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## Investigation of droplet-mediated sensible and latent heat fluxes in a turbulent air flow over a wavy water surface by direct numerical simulation

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The objective of the present study is to investigate sensible and latent heat transfer mediated by evaporating saline droplets in a turbulent air flow over a wavy water surface by performing direct numerical simulation. Equations of the air-flow velocity, temperature and humidity are solved simultaneously with the two-way-coupled equations of individual droplets coordinates and velocities, temperatures and masses. Two different cases of air and water surface temperatures,  $T_a = 27\text{ }^{\circ}\text{C}$ ,  $T_s = 28\text{ }^{\circ}\text{C}$ , and  $T_a = -10\text{ }^{\circ}\text{C}$ ,  $T_s = 0\text{ }^{\circ}\text{C}$ , are considered and conditionally termed as "tropical cyclone" (TC) and "polar low" (PL) conditions, respectively. Droplets-mediated sensible and latent heat fluxes,  $Q_s$  and  $Q_L$ , are integrated along individual droplets Lagrangian trajectories and evaluated as distributions over droplet diameter at injection,  $d$ , and also obtained as Eulerian, ensemble-averaged fields. The results show that under TC-conditions, the sensible heat flux from droplets to air is negative whereas the latent heat flux is positive, and thus droplets cool and moisturize the carrier air. On the other hand, under PL-conditions,  $Q_s$  and  $Q_L$  are both positive, and  $Q_L$  - contribution is significantly reduced as compared to  $Q_s$  - contribution. Thus in this case, droplets warm up the air. In both cases, the droplet-mediated enthalpy flux,  $Q_s + Q_L$ , is positive, vanishes for sufficiently small droplets (with diameters  $d \leq 150\text{ }\mu\text{m}$ ) and further increases with  $d$ . The results also show that the net fluxes are reduced with increasing wave slope.

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