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Influence of Ocean Organic Emissions on Marine Aerosol and Cloud, a Model Study.

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We present a model study of the potential influence of these ocean organic emissions on aerosol and cloud characteristics in marine regions. Recent studies indicate that the ocean surface emits relatively large quantities of organic matter and that this may significantly influence the cloud drop number concentration and optical thickness of marine clouds. Our study employs the aerosol climate model ECHAM5-HAM that is equipped with a detailed parameterization for aerosol activation to cloud drops and for in-cloud sulfur chemistry. In this study we assumed that the organic emissions from the ocean surface have a seasonality similar to DMS. Simulations were performed in which ocean emissions of organics contribute to one or more of the Aitken, accumulation and coarse modes, while both internal and external aerosol mixtures were investigated. In simulations that only considered ocean emissions of DMS and sea salt, cloud drop effective radii in the marine atmosphere are much larger than observed. Consideration of organic emissions strongly improves the agreement between the simulated and observed chemical composition of aerosol near Mace Head and between simulated and observed effective cloud drop radius over the North Atlantic region. The closest model-measurement agreement is obtained for simulations in which organic matter was introduced in the Aitken, accumulation and coarse mode simultaneously, reflecting different aerosol production and growth processes. The results indicate that the global amount of organic aerosol deriving from ocean surface emissions is in the order of 75 Tg C/yr. The model representativity also strongly improved for the Southern Hemisphere oceans.