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The impact of marine aerosols on atmospheric characteristics over ocean surface in frontal zones

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Ocean-derived aerosols are particles produced from the ocean surface and remaining suspended in the atmosphere during a certain period of time. Aerosols act as climate forcers both directly (by scattering and absorbing solar radiation) and indirectly (by affecting cloud microphysics as cloud condensation nuclei). To evaluate the degree of marine aerosols impact on weather conditions the numerical experiments with the HARMONIE model were conducted with the model domain covering area over the North Atlantic.
The results showed that marine aerosols have a significant impact on characteristics of the atmosphere (such as air temperature, specific humidity, precipitation, and vertical velocity) over the ocean surface. The most significant differences occur along the frontal zones with high gradients at all vertical levels in the atmosphere for all variables. Change in radiative fluxes leads to changes in temperature of the atmosphere. These anomalies appear as mesoscale cells of opposite signs alternating each other. It can be assumed that they are formed as a result of a chain of factors. Thus, the absorption and scattering of solar radiation in the upper troposphere during daytime, increasing of moisture content and subsequent increase in thermal inertia of the air, and enhanced greenhouse effect at nighttime are acting in different directions on formation of vertical structure and convection conditions. This leads to a strengthening/weakening of the updrafts and compensatory movements, and eventually to the changes in processes of precipitation formation. Thus, the simulation of weather conditions in frontal zones over the ocean requires considering the effect of the marine aerosols presence.