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How should air-sea interaction processes be introduced in models?

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The globe surface is to 70% covered by water and a substantial part of most global as well as regional models cover partly ocean areas. Thus it is of great importance that processes over sea and air-sea interaction is included in climate as well as weather prediction models. What makes the ocean different from land areas is that the surface roughness changes as a result of the forcing (in terms of waves) and also that sea surface temperature changes as a result of the forcing (due to mixing in the ocean). Ocean areas are to a much less extent driven by the diurnal cycle, being of great importance over land. The importance of sea surface temperature changes and waves introduces the need for atmospheric models coupled to ocean as well as wave models for a correct surface description. It is, however, not enough to introduce coupled model systems, the important air-sea interaction processes needs a correct description and the model components need to be consistent. When coupling a wave model to a regional climate model the impact on the atmosphere is relatively minor, but when introducing the impact of swell (decaying sea) in the model there is a significant change in surface roughness, surface heat fluxes and near surface wind speed. There are also changes in parameters indirectly influenced by the changed surface roughness, like cloud cover and precipitation. When the roughness is reduced, the turbulence in the atmosphere as well as in the ocean is changed and thus also the mixing. Different processes occur during different stability regimes in the atmosphere. In the very near neutral regime results from measurements have shown a significant enhancement of sensible and latent heat fluxes, for stable data measurements have shown a strong reduction of sensible heat fluxes. This is also of large importance to introduce in models, where secondary effect occurs in cloud cover and precipitation and on mixed layer depth in the ocean.