Generation of non linear surface gravity waves by the collapse of a low density granular column

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Résumé

Although many tsunamis are generated by underwater earthquakes, a significant fraction of them can also be generated by the flow or collapse of a great volume of material from the air into a body of water. Examples include subaerial landslides (1, 2), the collapse of glaciers, as well as pyroclastic flows (3, 4). This phenomenon has been the subject of several experimental studies available in the literature (1, 2, 3), as well as numerical simulations (4), and is quite complex as it involves the interaction of three different phases, i.e. water, a granular material and air as an interstitial gas. We have performed experiments using a rectangular granular column, comprised of monodisperse spherical beads made up of low density materials, released by a sluice gate to collapse in a canal filled up with water at various heights. The amplitude of the generated wave, its wavelength, as well as the dynamics of the granular material such as the velocity of the granular front at the surface of water and the volume of the immersed beads are obtained using image processing. For polypropylene – a material with density similar to ice - results show that in shallow water (fig.1a), the dynamics of the granular medium and of the surface of the water is influenced by the proximity of the bottom of the flume similarly to experiments carried out with a denser material such as glass (1), while in deeper water (fig.1b), the beads do not reach the floor because of their buoyancy, then rise back to the surface after the generation of the leading wave.
Keywords: Tsunami, Granular media, Low density gravity flow, Non linear waves, Surface gravity waves

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