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Assessment of the quality of tephra fall dispersal data

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Tephra fall deposits have been routinely mapped for over 3 decades. The dispersal data, used to define isopach and isopleth maps and subsequently retrieve some key eruption parameters, proved essential in hazard assessment at volcanoes. Yet the quality of this record is typically not assessed by most workers, or such an assessment is not included in publications. Tephra dispersal data quality has not been assessed systematically or quantitatively. We systematically reviewed published tephra dispersal datasets. Then we established in several ways what the ideal properties of dispersal data should be in order to lead to meaningful reconstructions of eruption parameters. Conceptual experiments enabling to intuitively and graphically derive what could be an ideal dataset are presented. The control exerted by the number of data points and by their spatial distribution on isopach shape and tephra layer volume estimation is statistically investigated on modeled tephra layers. Comparison with existing tephra dispersal datasets illustrate that tephra fall deposits have not, with rare exceptions, been sufficiently mapped (eg. isopach maps have not been constrained by measurements at enough locations) to accurately constrain dispersal data used to derive key eruption parameters and assess hazards. In only 2-3 case studies have enough measurement locations been considered to derive meaningful or well-constrained dispersal maps (in many studies, up to 10 times more measurement locations are needed). We illustrate that the problem is compounded by the fact that many points are not actually constraining dispersal data contours. The number of data points, their spatial distribution and the number of isopachs in geometric progression are the main limiting factors to accurately constrain physical eruption models. There is a need for keeping count on data quality; here we propose some basic measures or parameters relating to distinct aspects of data quality. Finally we offer recommendations for future studies of tephra fall deposits, including basic parameters that could be used as indicators of

data quality.