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Reexamination of atmospheric drag coefficients used in climate models for Arctic summer conditions

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Results from polar climate models depend strongly on the quality of the parametrization of subgridscale physical processes such as processes related to clouds, radiation, and turbulence. Realistic modeling of polar sea ice dynamics and atmospheric processes over sea ice needs a detailed representation of the near-surface atmospheric fluxes of momentum. In this conference contribution parametrizations of neutral drag coefficients mostly used in general circulation models (e.g., ECHAM, CCSM, MITgcm) are reexamined by comparing them with a recently developed parametrization including the impact of sea ice morphology. The new parametrization, using the sea ice and melt pond fraction as governing parameters, accounts for the effect of form drag caused by edges at leads, melt ponds, and floes. Based on remote sensing data on ice and melt pond fraction, it is shown that during Arctic summer the traditionally used drag coefficients differ from the new ones by a factor 0.5-1.2. The geographic distribution of drag coefficients obtained from both parametrizations is very different. Differences are due to a nonlinear and non-monotonic dependence of drag coefficients on sea ice concentration in the new parametrization.