

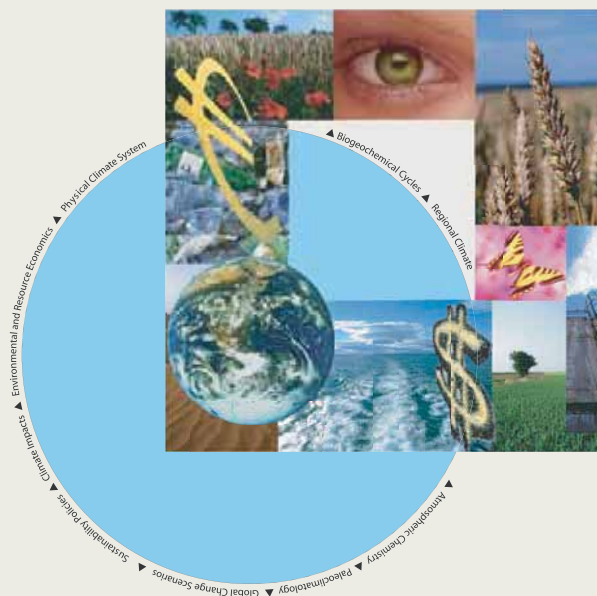


International Max Planck Research School on EARTH SYSTEM MODELLING

Quantifying the terrestrial carbon budget of middle latitude ecosystems: the role of Volatile Organic Compounds

Krzysztof Stanislaw Katrynski

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ABSTRACT

A substantial amount of carbon flux between biosphere and atmosphere belongs to photosynthesis and respiration activities. During daytime, leaves are affected by sunlight, take up CO₂ from the atmosphere and produce organic carbon for growth. A part of the carbon which is emitted by terrestrial vegetation as biogenic volatile organic compounds (VOC) contributes to the oxidative capacity of the atmosphere, to particle production and to the carbon cycle. With regard to the carbon budget of the terrestrial biosphere, a release of these carbon compounds is regarded as a loss of photosynthetically fixed carbon. The significance of this loss for the regional and global carbon cycles is controversial. I estimated the amount of VOC carbon emitted in relation to the CO₂ taken up, based on my own airborne and micrometeorological flux measurements of VOC concentrations and CO₂ exchange, and on the literature and model data. During two measurement campaigns over the Siberian region a series of experiments was performed. While VOC flux estimates are small in relation to net primary productivity, the amount of carbon lost as VOC emissions might be highly significant relative to net ecosystem productivity. In fact, VOC losses are of the same order of magnitude as net biome productivity. Although it should be assumed that large amounts of these reemissions are recycled within the biosphere, a substantial part can be assumed to be lost into longer-lived oxidation products that are lost from the terrestrial biosphere by transport. However, our current knowledge and measurement technique does not yet allow a reliable estimation of this carbon.