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Assessment of the impact of the Eyjafjallajökull's eruption on surface air quality in France

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The eruption of the Eyjafjallajökull in April 2010 led to the injection into the troposphere of an important amount of material whose quantity and nature was and remains difficult to assess. In the days following the onset of the eruption, this plume was scrutinised for scientific purposes and decision making (especially with regard to aviation hazard assessment). This paper complements the existing documentation of this event by investigating any possible impact of the Eyjafjallajökull April 2010 eruption on air quality in France.
In the hours following the eruption, a number of initiatives were taken to monitor the situation in order to address the concern of decision makers regarding both aviation and sanitary issues:
- A forecasting suite of models was implemented to document the plume location, shape and load in particulate matter (PM),
- Several 24/7 Lidars were operated to monitor the altitude of the plume,
- A dedicated emergency air quality assessment procedure was deployed in France to collect and analyse PM samples at the surface.
Forecasts of the plume position were performed making use of Eulerian (the Chimere Chemistry and Transport Model) and Lagrangian (the Flexpart Lagrangian Particle Dispersion Model) tools. A special focus was given to the occurrence of a subsidence towards the boundary layer and subsequent impact on air quality.
The Lidars operated by IPSL at the SIRTA observatory (South of Paris) detected the presence of a layer with high aerosol load the 16th of April and a clear subsidence during 48hrs leading eventually to the injection of volcanic material in the boundary layer the 18th. The SIRTA Lidars measure backscattering ratio at 1064nm, 355nm, and 532nm, the latter providing also information about linear and cross polarization. We can thus derive a wealth of information on the particle size and shape distribution.
In a large part of France, PM concentration data from real time air-quality monitoring networks showed an increase of PM10 concentrations during the episode that was mainly due to transboundary air pollution and anthropogenic sources. But a more detailed investigation focused on the Eastern part of France allowed for the identification of an unambiguous signal that can be attributed to the volcanic ash plume. Evidences include (1) unprecedented SO2 levels observed at remote and elevated sampling stations, (2) unusual non-volatile and coarse PM fraction and (3) significant levels of Aluminium, Iron, and Titanium in PM10. The timing of these anomalies also matched estimates provided by the models, contributing to corroborate their volcanic origin.
The synthesis of information provided by eulerian and lagrangian modelling, ground-based remote sensing and surface sampling, allows to estimate quantitatively the contribution of the volcanic ash plume to about 10 to 30ug/m3 of total PM10 during the episode.