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Teleconnections and surface processes: Non-stationarity and modulating effects

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Teleconnections link weather and climate phenomena of remote locations. Such statistical links are due to inherent phenomena of atmospheric (and oceanic) circulation. Important for the teleconnections are such features like midlatitude planetary waves, linking weather and climate in zonal direction, and the mean meridional circulation, basically the Hadley circulation, linking the tropics with higher latitudes. In the tropics, the Walker circulation is responsible for zonal teleconnections. These basic features of the general atmospheric circulation are closely linked and any local or regional process changing these atmospheric circulation systems potentially also involves remote changes of weather and climate. This includes the strength and position of stationary planetary waves as well as variations in strength and position of deep tropical convection. Surface processes interact with the atmosphere by fluxes of momentum, heat, moisture, trace gases and particles. Land use changes affect these fluxes not only directly, but also indirectly e.g. by effects of aerosol particles on the efficiency of rain formation and release of latent heat in deep convective clouds. Propagation characteristics of Rossby waves are influenced by the mean atmospheric flow and, hence, the variable subpolar and subtropical jets can modulate teleconnectivity, leading to non-stationarity of the statistically derived teleconnections.

Examples will be given a.o. of how changes in land use on the Tibetan Plateau or deforestation and aerosols from biomass burning in the tropics lead to climate anomalies on a hemispheric to global scale. Examples will also be given of the variability in time of teleconnections related to the ENSO cycle.