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Environmental changes' influence on North Eurasia forests' vegetation (global and local effects)

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If we divide a map on small pixels (about several km) and correlate forests' vegetation characteristics in each pixel with environmental parameters, we see very variegated picture, which means that forest dynamics depends on many factors, both local and global. Such maps have been obtained for Northern Eurasia region on the base of remote sensing data on Normalized Difference Vegetation Index (NDVI) from NOAA-AVHRR satellites for 25 years. Knowledge of local dependencies sometimes is very useful, but "we can not see the wood for the trees" at such an approach.

We consider here a hypothesis: if the global effect of the climate changes' influence on forests really exists, it must be observable under large-scale time- and spacial- averaging. Simple averaging by all the territory, obviously, gives poor result, as includes a lot of different types of forest, so high-resolution NDVI data were averaged over all Northern Eurasia just for evergreen and deciduous forests. Yearly Mean Speed of Green Biomass Change (S = maximum NDVI/vegetation season duration) time-series were calculated for consequent modeling.

Two types of green biomass growth changes, depending on time-scales, were observed:

- a long-term trend, which demonstrates fall of forests' green biomass for 25 years (possibly connected with global warming);
- relatively short variations of forests' productivity with two-five years periods.

Our modeling was based on five environmental parameters such as:

- sum of global radiation income for vegetative season;
- relative solarization for vegetation season;
- mean temperature for vegetation season;
- yearly amount of precipitation,
- annual value of the Kp-index of geomagnetic activity

The results of modeling of the regional climate changes' influence on forests show that trees of North Eurasia are very sensitive to variations of temperature, precipitation, solarization and geomagnetic field. Speed of green biomass change (both for coniferous evergreen and coniferous deciduous forests) can be described by a function, depending on five environmental parameters and correlating with original time-series at R=0.8-0.9. It is shown that coniferous deciduous forests are less sensitive to climate changes, possibly because of their natural property - very high adaptability to external conditions.

Obtained results clearly demonstrate combined impacts of environmental parameters on terrestrial ecosystem. They could explain observed episodic growth of tree-mortality rates nowadays and in the past, and give the possibility to predict changes in feedbacks between the Earth and forests.

The results were obtained within the frame of Russian-Bulgarian project "Geosol".