

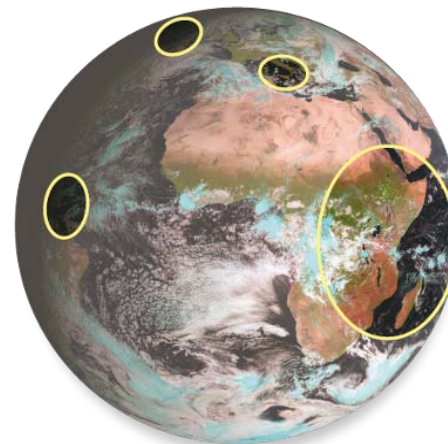
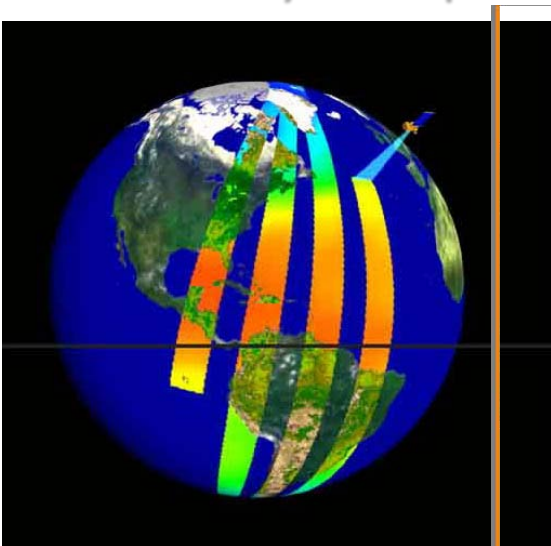
Near-Real-Time Global Volcano Monitoring by Geostationary and Polar orbiting Payloads



On the technological and volcanological standpoint, EVOSS built on lessons learnt from **the European Commission “Laboratory Volcanoes”** initiative, funded in **FP5** , and from the **ESA’s DUP** (Data User Programme, 1998-2002) and **DUE** (Data User Element, 2003-2007).

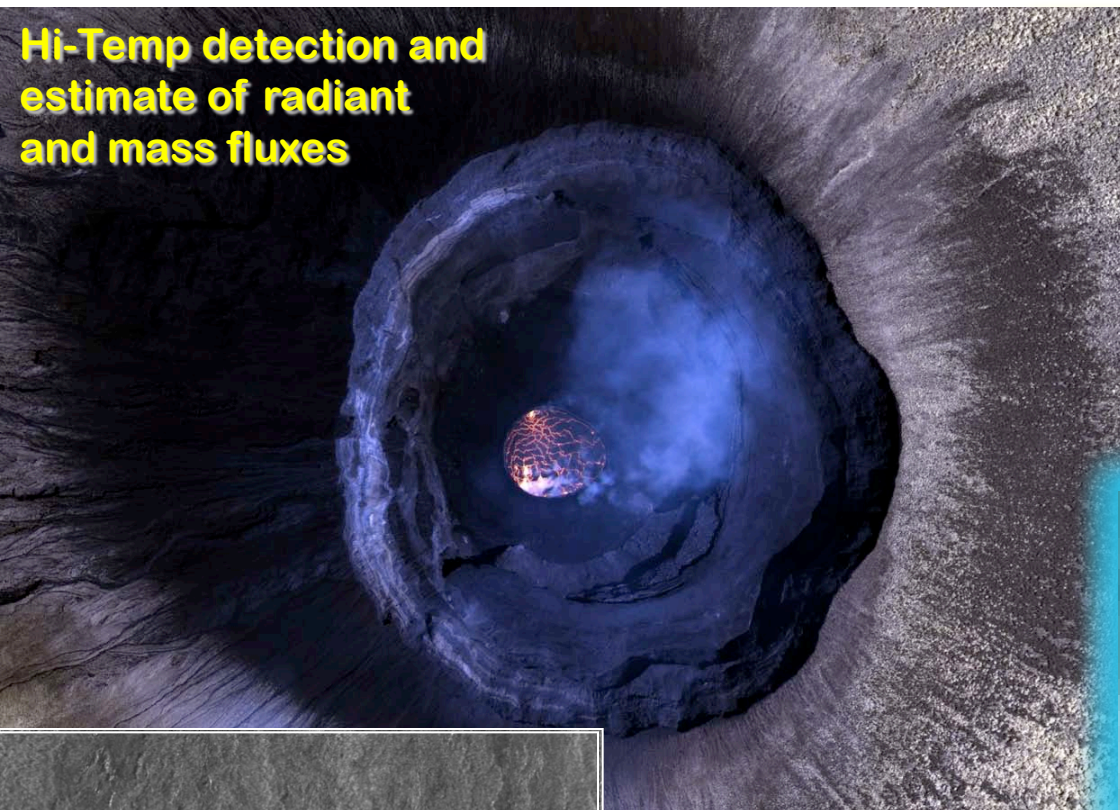
EVOSS is:

