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Propagation of eruptive plumes to "non traditional" directions in northern Chile: Examples from Isluga and Lascar volcanoes

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The record of historical eruptions has demonstrated that the propagation of eruptive plumes in the troposphere from northern Chile volcanoes is normally to the E and SE directions. In fact, meteorological measurements show that between 61 and 77% days of a normal year, the main wind direction is to E and SE. Under this scenario, the modelling of eruptive plumes propagation in the troposphere has been traditionally done considering winds to E and SE directions. In this work, we modelled eruptive plumes propagation to "non traditional" directions, corresponding to N, NW, W, SW and S directions, using ASH3D software, a 3D Eulerian atmospheric model developed by USGS, taking as examples two active volcanoes from northern Chile, Isluga and Lascar. Our models considered four eruptive scenarios (Eruptive column altitude over sea level, duration of eruption and volume erupted): 1. 5 km, 2 hours, and 0.001 km3; 2. 10 km, 4 hours, 0.01 km3; 3. 25 km, 8 hours, 0.1 km3; 4. 35 km, 12 hours, 1 km3. The total time for simulations was 48 hrs, with two starting times (14:00 and 22:00 hrs UTC). The results shows that despite plumes present changes in the propagation direction, in very few cases returning to E and SE directions. In a maximum radius of 100 km around active craters, the minimum tephra fall thickness varied from 0.1 mm and >10 cm for scenarios 1 and 4, respectively. In the scenario 3 (eruptive volume >0.1 km3, similar than April 1993 Lascar eruption), populated cities located over 150 km distance from the active craters appear being affected by tephra fall, and tephra fall deposit thickness >1 mm. Consequently, eruptions in concordance with "non traditional" winds directions, could be affect considerably both most populated cities (normally coastal cities) in northern Chile and local flights routes.