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Dilute pyroclastic density currents of Italian active volcanoes: facies architecture, physical modelling and impact parameters

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A new method for the reconstruction of the physical characteristics of dilute pyroclastic density currents is introduced. The velocity, density and particle volumetric concentration profiles of the stratified current are calculated, together with the profile of dynamic pressure, which is a useful parameter for checking resistance of buildings. The model links turbulent boundary layer shear flow theory with particles coupling to gas turbulence. The working procedure starts with the recognition in the field of the fining upward sequence of layers formed during the time integrated depositional history of an individual current. Distinct processes of particle transportation and deposition are associated with the different particle modes composing the bedset. The system of equations for the solution of the fluid-dynamic parameters is implemented into two alternative ways. The first one uses data of particles coming from both the basal coarse layer and the overlying laminated layer of the bedset. The second uses features of two distinct components of the laminated layer. A statistic test is formalized for checking model results against experimental data of actual particles. Model calculations give the average solution, as well as solutions corresponding to a range of 68% of probability around the average value. The maximum solution can be considered as a safety value for impact parameters. The methodology is applied to deposits of recent eruptions of Vesuvius, Campi Flegrei and Vulcano in Italy, and results are discussed in terms of hazard and expected damage.