- A) Focused on the higher end of volcano dynamics**, from sustained unrest to eruption (requirement scaled on major crises 1991-1992 and 2001 at Etna, 1995-2006 at Soufriere Hills, 2002 at Nyiragongo, 2003 at Karthala, 2007 at Piton de la Fournaise)
- B) Designed to serve in Supra-Regional operations theatres**
- C) Very-high Temporal Resolution and Real-Time are given priority** over high-to-very high spatial resolution at moderate-to-low refreshment rates
- D) System(s) scaled on spatially scattered, long lasting crises** (months to years);
- E) Sustainability of data provision has priority.**



- Technology :** a ‘cloud’ of remote processors runs - 24/7 and in real-time - State-of-Art algorithms relating to processing methods that have proved both robust, and suited to unsupervised RT operations
- Structure :** in the ‘cloud’, each product has 1 RT/NRT content provider (6 content providers in 4 countries, 1 central dynamic repository serving the Virtual Volcano Observatory, and 1 supervision and quality control unit)
- Demo/Ops. :** From October 9, 2011 to June 30, 2013 (full – for EC grant)
From July 12, 2013, for Thermal and SO₂ GOME-2
- Success :** **94% →** 45 out of 48 eruptions (45 subaerial and 3 submarine) by any combination of methods - excepting ground deformation.
- Access :** Full real-time access to the VVO from December 2011 onwards
- Improvements :** upon request of End Users, or based on new evidence from research, or to exploit new observation modes
migrations : **RSS on MSG-1 and -2, and MSG-2 and -3, full disk**
porting tests: **JAMI / MTSAT-1 and -2 → 2012-2013 Tolbachik**

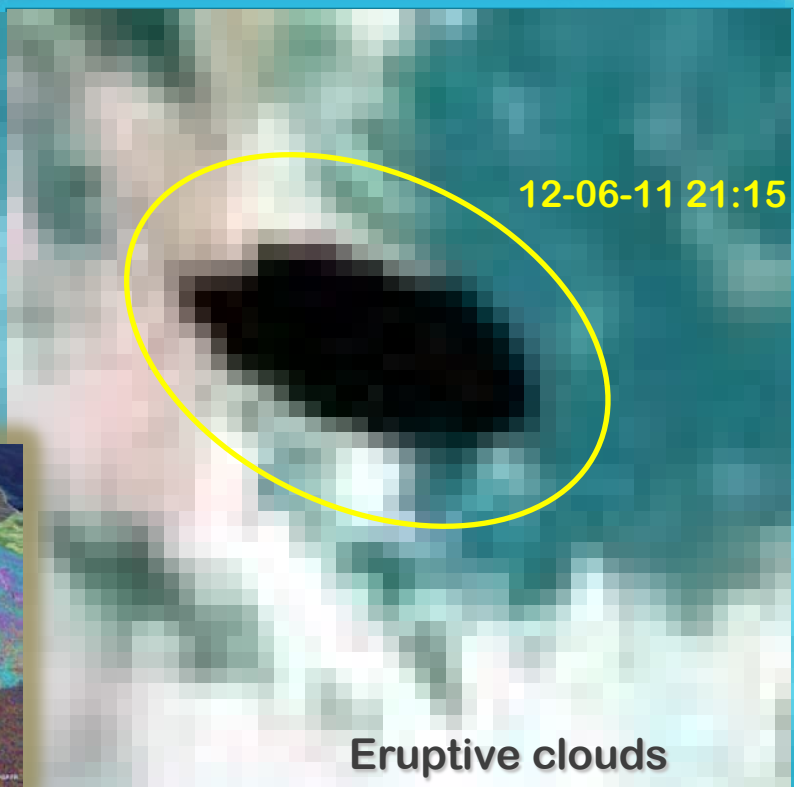
Hi-Temp detection and estimate of radiant and mass fluxes



