daily temperatures of the beginning of December, too, exceed the long-term means by up to eight degrees Celsius. These regional phenomena bring about a new swing of discussions of the global warming and carbon emissions.

However, we would like to use this opportunity to demonstrate the potential power of the biotic pump mechanism in explaining and predicting such regional climate anomalies.

As long as most part of the North-West European Russia remained covered by forests, this forest cover ensured a large flux of evaporation exceeding that of the Arctic ocean and Northern Atlantic, both due to the high leaf area index of the forests as well as due to their more southern location and, hence, higher temperature. In the result, winds were predominantly blowing from the ocean to the continent, bringing cool weather and precipitation.

In several recent years of market economy in the former Soviet Union, forest cutting, after an initial temporary decline, was greatly intensified in the European part of Russia. Here the country's road network is the densest and there is a (comparatively) easy reach to almost every forest plot. Large territories have recently been clear-cut in Leningrad district and Republic of Karelia, two subjects in the North-West of Russian Federation with a cumulative area comparable to that of Western Europe. The leaf area index and total evaporation flux should have thus experienced a regional-scale drop.

As a result, summer patterns of atmospheric circulation were distorted. The remaining forests could not maintain the same magnitude of the ocean-to-land moisture flux. Southern (land-to-ocean) winds aridifying the land and warming the ocean became more frequent. Large-scale forest fires were recorded this year in the Leningrad district as a by-product of increased aridity. Now – in winter – the ocean that was extra-heated in summer, continues to display an evaporation flux exceeding the evaporation flux from the deforested land. This is a positive feedback. The warm ocean, with its large evaporative force, sucks atmospheric air in from the adjacent part of the European continent. The incoming warm air, in its turn, prevents ocean from usual winter cooling thus maintaining the large value of the evaporative force over the ocean.

Strong winds blowing in the southern direction (from land to the ocean) have brought to Europe the abnormally high late autumn and early winter temperatures, as well as much liquid precipitation in the north, where it is unwanted and useless upon the end of the vegetative season. In contrast, precipitation in summer, when it is most important

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for agriculture, can be expected to further decline in Europe with progressing deforestation and desertification of European Russia and cease of biotic pump functioning. Maximum summer temperatures will continue to rise. These general trends can be accompanied by climatic fluctuations on various temporal scales.

It is clear that these ideas have to be set onto a concrete quantitative background, which is perhaps a task not for one or two researchers, or even a team, but can be only accomplished in an international and multidisciplinary endeavor. However, these considerations outline a principally different approach to the problem of regional climate anomalies. It does not refer to some global processes of unresolved relevance to particular regions of the planet, but is strictly linked to the regional antropogenic activities, of which deforestation potentially emerges as the most important driver of the unfavorable changes of atmospheric circulation and water cycle.

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