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Mount St. Helens (Washington, USA) and World Trade Center (New York, USA) collapse: a fluid dynamic analogy

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When a skyscraper collapses, the non-fragmented material is rapidly deposited close to the source, whereas the fragmented counterpart is loaded turbulently in the associated currents. Indeed, on impact with the ground, collapses of volcanic columns, domes, or sectors of volcanoes generate thick deposits of coarser material, and from there on the finer material is suspended over the landscape, to be re-deposited far away in thin deposits. Here, we explore the multiphase fluid dynamic behavior of the World Trade Center (New York, USA) collapse, which on 11 September 2001 followed the fragmentation of the Twin Towers, and generated shear dusty currents.
These currents had a multiphase and turbulent behavior, and resemble the volcanic flow generated during the 18 May 1980 explosive eruption of Mount St. Helens (Washington, USA), in which a sector of the volcano collapsed, then a highly mobile, multiphase turbulent current followed and heavily interacted with the surrounding landscape. This analogy allows to focus on the comparison between volcanic and skyscraper collapse.
A computational fluid dynamic investigation, along with a locally refined Cartesian grid, are adopted to simulate numerically the propagation of the 11 September dusty currents in Manhattan. Results of flow dynamic pressure, the parameter of volcanic hazard, and particle deposition reveal that the pressure can locally increase up to a factor 10 because of flow-building interaction. Also, the surrounding buildings make the urban setting as of a high turbulence and exponential decay of deposit thickness.