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Monitoring volcanic plume height and fountain height using webcams at the 2021 Fagradalsfjall eruption in Iceland

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The 2021 Fagradalsfjall basaltic fissural eruption in Iceland was closely studied due to its proximity to Reykjavík, which allowed easy installation and maintenance of monitoring equipment. Here we present the results from a network of calibrated webcams maintained by the Icelandic Meteorological Office and Department of Civil Protection and Emergency Management which were used to monitor volcanic plume height and fire fountain height. A number of different camera designs optimised for different power and communications constraints were used, some built in house at IMO, and they will be presented here. To make a 3D height measurement from a 2D web camera image requires extra geometric constraints, which are provided by assuming the vent location and wind direction, in a similar manner to the method applied at Etna. We have implemented this technique as a react.js single page app, which is kept updated by a messaging queue system which pushes new images through the servers at IMO. Additionally, the webcams have to be calibrated, in that the geometry of the camera and lens distortion parameters have to be known - this is either performed in the laboratory, or where the cameras were not available before installation, using one of a number of vicarious calibration techniques developed for this purpose. The resulting plume heights were used to constrain SO₂ dispersion models that were the basis for air quality forecasts during the eruption.