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The role of surface active agents in the processes of heat (mass) transfer in a system ocean-atmosphere

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The dynamical processes in a thin sea surface layer are studied. It is commonly believed that more than half of heat balance in a system "ocean-atmosphere" is governed by hidden heat, which is supplied from the oceanic microlayer to the atmosphere. However, the role which plays gravity-capillary convection in this process is purely understood so far. The situation becomes even more sophisticated in the case of the presence of surface active agents (SAA) of biogenic and man-caused origin. They change the rheology of matter and introduce an additional physical process - adsorption, which leads to the concentration of SAA at the free surface. A two dimensional numerical model for study of a two-phase convection in a thin sea surface boundary layer was developed. The specific feature of the model is in its ability to reproduce the gravity and capillary convection in the presence of adsorption. Besides the ordinary mass, heat and momentum balance equations, the model comprises also relationships responsible for surface effects related to SAA. Numerical experiments have shown that the presence of SAA in sea water may intensify dramatically the heat fluxes in the system ocean-atmosphere. They initiate the capillary convection in thin upper layer. Even though the capillary convection is many times weaker than its gravity counterpart, it becomes a starting mechanism for the gravity convection. This, in turns, leads to the considerable increase of the heat flux from the ocean to the atmosphere (several times) in comparison with simple heat exchange which provides by only diffusion.