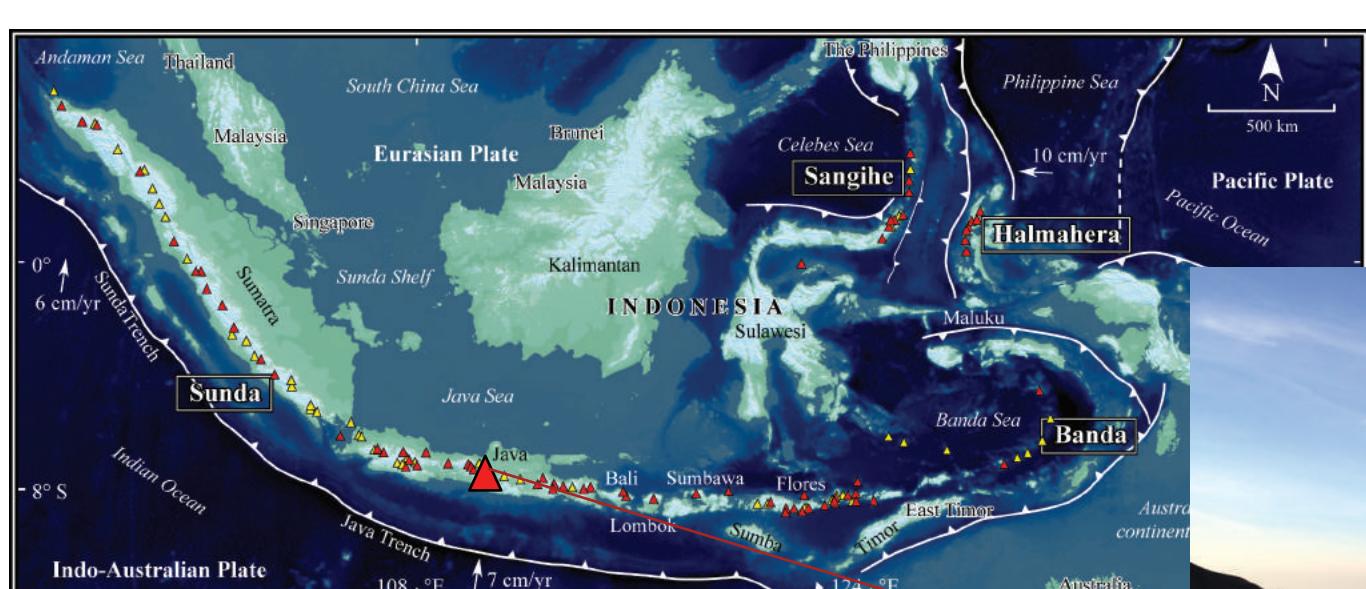


Tracking the evolution of the Merapi volcano crater area by high-resolution satellite imagery

V. Pinel (1), P. Bascou (1), A. Solikhin (2), F. Beauducel (1,2,3), R. Putra (2),
A. B. Santoso (2), H. Humaida (2), J.-P. Metaxian (1,3)

(1) ISTerre, IRD, CNRS, Université Savoie Mont-Blanc, Chambéry
(2) BPPTKG, PVMBG, Geological Agency, Indonesia, (3) IPGP, Paris



