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## Flow induced on a salt waterbody due to the impingement of a freshwater drop or a water source

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### Highlights:

- The paper experimentally and theoretically studies the physics of solutocapillary flow which arises when a fresh water drop impinges on a saltwater body. It is shown that when a freshwater drop impacts a saltwater body there is a dramatically strong flow on the surface which extends over an area that is several orders of magnitude larger than the impact area itself. The flow arises because when the drop mixes with saltwater the local salt concentration is reduced which gives rise to a surface tension gradient as the surface tension decreases with decreasing salt concentration. The presence of salt fundamentally therefore changes the characteristics of the flow that arises due to the impact of drops, and this in turn alters the state of mixing at the air-water interface.
- The results presented are of broad interest as they model the transport of sparingly soluble gases across air-water interface which is of fundamental importance for a range of natural processes as it regulates concentrations of various constituents of the biogeochemical cycle. We are looking forward to hear from you. Thank you very much.

### Abstract

The particle image velocimetry (PIV) and planar laser-induced fluorescence (PLIF) techniques are used to study the flow induced on the surface of a body of saltwater when a drop impinges on its surface or when a source is present on the surface. The measurements show that the impingement of a fresh water drop causes a strong axisymmetric solutocapillary flow about the vertical line passing through the center of impact. The fluid directly below the center of impact rises upward, and near the surface it moves away from the center of impact. The flow, which develops within a fraction of second after the impact, persists for several seconds. In comparison, when a freshwater drop falls on a body of freshwater, the flow induced on the surface is much weaker and persists for a relatively shorter duration of time and the volume of water circulated is two orders of magnitude smaller. Similarly, when a fresh water source is present on a body of saltwater there is a solutocapillary flow which on the surface is away from the source and below the surface is towards the source.

### Graphical Abstract

Center of drop impact

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