SO₂ mass and mass flux

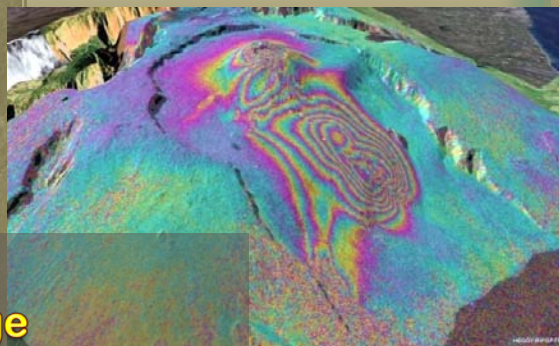


VVO



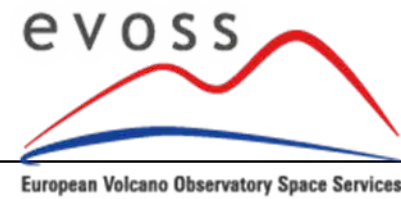
12-06-11 21:15

Eruptive clouds



Change Detection, Pattern recognition, Volume Change

48 eruptions dealt with by eVOSS



Nyamulagira (Congo) :	Eruption	January 2 to 29, 2010
Soufriere Hills (Montserrat) :	Pyroclastic flow on	February 11, 2010
Eyjafjallajökull (Iceland) :	Eruption	March 20, 2010
Manda Hararo (Ethiopia) :	Eruption	March 21, 2010
Piton de la Fournaise (Reunion) :	Eruption	October 14, 2010
	Eruption on:	December 9, 2010
Etna (Italy) :	Eruptions on:	January 12, 2011
		« April 9 and May 11, 2011
Grimsvötn (Iceland) :	Eruption	May 24, 2011

Quantitative Thermal – tests and operation

Nabro (Eritrea) :	Eruption	June 12 to July 17, 2011 (first tests)
Nyiragongo (Congo) :	Lava lake - permanent	since June 2011 (SEVIRI operation tests)
Erta Ale :	Lava lake – permanent	June 2011 to June 2013 (MODIS ops.demo)
Etna (Italy) :	Eruptions on:	July 9–19–25–30, 2011
		« August 5–12–20–29, 2011

+ Quantitative Thermal and SO2 online

Etna (Italy) :	Eruptions on:	September 8–19–29, Oct. 8-23, 2011
Nyamulagira (Congo) :	Eruption	November 6, 2011 to March 15, 2012
Etna (Italy) :	Eruptions on:	November 15, 2011
		« January 3, 2012
		« February 6, 2012

+ Quantitative Ash Retrieval online

Stromboli (Italy) :	Eruption	July 6-7, 2012
Etna (Italy) :	Eruptions on:	March 4-18, 2012
		« April 1-12-24, 2012
		« February 2-19-20-21-22-28, 2013
		« March 4, 16; April 3, 11, 18, 20 and 27,

