

FUTUREVOLC Partner UNIVBRIS

Jeremy Phillips, Mark Woodhouse, Andrew Hogg

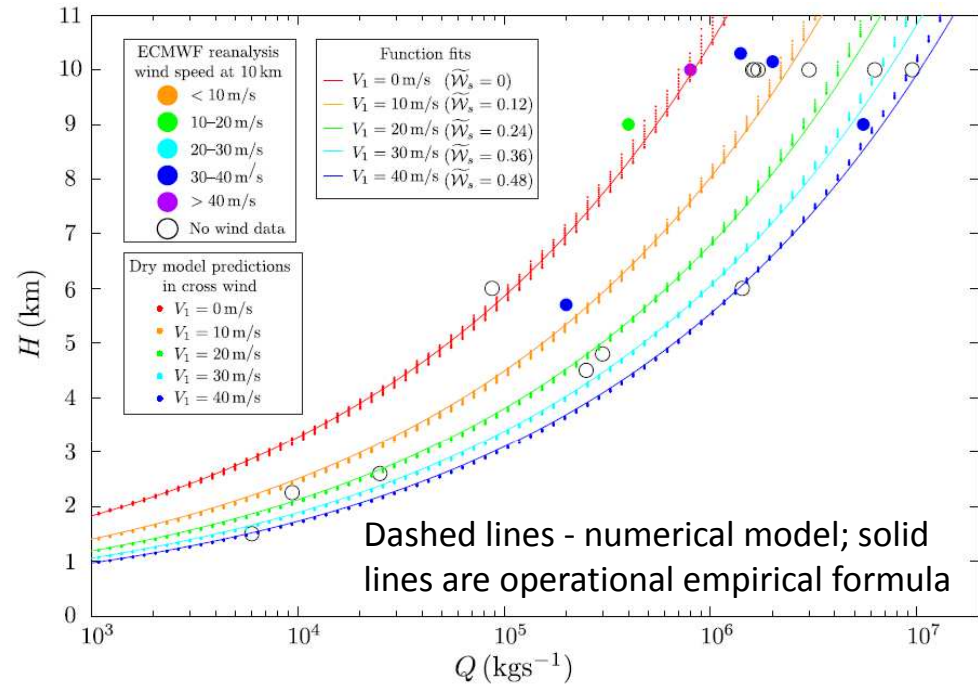
Deliverables (D7.1):

- Improved plume height-source mass flux relationships (MS60; 12 months; synergy with D8.5 far-field dispersion modelling);
- Tephra deposition model based on an unsteady source and wind-affected plume (MS66; 18 months; synergy with D7.5 real-time tephra fallout detection)

Role in Project (WP7) – to develop and provide physics-based theoretical models of plume dynamics and tephra dispersion to help understand the new observations/monitoring data and apply the results operationally

1. Height-mass flux relationships for wind-affected steady plumes

Development of a continuum model for wind-affected steady plumes (Woodhouse et al, JGR, accepted)



Model predictions are in good agreement with observations for eruptions where wind speed is known

Modification of existing empirical laws for plume height as a function of wind speed

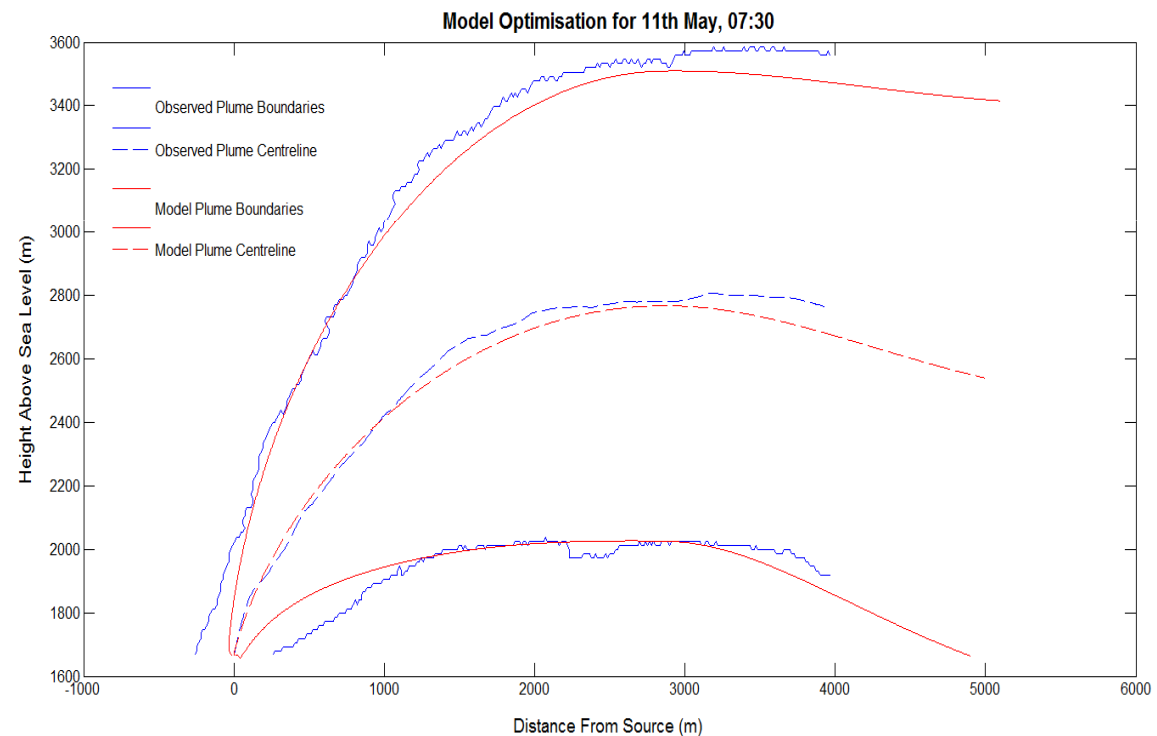
$$H \approx H_0 \frac{1 + 1.373W_s}{1 + 4.266W_s + 0.3527W_s^2},$$

$$W_s = \frac{\dot{\gamma}}{N} = \frac{V_1}{NH_1},$$

V_1 is wind speed at reference height H_1 (e.g. tropopause)

