June
2018

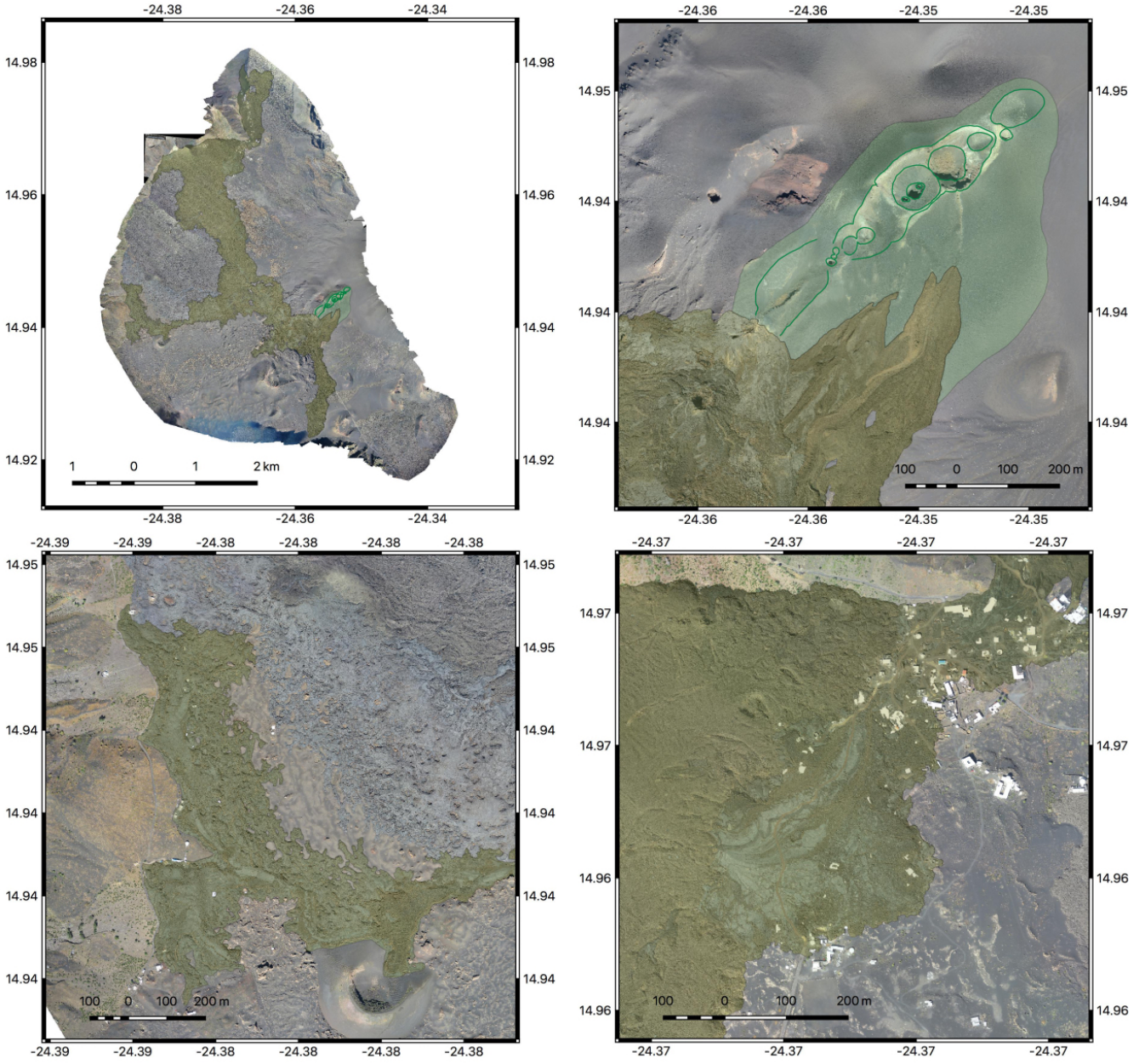
FIRE: Eruption Timeline

Ricardo Ramalho

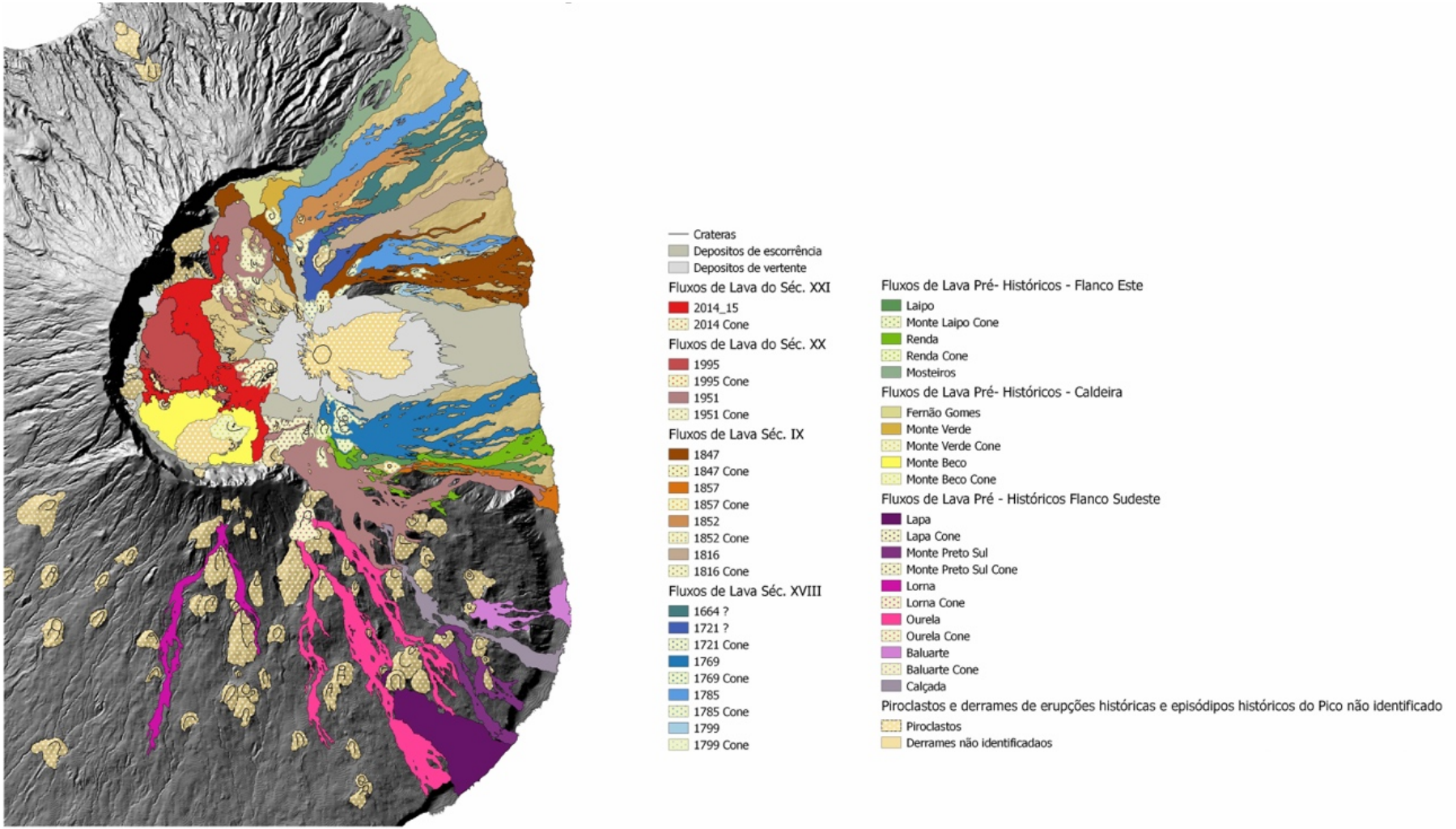
AL1: Volcanic structure

- Final 13cm-resolution orthophotomap produced
- Final 13cm-resolution Digital Surface Model (VHR-DSM) produced
- Final Mapping of 2014/2015 lava field produced
- Preliminary mapping of all historical and pre-historical lava flows concluded (MSc Ana Teves). This was made on the basis of:
    - Analysis of new UAV-derived orthophotomap
    - Analysis of satelite imagery (Pleiades, Sentinel-2, Apple Maps)
    - Analysis of existing orthophotomap (Minicipia)
- Reconstitution of the 2014/205 eruption using thermal infra-red remote sensing of high temporal resolution (MSc Vasco Miranda)
- Collaboration with the HotVolc platform – detect SO_2, lava flow rate and detect ash in the atmosphere using high frequency (15 min) MSG-SEVIRI geostationnary satellite images.

