

A sharp increase in CO₂ concentration in West Siberia: anthropogenic impact or response of Siberian ecosystems to a changing climate

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Long-term airborne observations of greenhouse gases carried out in the troposphere over south-western area of West Siberia since 1997 allowed some specific features in CO₂ trends to be revealed at different heights. At an altitude of 7 km above ground level (AGL), the average annual rate of CO₂ increase was 1.72 ppm yr⁻¹. The main distinctive features in the tendencies of CO₂ mixing ratio have been found in the lower troposphere. Thus, for the period from 1997 to 2004, July concentrations of CO₂ at an altitude of 500 m AGL increased slightly with a rate of 0.17 ppm yr⁻¹, while since 2005 they began to rise dramatically with a rate of 3.64 ppm yr⁻¹.

Analysis of the possible causes of such long-term behavior showed that it was resulted from neither reduction of forest area, nor wildfires, nor forest diseases. Also it is impossible to state that reducing CO₂ sink has been caused by the impact of climate changes on ecosystems.

Possibly, anthropogenic CO₂ accumulation resulted in that Siberian forests cannot assimilate such additional amount of carbon dioxide. A decrease in the sink for atmospheric CO₂ is also observed in the Amazon (Brienen et al. 2015). Brienen et al. (2015) assume that it may be caused by a sustained long-term increase in tree mortality. There is also a supposition that it can be a result of a vegetation replacement by other types of plants or young trees, which absorb less amount of CO₂ (Kunstler et al., 2015; Crowther T. W., 2015). However, it seems highly unlikely to test these hypotheses in the near future due to a huge area of West Siberia, most regions of which are difficult to access.

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