2. Model testing against Webcam records (with Halldor Bjornsson, IMO)

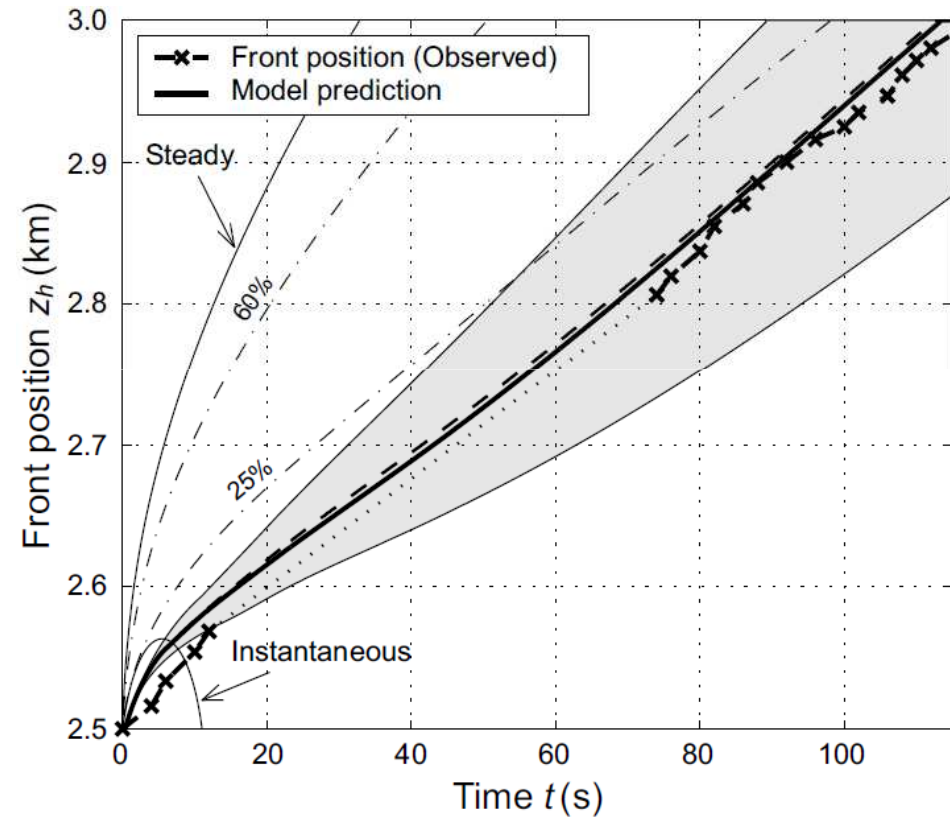
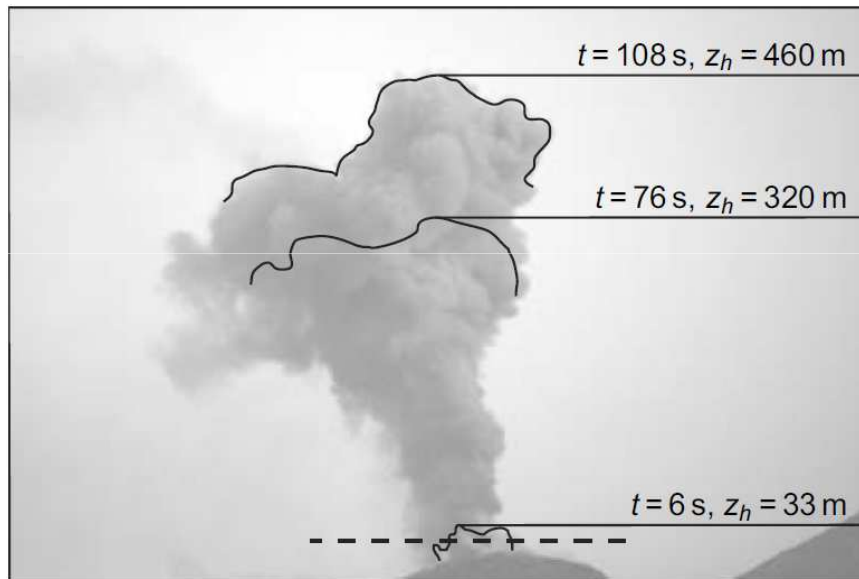
- Automated detection of plume edges on webcam images is used to test model predictions (centreline is matched, then plume edges predicted by the model are compared with observations for known meteorological conditions, with source conditions fitted)
- Model predictions are reasonable



- Further testing with source mass constrained by high time resolution tephra stratigraphy planned for summer 2013 (with UI).

3. Unsteady Plume Modelling

- We have applied an existing unsteady plume model to Vulcanian eruptions at Santiaguito (Scase et al, Geology, in review)



- This model can provide a tool for integrating new monitoring measurements of source parameters to predict plume height changes