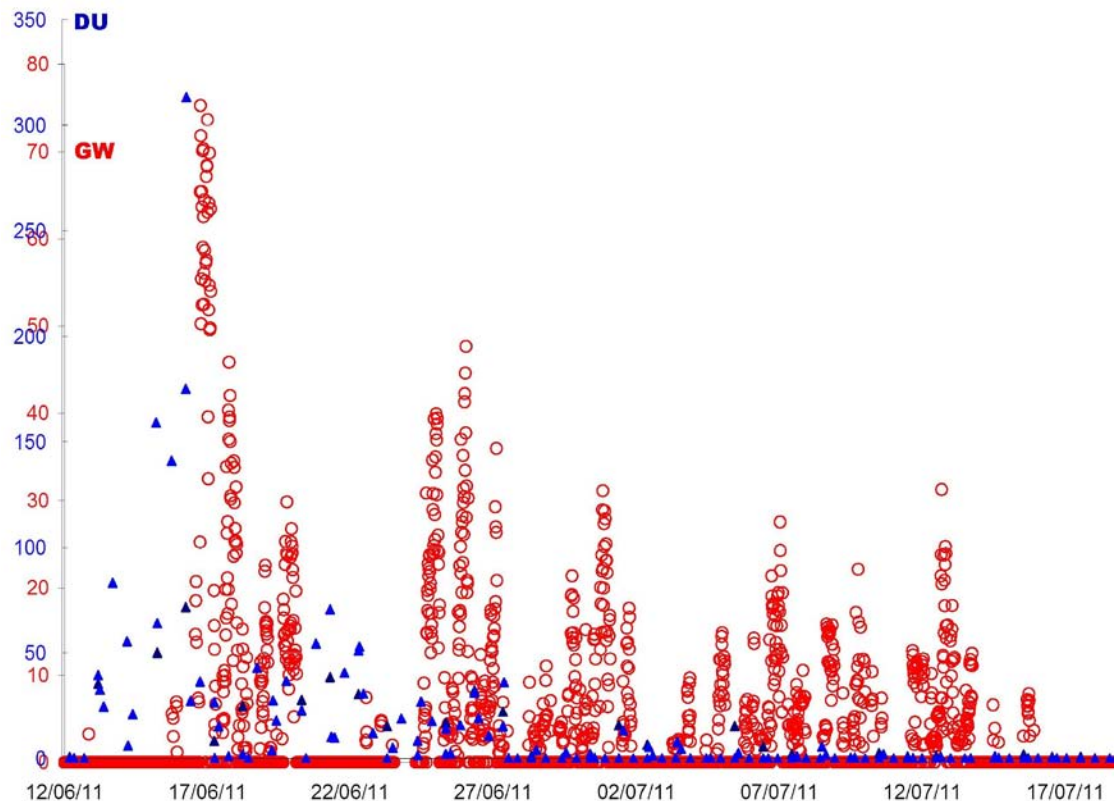
- Quantitative Thermal and SO2 online

2013

Jebel Zubair (Yemen) :	Submarine	September 29 – October 14, 2013
Etna (Italy) :	Eruptions on	October 26-27, November 11 and 16-17, 2013

SO₂ (DU)

RadFlux (GW) by **SEVIRI**
DU_{max} by **OMI, GOME2, SCIAMACHY**

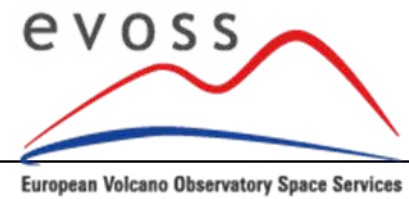


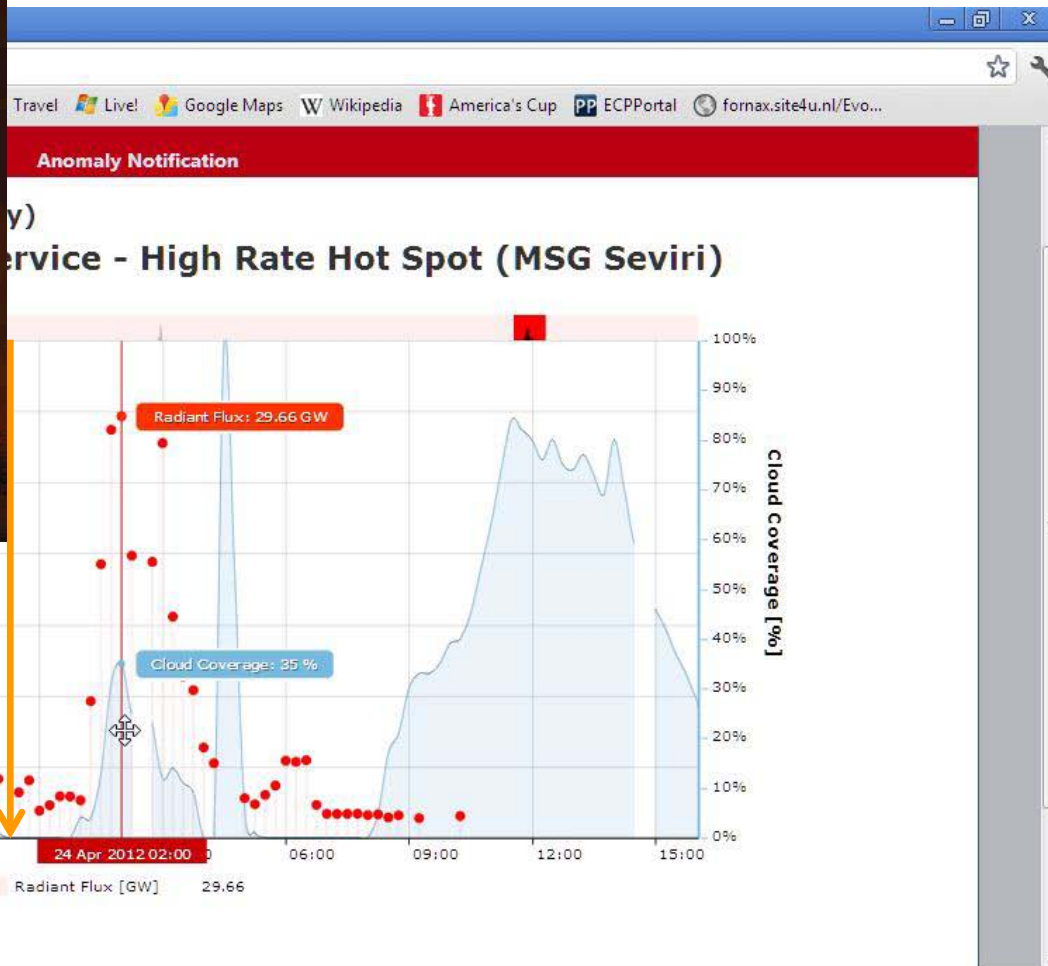
Congo:
18-month SO₂ monitoring
(including the eruption of
Nyamulagira, Jan. 2010)