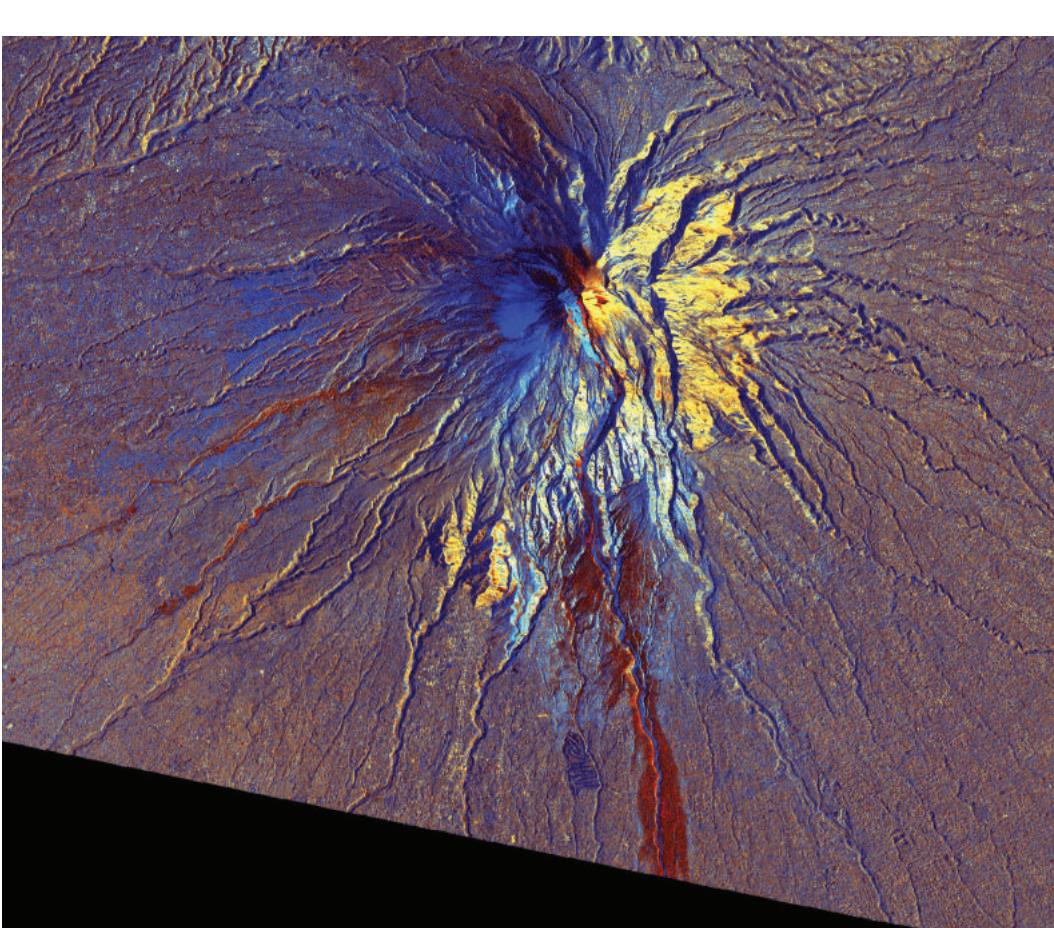
Merapi volcano, one of the most active volcano in Indonesia,
located in the Province of Yogyakarta in Central Java



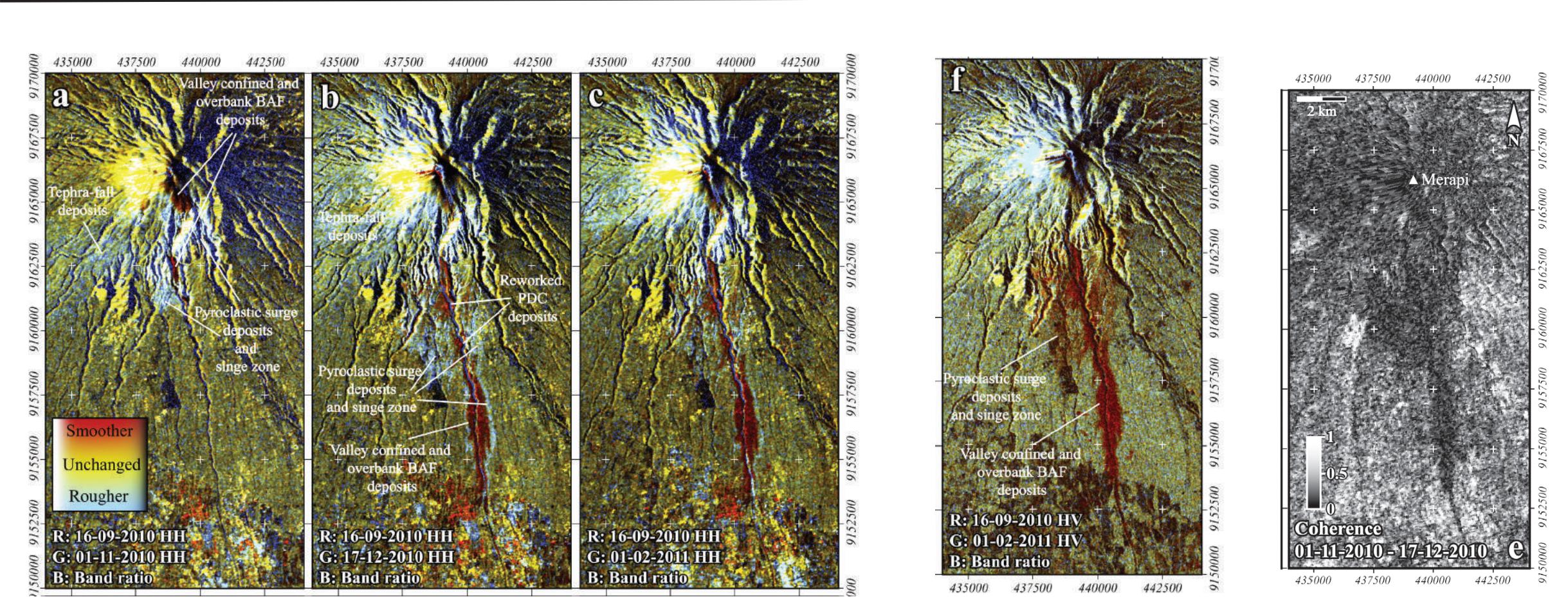
Activity characterized by a succession of dome growth and
collapse generating pyroclastic density currents (PDCs)
Latest large eruption: November 2010, VEI4,
PDCs reaching more than 15 km from the summit

