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Generation of gravity waves by convective plumes MICHAEL LE BARS, IRPHE, CNRS and Aix-Marseille University, France, and Department of Earth and Space Sciences, UCLA, USA, STEPHANE PERRARD, PETER HUCK, ADRIEN AUBERT, PATRICE LE GAL, IRPHE, CNRS and Aix-Marseille University, France — In many geo- and astrophysical situations, a turbulent convective fluid layer is separated from a stably stratified one by a relatively sharp but deformable interface. Examples include the oceanic upper mixed layer and underlying pycnocline zone, the convective and radiative zones in stars, the atmospheric convective layer and overlying stratosphere. Here we present 2 experimental studies to get a global description of the properties of the excited wave field and its interaction with the convective motions. In the first set-up, a turbulent plume generated by injection of water impinges upon the interface between a uniform density layer and a linearly stratified one of salted water. In the second set-up, we take benefit from the unusual property of water that its density has a maximum value near 4°C to study its convective and oscillatory motions in a tank with a bottom boundary at about 0°C and an hotter upper surface. In both experiments, the velocity fields are measured non-intrusively using PIV, allowing to determine the energy flux extracted from the plume and transported by the waves. The spectral analysis of the signals exhibit preferred values of the frequency and wavelength of excited waves which depend on the location. Those results compare well with a simple analytical approach where the impinging plume is modeled as a initial displacement of the interface with a Gaussian shape in time and space.

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