Abstract Submitted
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Dynamics of a reactive spherical particle falling in a linearly stratified layer[1] LUDOVIC HUGUET, VICTOR BARGE-ZWICK, MICHAEL LE BARS, CNRS, Aix Marseille Univ, Centrale Marseille, IRPHE, Marseille — The behavior of a particle falling in a stratified layer has already been studied for regimes of small Reynolds Re or Froude Fr numbers. However, the dynamics of a reactive particle have been unexplored, especially for regimes of interest for geophysical applications (large Re and Fr numbers). In a large water tank with linear stratification, reactive spheres made of a mixture of ice and hydrohalite solidifying below $-21.1°$C. are released from the top and melt while they sink. PIV is used to track their falls and the dynamics of the surrounding environment. Results are compared with non-reactive plastic spheres. For large Reynolds and Froude number, the added drag (compared to a sphere in a homogeneous fluid) of the plastic spheres due to the stratification is proportional to $(Re/Fr^2)^{0.5}$. For the reactive spheres, the added drag is much larger, suggesting to a strong modification of the wake due to the melting. We also characterize the generation of internal waves and the associated radiated energy. While increasing with radius for plastic spheres, the ratio of wave energy compared to the initial potential energy of the spheres is constant over the explored range for reactive ones.

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