HR Satellite acquisitions

TerraSAR-X 2010/10/26
TerraSAR-X 2010/11/06



Red: TerraSAR-X 2010/10/26
Green: TerraSAR-X 2010/11/06
Blue: TerraSAR-X 2010/11/06/2010/10/26



Mapping eruptive deposits of the 2010 eruption with ALOS images
(amplitude and coherence) from Solikhin et al, 2015

Volcanic events

largest event in more
than a century
VEI 4 eruption

2010/10/26 explosions

2010/11/06 paroxysmal event

2012/08

12 phreatic explosions

2013/04/26
Pleiades image (reference)

2014/04

2015/01/03
small crater wall destabilization

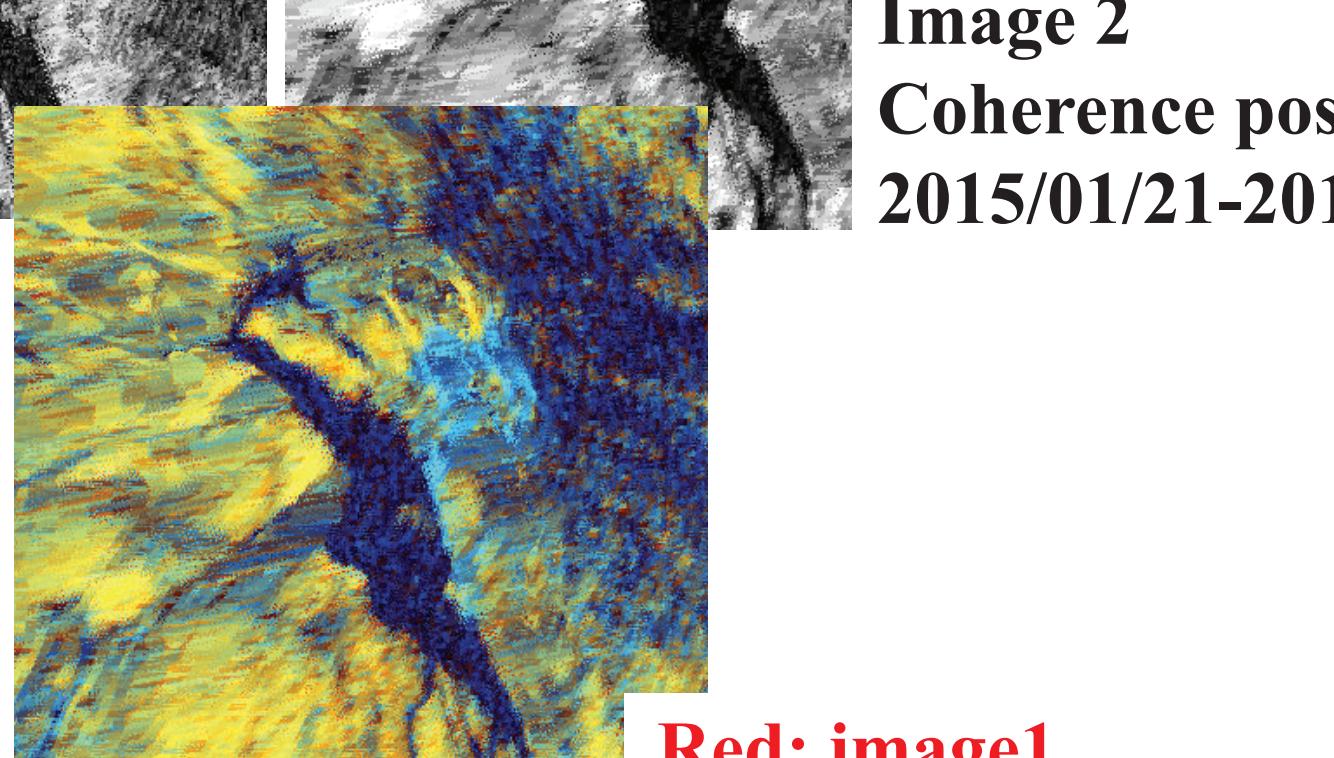


Image 2
Coherence post-event
2015/01/21-2015/01/22

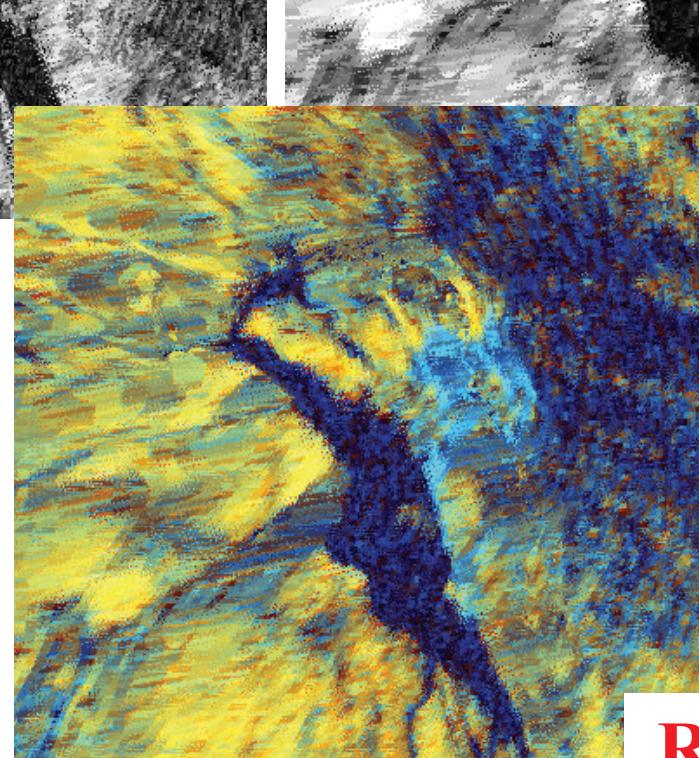
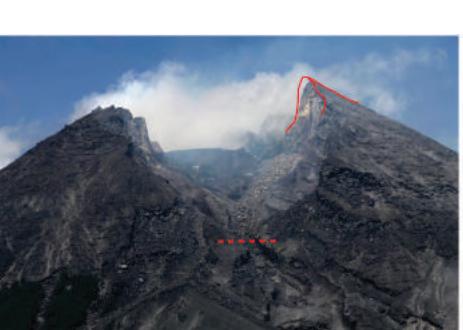


Image 1
Coherence co-event
2014/12/31-2015/01/21

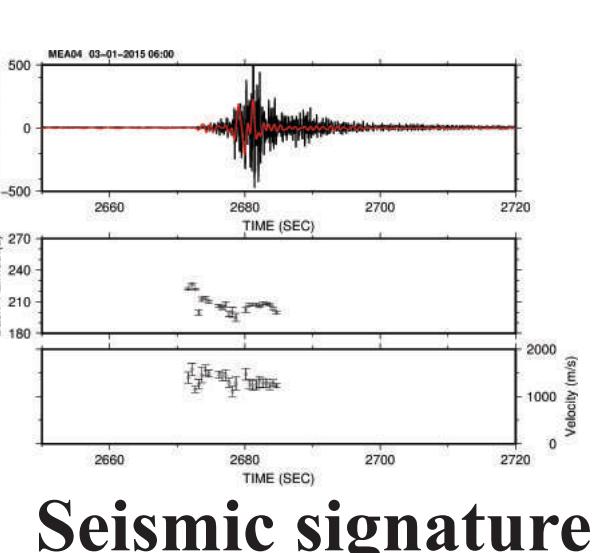
TerraSAR-X 2014/12/31
TerraSAR-X 2015/01/11
TerraSAR-X 2015/01/21