Nabro:
merge of synchronous
Thermal Radiant flux
and SO₂ DU_{max} values



Eruptions



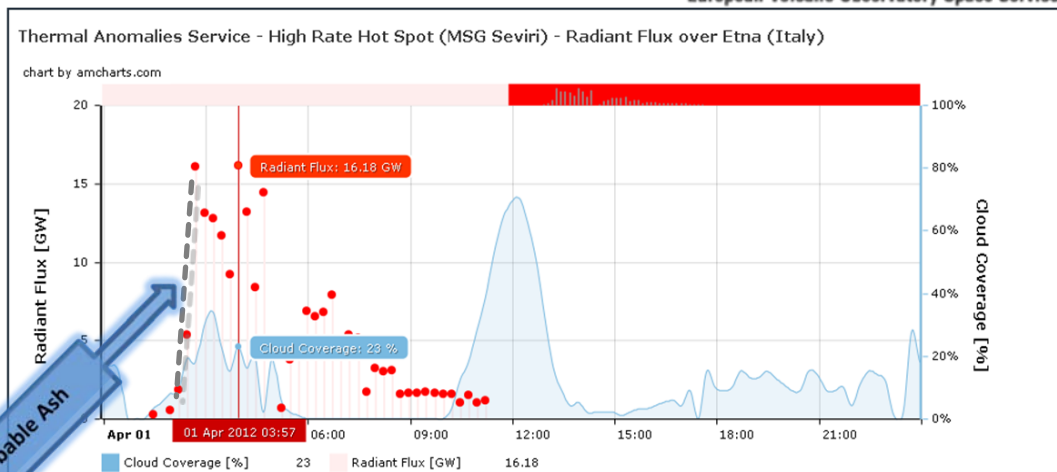
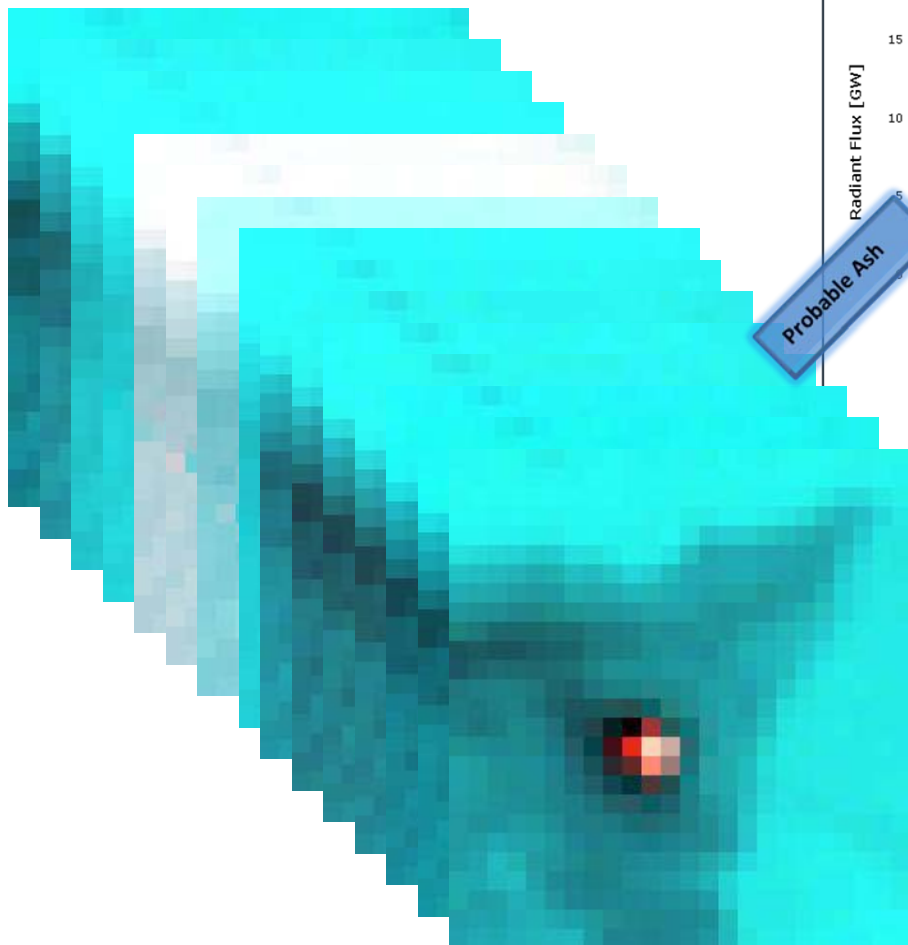