Mapping of 2014/2015 eruptive products

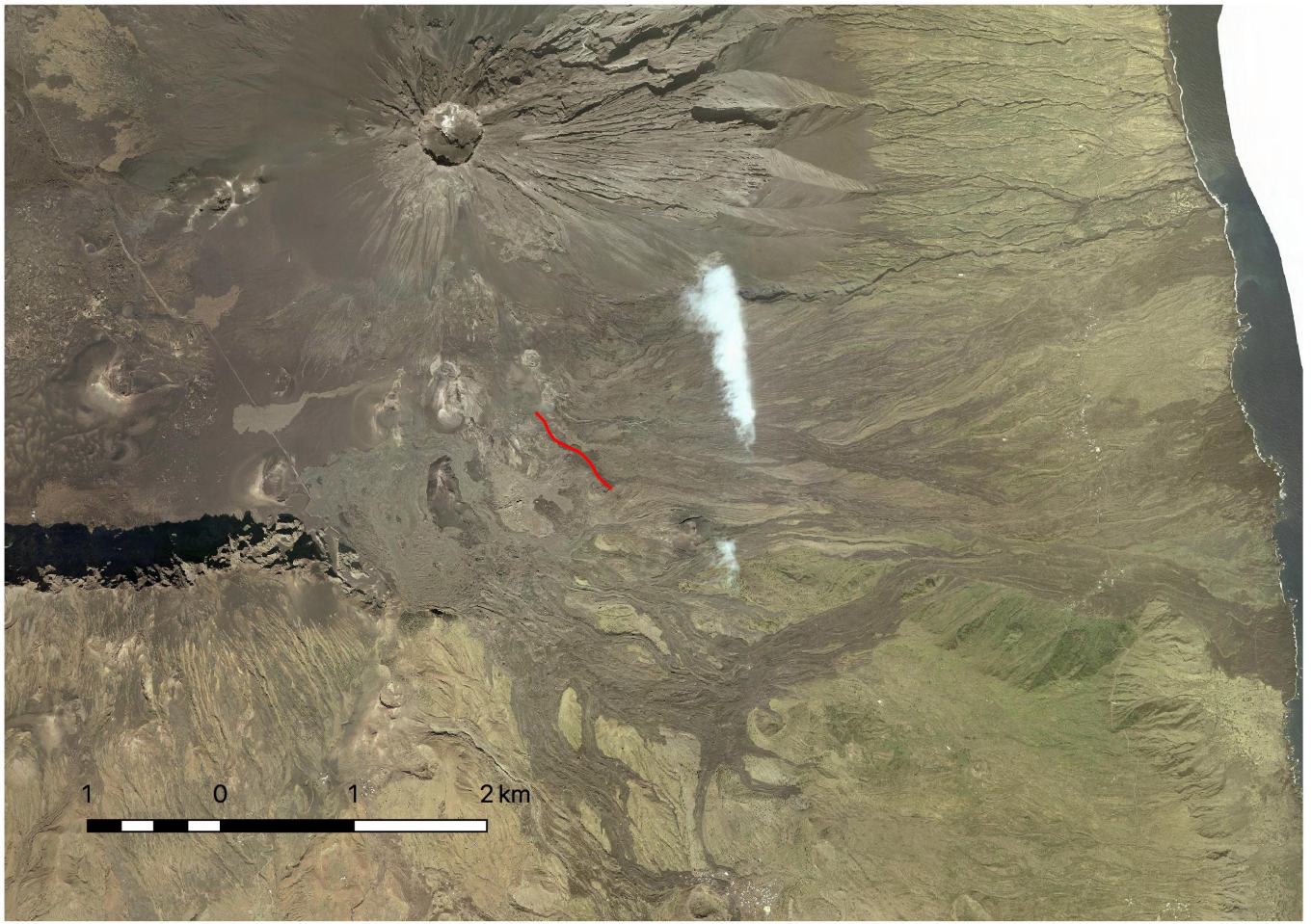


Mapping of historical and pre-historical flows



Mapping of historical and pre-historical flows

Mapping of historical and pre-historical flows



AL2: Eruption dynamics

Satélite MODIS Aqua

Resoluções
- Espacial: 1 km/pixel
- Espectral: 36 bandas
- Temporal: 1 imagem/noite