2014/12/19



2015/01/06

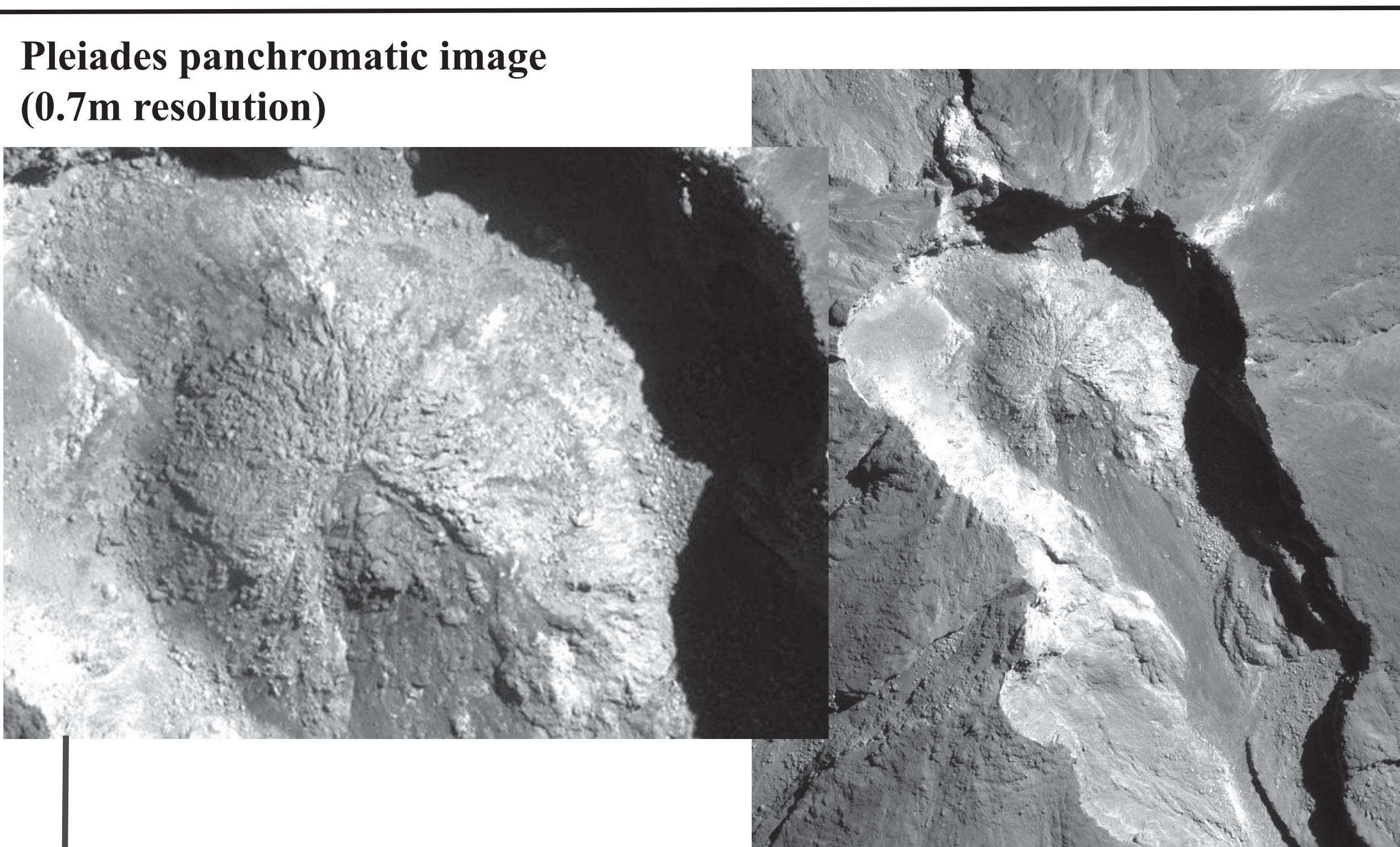


Seismic signature
2015/01/03

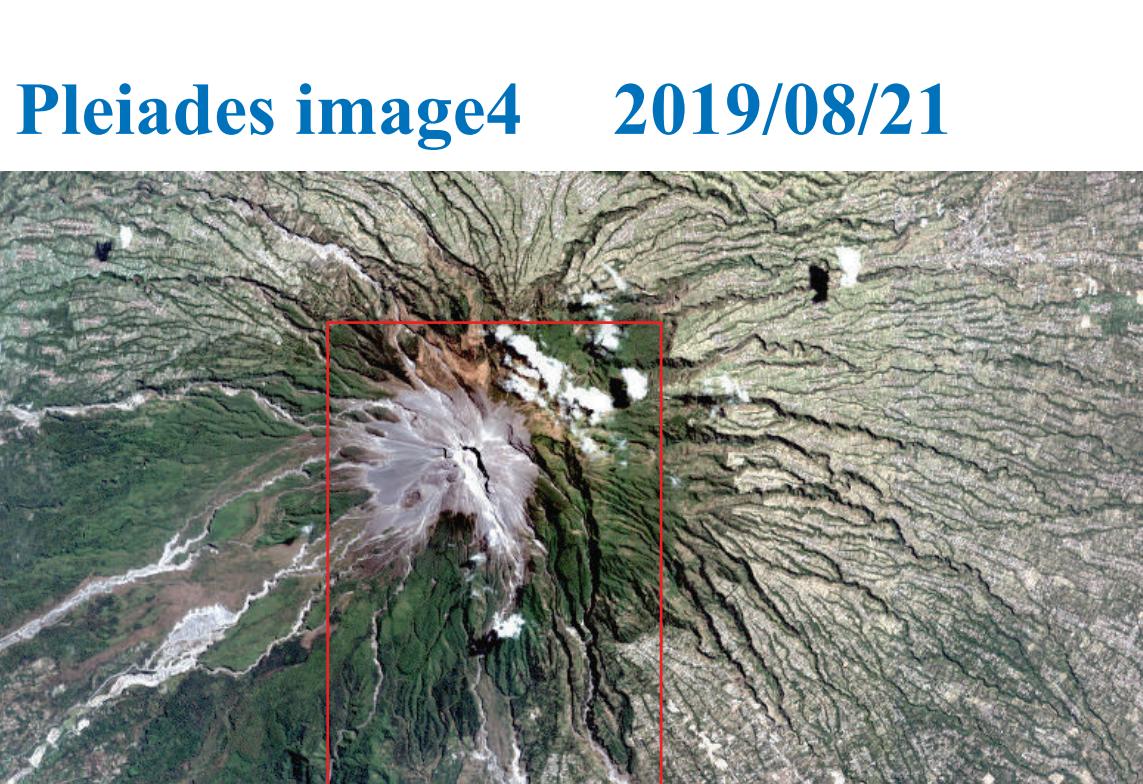
Mapping crater wall destabilization
by coherence change detection