wms (4)

Show all downloads...



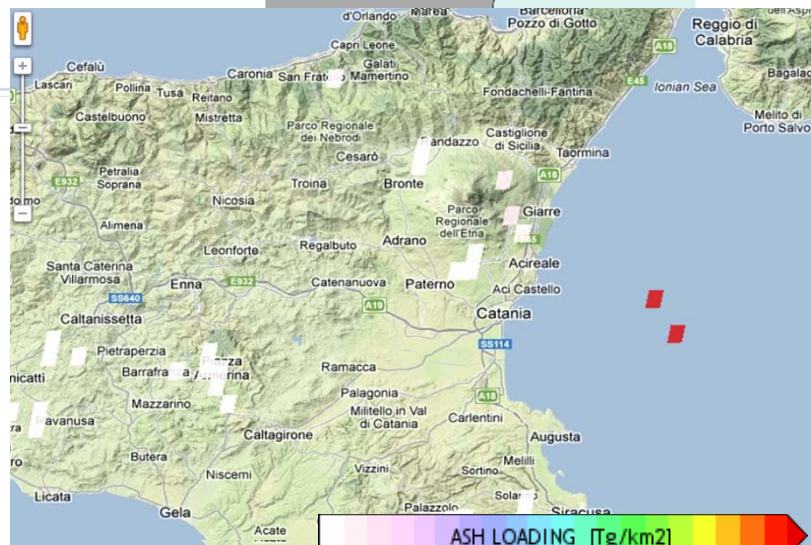
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29/04/2012

