Estimation of forest NPP and carbon sequestration in the Three Gorges Reservoir area, using the Biome-BGC model

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The Three Gorges Reservoir area is one of the most ecologically sensitive areas in China, and the forest landscape pattern in this region shows dramatic change due to the influence of the Three Gorges reservoir project. In this study, the locally parameterized Biome-BGC model, generated with long-term meteorological monitoring data, was used to simulate net primary productivity (NPP) and carbon density of the vegetation layer, the litter layer, and the soil layer for various forest types from 1992 to 2012 in this area. The total and unitary forest NPP presented obvious annual fluctuation under the combined influences of land use change and extreme weather events. Apart from the year 2006, from 1992 to 2012, the NPP values of each forest type showed an increasing trend, although the growth rates decreased. In 2006, due to abnormally high air temperatures and less precipitation, total and unit area forest NPP values decreased by 46.3% and 53.9% compared to 2002 respectively. From 1992 to 2012, the carbon stocks of the forest vegetation layer, the litter layer, the soil layer, and the entire area gradually increased with a decreasing growth rates. Additionally, Forest carbon stocks were high in the east and the south and low in the west and the north. Generally, the forest productivity is greatly affected by the physiological and ecological characteristics of the plants themselves as well as the environmental factor, whereas total forest productivity is largely influenced by human activities. The increase in forest area and the optimization of the forest landscape pattern could improve the forest productivity and carbon sequestration.