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Simulating vegetation dynamics in Chile from 21ka BP to present: Effects of climate change on vegetation functions and cover

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Vegetation composition and establishment is strongly dependent on climate conditions but also a result of vegetation dynamics (competition for light, water and nutrients). In addition, vegetation exerts control over the development of landscapes as it mediates the climatic and hydrological forces shaping the terrain via hillslope and fluvial processes. At the same time, topography as well as soil texture and soil depth affect the microclimate, soil water storage and rooting space that is defining the environmental envelope for vegetation development.

Within the EarthShape research program (www.earthshape.net) we evaluate these interactions by simulating the co-evolution of landscape and vegetation with a dynamic vegetation model (LPJ-GUESS) and a landscape evolution model (LandLab). LPJ-GUESS is a mechanistic model driven by daily or monthly weather data and explicitly simulates vegetation physiology, succession, competition and water and nutrient cycling. Here we present the results of first transient vegetation simulations from 21kyr BP to present-day using the TraCE-21ka climate dataset for four focus sites along the coastal cordillera of Chile that are exposed to a substantial meridional climate gradient (ranging from hyper-arid to humid-temperate conditions).

We show that the warming occurring in the region from LGM to present, in addition to the increase of atmospheric CO_2 concentrations, led to a shift in vegetation composition and surface cover. Future work will show how these changes resonate in the dynamics of hillslope and fluvial erosion and ultimately bi-directional feedback mechanisms of vegetation development and landscape evolution/ soil formation (see also companion presentation by Schmid et al., this session).