Normalized Thermal Index (NTI)
(Wright *et al.*, 2002)

$$NTI = \frac{Band22 - Band32}{Band22 + Band\ 32}$$

$Band22$: 3.929-3.989 μm
$Band32$: 11.770-12.270 μm

Limiar T de anomalia térmica:
- Original : T > -0.80
- Tese V. Miranda : T > -0.82

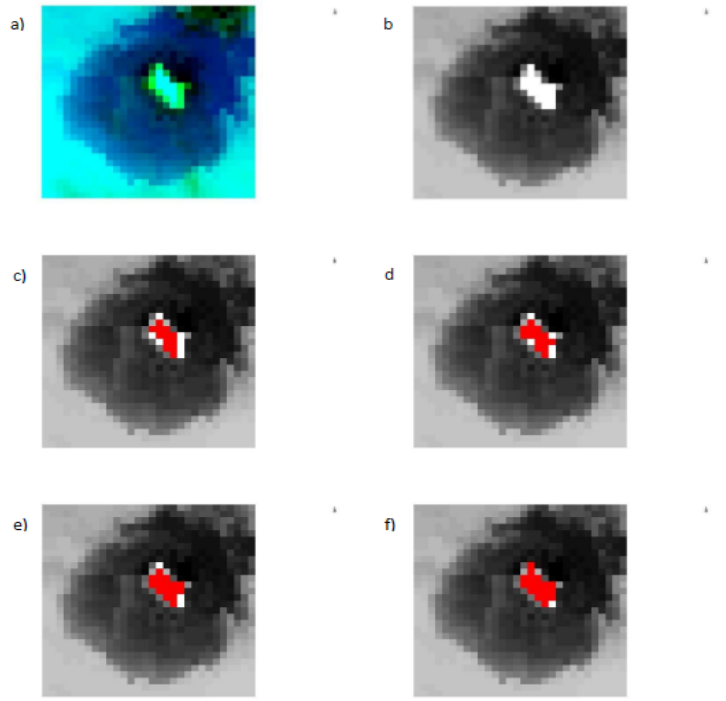
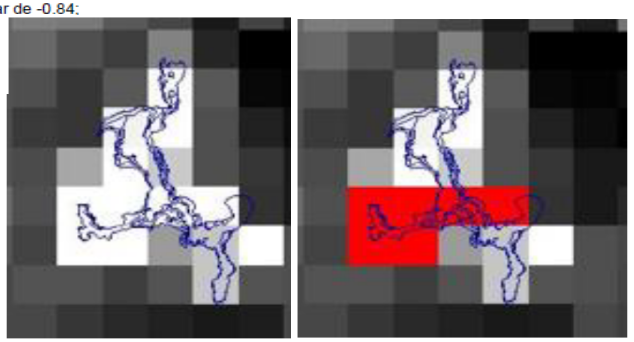


Figura 13 - Imagem MODIS captada no dia 26/11/2014: a) Composição colorida das bandas 9, 22 e 32; b) NTI; c) limiar de -0.78 (pontos a vermelho); d) limiar de -0.80; e) limiar de -0.82; f) limiar de -0.84;



Comparação do NTI (T>-0.82) de 28/12/2014 com os contornos vectoriais *Copernicus* dos derrames

AL2: Eruption dynamics

- Four modelling approaches were considered, by growing order of hydrodynamic complexity: a) probabilistic; b) cellular automaton; c) depth-averaged; and d) full 3D CFD
- The models chosen to represent each approach were a) Q-LavHA; b) MAGFLOW; c) VolcFlow; and d) COMSOL
- Preliminary results show that:
  - probabilistic models are not very effective in modelling the far-field as the propagation process is not fully determined by mass forces (pressure imbalances and inertial forces are apparently not negligible);
  - the influence of the resolution of the DEM is not apparent in the results of the probabilistic model;
  - cellular automata models can reproduce better the final lava coverage

Dissemination

Number of papers:

- in prep. : 1
- submitted: 0
- published: 0

Number of communications (national and international):

- planned: 1
- done: 2

Number of outreach: 1

AL3: Strategies for Risk Mitigation

- Not yet ;-)