Red: image1
Green: image2
Blue: Image2/image1

Optical images (K. Kelfoun)



Pleiades panchromatic image
(0.7m resolution)
DEM (3m resolution, 1m precision)
produced with AMES Stereo Pipeline
automatically coregistered
(Berthier et al., 2007)



Pleiades image4 2019/08/21

ISIS proposal submission

ISIS proposal accepted

Pleiades image1 2019/02/26

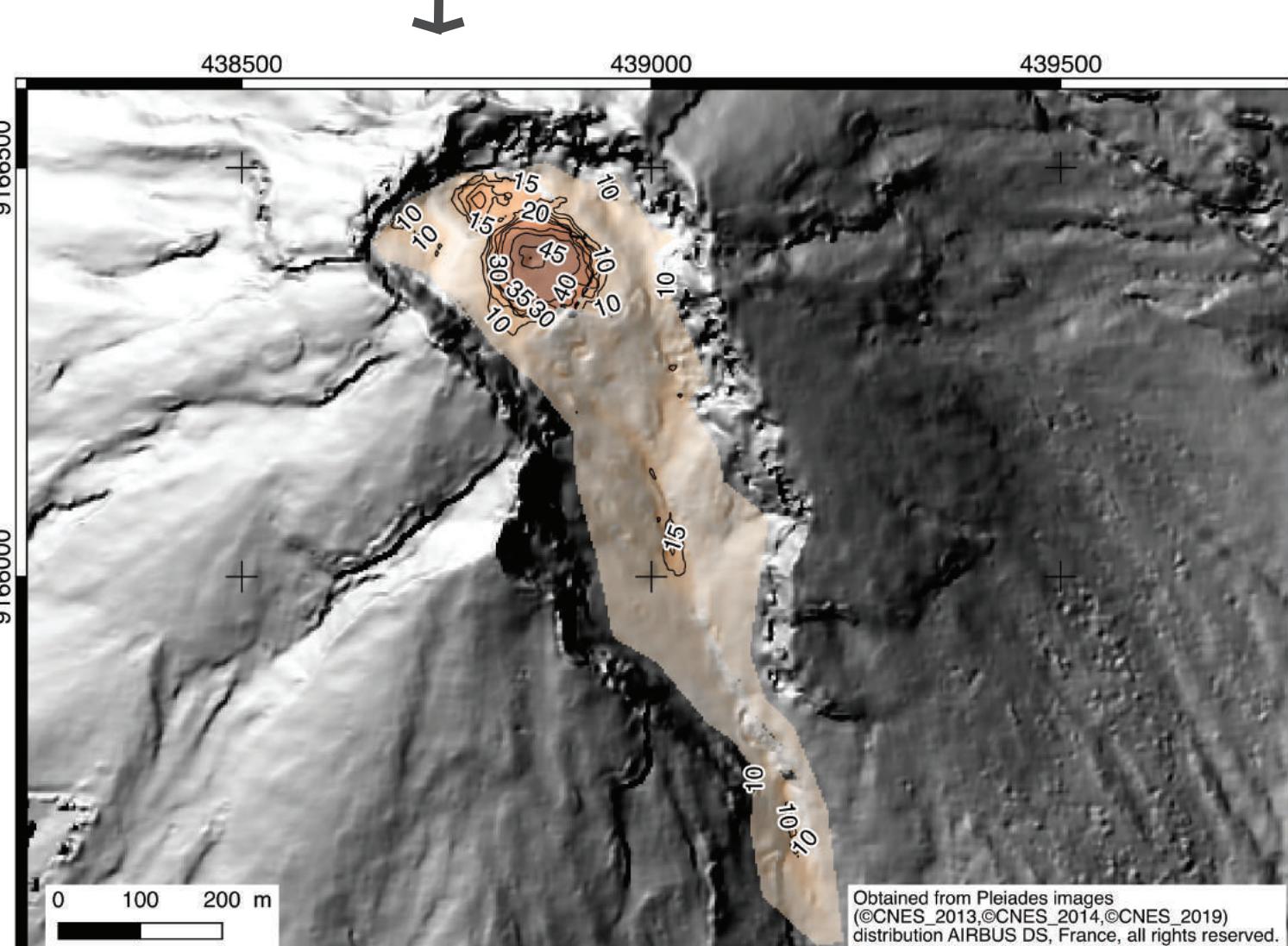
Pleiades image2 2019/05/21

Pleiades image3 2019/06/18

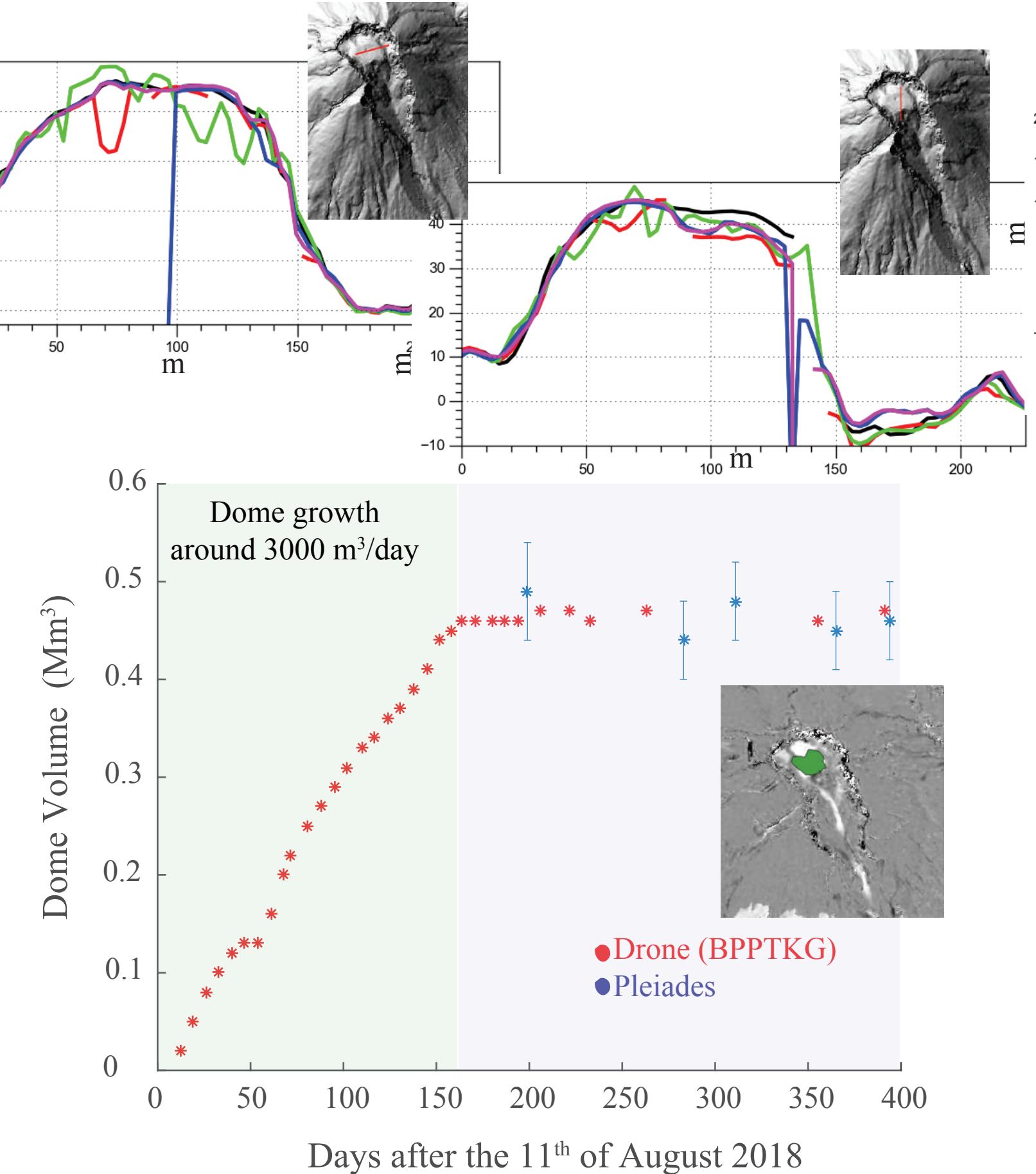
Pleiades image4 2019/08/21

Pleiades image5 2019/09/09

