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Understanding and evaluating the coupling of parameterized processes on the daily timescale.

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Most of the systematic biases in global models come from the interaction of their component parameterizations. Over land, these involve the sub-surface thermal and hydrologic processes, land-surface, boundary layer, cloud and precipitation parameterizations, as well as the shortwave and long-wave feedbacks from the cloud fields on the surface radiation budget. Across climate regimes the relative impact of different parameterizations change. Precipitation determines the hydrological regime and affects vegetation; while the radiation budget, modulated by clouds and seasonality, drives the surface thermal response. Understanding the tight coupling of these physical processes, which are largely parameterized, is critical. For the most part, this work has not yet been done, and this has limited progress in regional climate modeling. New submodels for single processes are tested off-line and introduced as 'plug-compatible' components into the fully interactive system. The mutual incompatibility of component parameterizations is sometimes discovered later from the resulting model biases, but their mutual interactions are rarely understood. A different strategy is needed, that pays attention to key observables, that can be used to evaluate the land-surface interaction quantitatively. This talk will address two aspects. One is stratifying surface processes in relation to a 'cloud albedo', which quantifies the surface short-wave cloud feedback. The second is the link in the fully coupled system between the amplitude of the diurnal temperature cycle (and the strength of the nocturnal boundary layer) to the daily mean net long-wave radiation flux.