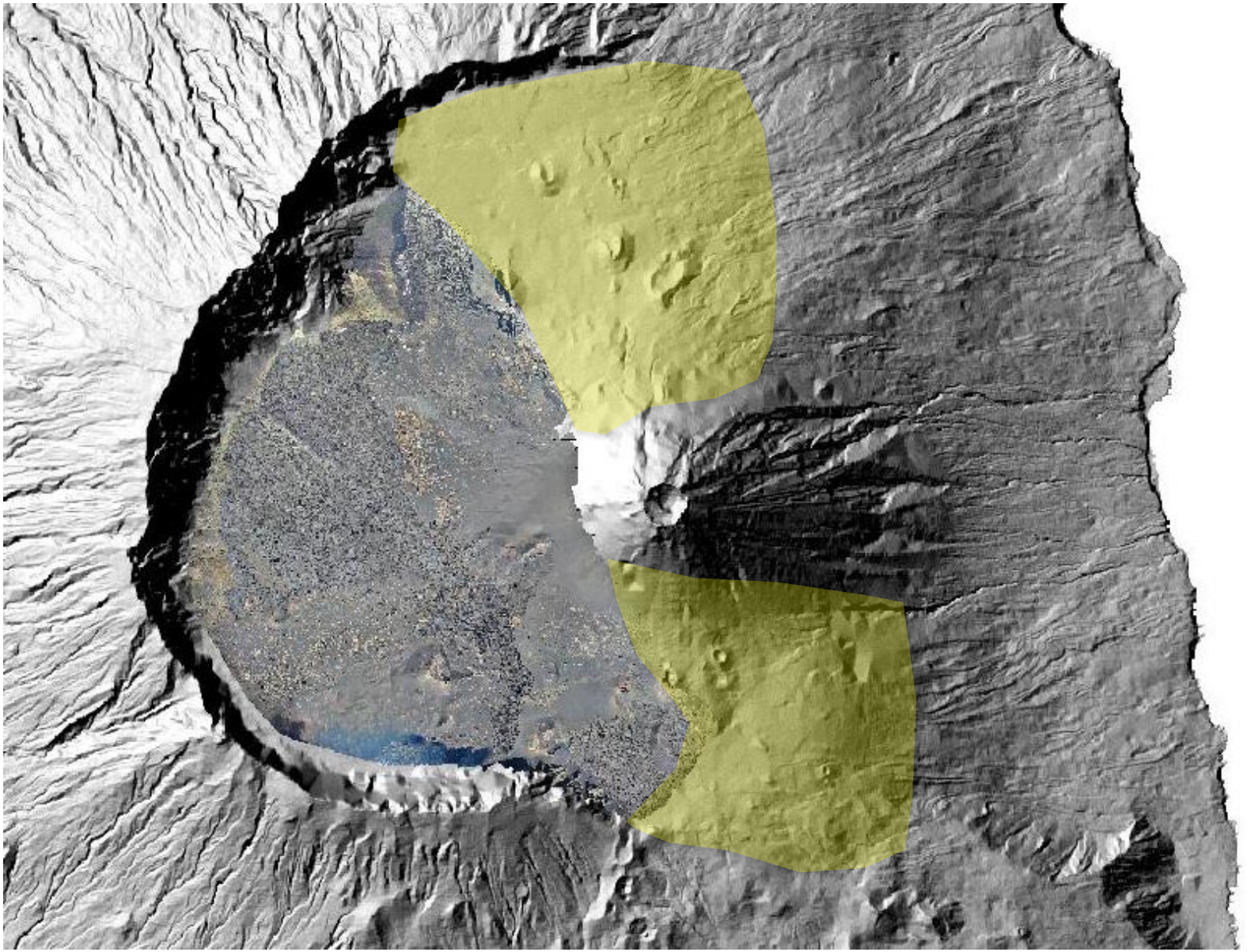
Challenges/issues encountered/anticipated

- DEM: problems with point-cloud recognition in ash/pyroclastic areas – manual solution, very time-consuming
- Lack of agenda to make second mission
- Detailed reconstruction of the eruption timeline somewhat dependent on availability of Bruno Faria to integrate syn-eruptive field observations with geophysical data

Plans for coming months

- Complete Lava flow modelling
- Interaction with WP2 and WP7 regarding the following points: remote-sensing imagery
- Detailed mapping of historical and pre-historical lava flows to be completed in June/july
- Publication of VHR-DSM in ESSD
- Further acquisition of stereo aerial photo in December/next year?
- Writting and submission of papers (e.g. ESR, JVGR)

Future areas to cover?



Other