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Tephra-fallout hazard of Violent Strombolian eruptions at Vesuvius: insights from the 1906 event

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Mt. Vesuvius is one of the most studied volcano in the world and its vicinity to an extremely populated area makes it also one of the most threatening. Violent Strombolians (VS) events have occurred in the most recent history of the volcano and are likely to occur in case of its reactivation in the future.
In order to assess the regional hazard of this eruptive category we performed new field work and adopted a dispersal code to simulate the associated tephra dispersal and fallout. Attention was specifically focused on the 1906 event. Based on field analyses and historical observations, we reconstructed the temporal evolution of the eruptive source conditions during the event. We assumed a 5-day long scenario characterized by two distinct phases: a former short and intense phase of lava fountaining followed by a prolonged weaker phase of ash emission. Grain-size distributions adopted, for the two phases, as input to the model were derived from deposit records accounting also for the presence of sub-micron particles.
Based on simplified reconstructions of wind field directions, we simulated the 1906 event and compared it with field data in order to evaluate the validity of the event characterization as well as the model performance. In particular, model outcomes were compared to refined field measurements and deposit distributions.
In addition, several hypothetical scenarios with the same source conditions were simulated by adopting realistic meteorological data. Results are shown for specific cases in terms of hazard assessment on the ground (ash deposition and ash concentration in the air). The model clearly highlighted the remarkable effect of the variable local meteorology on ash dispersal and the key role of wind shear on the final cumulative ground deposit. In particular, the prevailing zonal wind, present at this latitude, demonstrated how ash fallout on the city of Naples is a possible scenario to be considered. Lastly, the effect of wet deposition and precipitation on volcanic cloud dispersal and ground deposit patterns are also shown.