Supplementary material

Figures

This additional figure shows an application of the code to the Krakatau volcano, where vaporization and entrainment of water are modeled. The $\gamma_{i_s,wv}$ coefficient controls the amount of fraction of heat lost by particles producing water vapor entrained back into the flow. In Figure 1, we show the effect of varying $\gamma_{i_s,wv}$ on flow characteristics and runout along transect 3 from Figure8 of the paper. Increasing $\gamma_{i_s,wv}$ does not have a significant effect on flow temperature, which does not vary greatly from flow source to flow cessation, but it does impact the flow thickness, larger flow thickness for larger $\gamma_{i_s,wv}$. This is related to the water vapour fraction. Increasing $\gamma_{i_s,wv}$ results in a significant increase in the water vapour volume fraction, and a decrease in the solid volume fraction in the flow with distance from source.

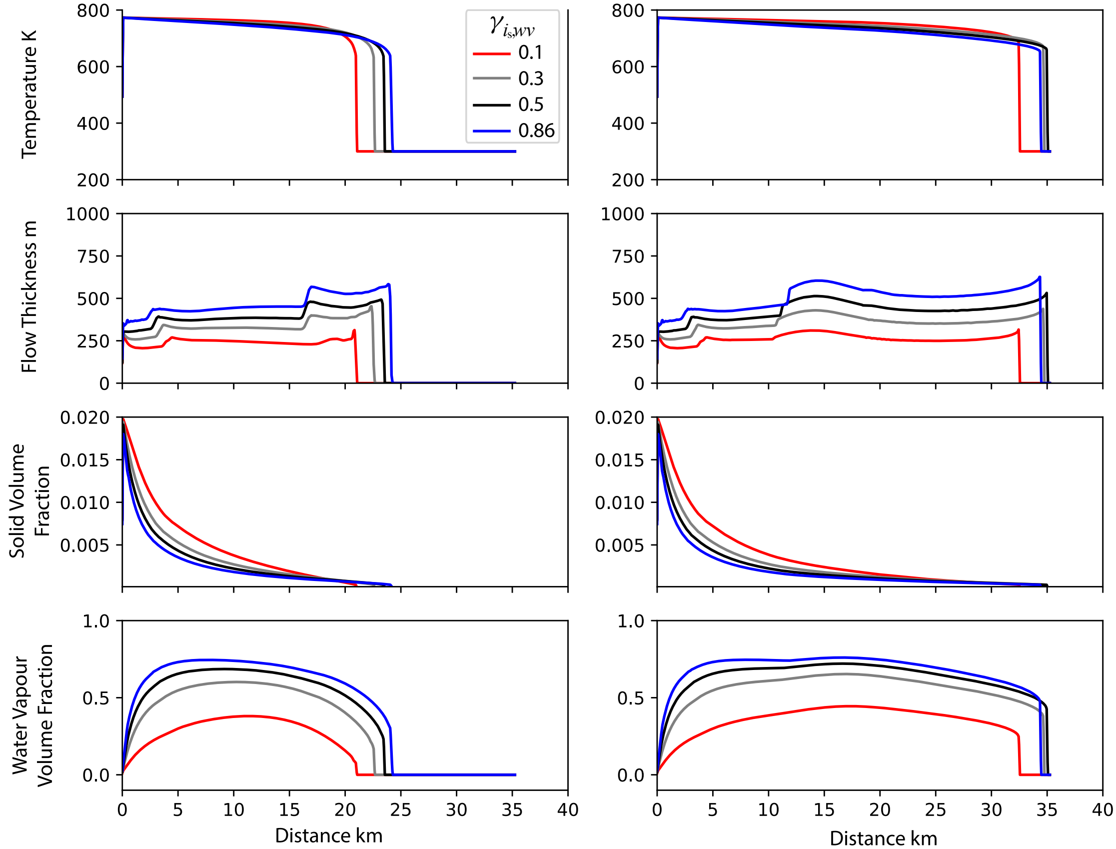

Figure 1. Variation in volume fraction of flow components along transect 3 at 360 and 1320 seconds post flow initiation for $\gamma_{i_s,wv}$ coefficients of 0.1, 0.3, 0.5 and 0.86. A grainsize of 100 microns and an MFR of 10^9 were used in all simulations.

Video

The video shows an animation of the output of the code for a 2580 s simulation of a transient dilute pyroclastic density current at the Krakatau volcano. The opacity of the flow is proportional to the flow density. The video shows the capability of the numerical model to face a complex natural case involving the propagation of PDCs over the sea surface and across topographic obstacles, showing the relevance, at a large scale, of non- linear fluid dynamic features, such as hydraulic jumps and von Kármán vortices.