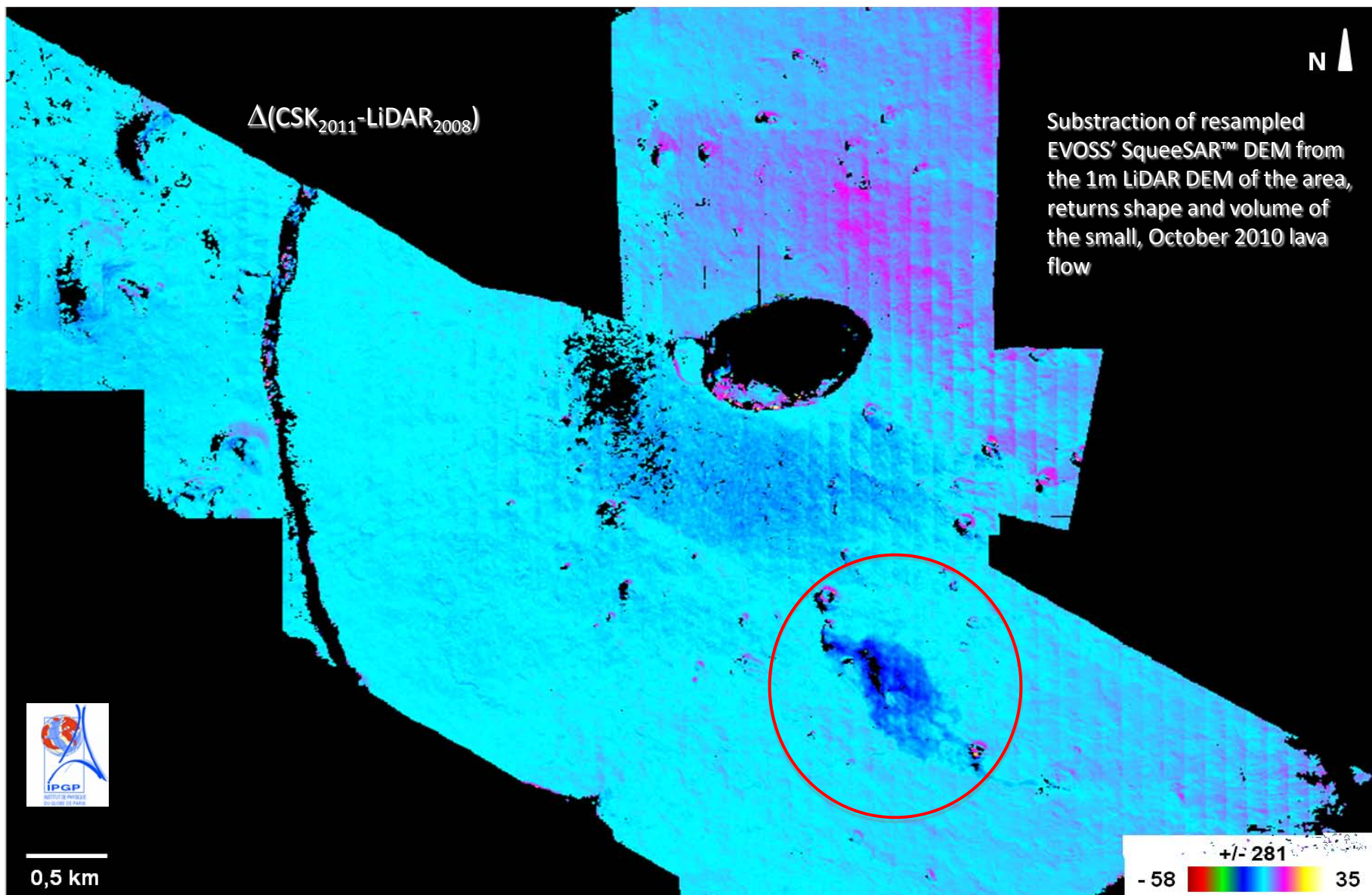


Product Information	
Date	2012/04/01 03:57
Total Radiant Flux	16.18 GW
Cloud Coverage	23 %



Click over the product preview to enlarge it





04/11/2011



11/11/2011



19/11/2011



20/11/2011



27/11/2011



05/12/2011



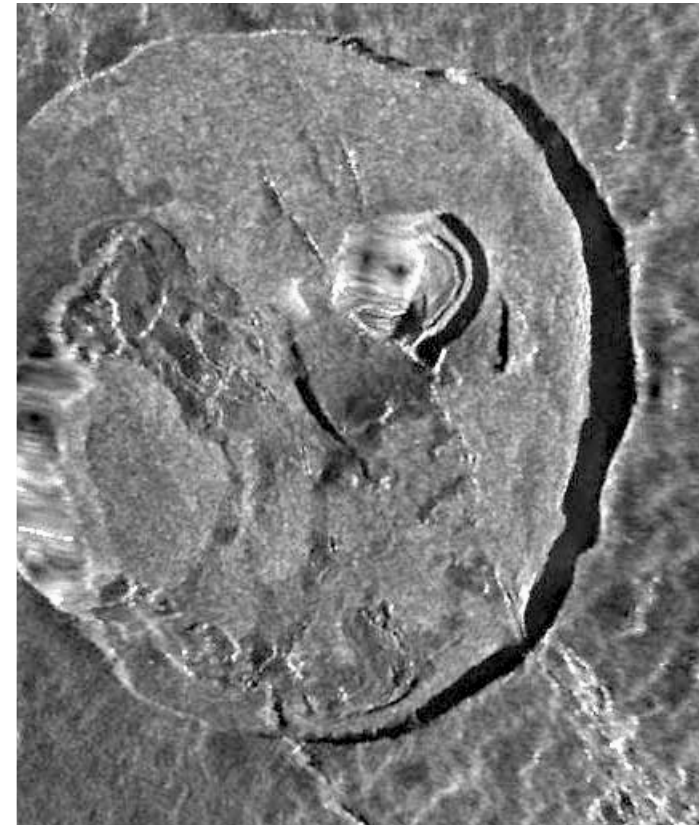
Evolution of the Nyiamulagira lava flow in 2011