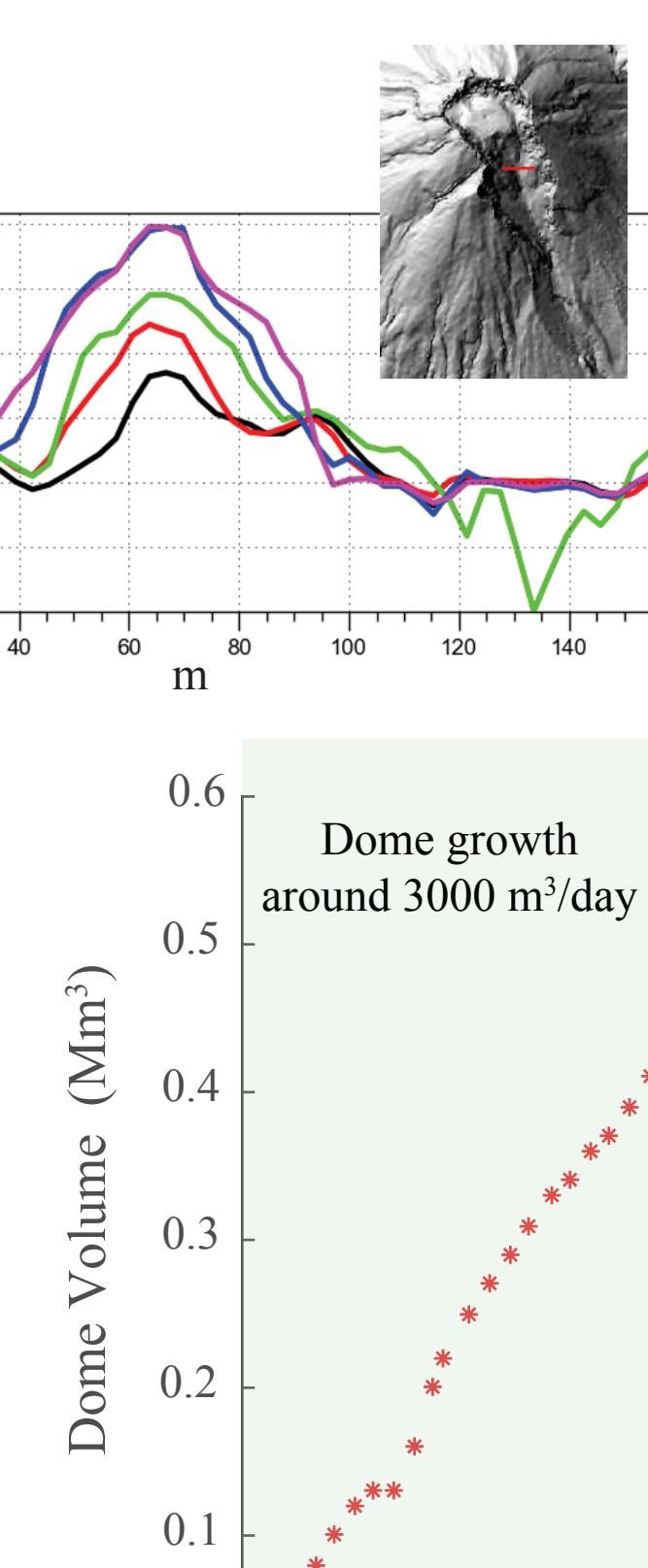
Tri-stereo images



2019/02/26 / Reference



No significant growth of the dome since february 2019
Good agreement between Pleiades estimation and drone measurements



Accumulation of deposits by dome destabilization
a few hundreds of meters below the dome
No drone measurements available

Magma inflow is still going on

Obtained from Pleiades images (@CNES_2013, @CNES_2014, @CNES2019) distribution AIRBUS DS, France, all rights reserved Commercial uses forbidden.

REFERENCES

*Berthier E., Arnaud Yves, Kumar R., Ahmad S., Wagnon Patrick, Chevallier Pierre. (2007). Remote sensing estimates of glacier mass balances in the Himachal Pradesh (Western Himalaya, India). *Remote Sensing of Environment*, 108 (3), 327-338. ISSN 0034-4257

*A. Solikhin, V. Pinel, J. Vandemeulebrouck, J.-C. Thouret, M. Hendrasto, Mapping the 2010 Merapi pyroclastic deposits using dual-polarization Synthetic Aperture Radar (SAR) data, *Remote Sensing of Environment*, <http://dx.doi.org/10.1016/j.rse.2014.11.002>, 180-192, 2015.