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Contribution of radiation and land surface conditions to near-surface air temperature variability and trend

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The evolution of near-surface air temperature is influenced by a variety of dynamical, radiative and surface–atmosphere exchange processes as well as by numerous other climate factors. The contribution of the single driving mechanisms is still not completely quantified. Using stepwise multiple linear regression and focusing on radiation (diagnosed by incoming shortwave and incoming longwave radiation) and land surface conditions (diagnosed by soil moisture and albedo) about 77 % of the interannual temperature variability and 99 % of the multi-decadal temperature trend over land can be explained. The linear model captures well the temperature variability in mid-to-high latitudes and in regions close to the equator, whereas in desert regions its explanatory potential is limited. While radiation is an essential explanatory variable over almost all of the analyzed domain, land surface conditions show a pronounced impact on temperature in some confined regions. The respective contributions of radiation and the land surface are of similar magnitude for interannual temperature variability and multi-decadal temperature trend. The radiation components contribute about 60 % to 65 % to the explained variance while the land surface variables account for 25 % to 30 %. Thus, for the high explanatory power of the linear models both radiation and land surface processes are essential.