Climatic feedbacks in ecosystems of the arctic region

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An important part of the changes in climate that we have experienced and is likely to see in the coming century can be attributed to feedback mechanisms at high northern latitudes. These climatic feedbacks where a relatively small initial change in temperature or precipitation, may have a dramatic effects on the energy balance of the surface or the exchange of greenhouse gasses, is not understood to the full extend but known to be of major importance for the future climate not least in the arctic region. Through our field experimental data on the exchange of CO2 and CH4 between the surface and the atmosphere from a number of locations in Greenland, Sweden and Russia, we here try to synthesis our knowledge on feedbacks between climate and greenhouse gas exchange and point at gaps in the scientific understanding. Our results show that in high arctic Greenland the CO2 exchanges is very sensitive to changes in the snow cover and that a longer snow free period during summer may induce a higher CO2 uptake in the vegetation, but also that higher temperature leads to increasing decomposition in the soil, resulting in increased emissions of CO2 and CH4. Melting of permafrost in the sub-arctic region of Sweden alter the hydrological properties of wetland ecosystems and through that also the vegetation composition again leading to changes in the emission of these two prominent greenhouse gases. Our measurements from the Siberian boreal wetlands as well as from the northern Russian tundra show that a better understanding of the processes behind emission of methane is crucial for evaluating the overall effects of climatic change on the full greenhouse exchange, from these vast areas. Though giving a fairly complex picture of climate feedbacks in northern latitude ecosystems, it is unequivocal that these are important for the understanding of present climatic conditions and a better understanding could potentially improve model predictions of future climate.

