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Vegetation and climate interactions: an introduction

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Plants play a key role in the climate system by influencing the hydrological cycle and the carbon cycle, as well as by affecting the Earths energy balance via changes in albedo. Moreover, changes in climate may result in adaptive responses in vegetation that can feedback to the climate system. The processes that are most dominantly affected depend on the time scale of interest. This session will explore climate and plant interactions and feedbacks through a very large spectrum of processes and time spans. At very short time scale (several minutes) plants may influence the formation of shallow cumulus clouds. At geological time scales (millions of years) evolutionary changes in plant functional traits, such as rooting depth, may influence mineral weathering rates and subsequent atmospheric CO_2 levels.

To introduce this session we will show that as soon as plants colonized continents the climate was deeply modified. This major change took place during Devonian and corresponds to the opening of a new terrestrial carbon reservoir (soil and vegetation) and therefore contribute to a large decrease of atmospheric CO_2. But, this period is also associated with a large change in terrestrial albedo from dessert to vegetation cover. We shall explore the climate impact of such a “terrestrialisation” during Late Devonian (375 Ma). Building on from here, this session will investigate the climate-vegetation interactions through geological time (Late Paleozoic, Cretaceous, Holocene...) and Anthropocene projections.

In modern times we are introducing a large quantity of CO_2 to the atmospheric reservoir at extreme rates that is affecting the vegetation globally. Owing to recent developments the consequences of terrestrial biosphere interactions for climate change are accurately monitored and simulated through a hierarchy of different co=mplexity models. Therefore, we may predict major interactions which could take place during this century in terms of changes in the water cycle and radiative feedbacks. The contributions to this session highlight that many aspects of vegetation-climate interactions remain to be fully understood. Of specific interest is how processes couples across time scales and, via lag effect, may increase their influence on the climate system as time progresses.