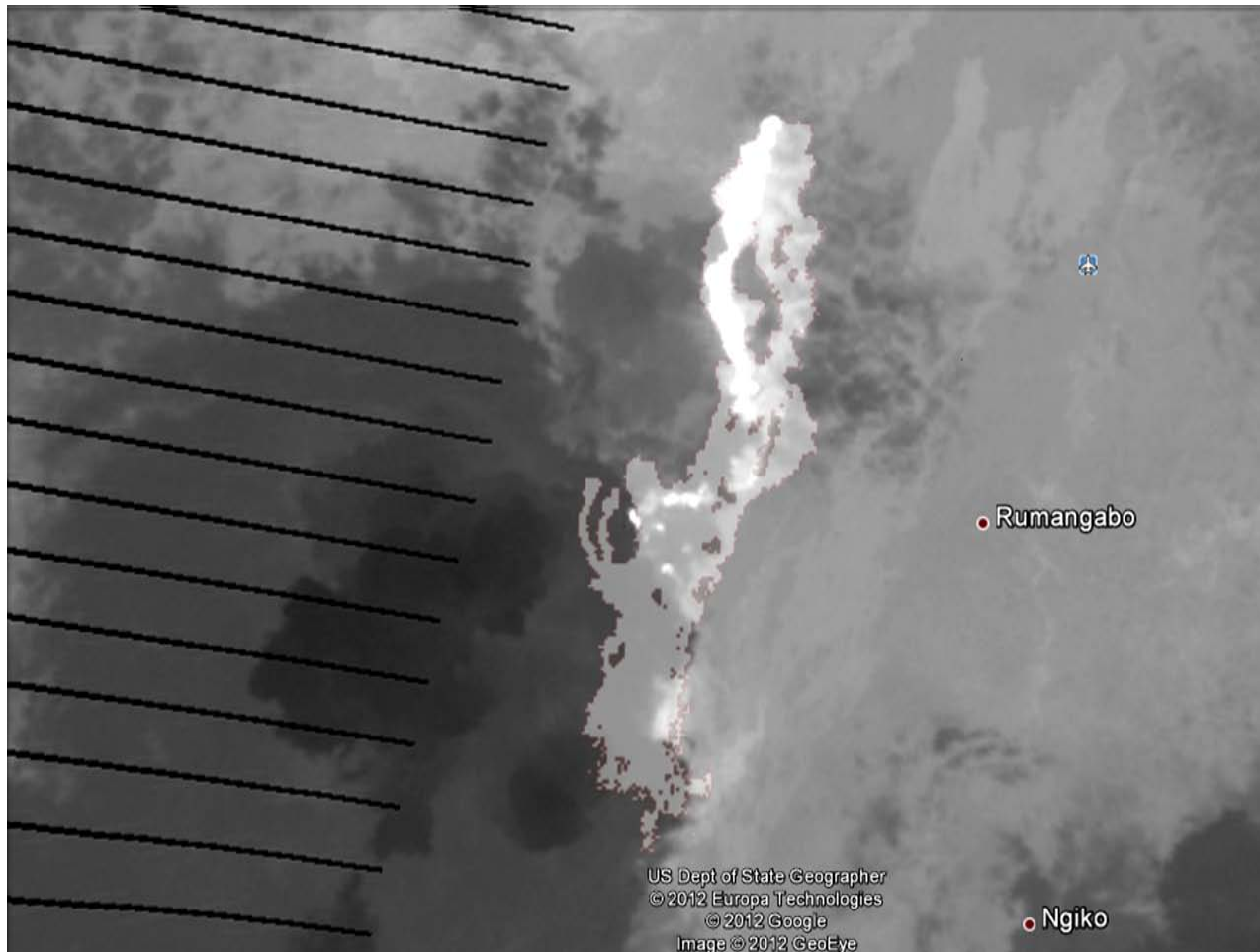
CSK Himage – December 9, 2011

Nyamuragira crater dynamics

May 12, 2012



May 14, 2012



TIR Landsat 7 (LSC-off) 20111121

+ CSK lava flow on 20111120 by
SqueeSAR™ constrained Δ_{DEM}

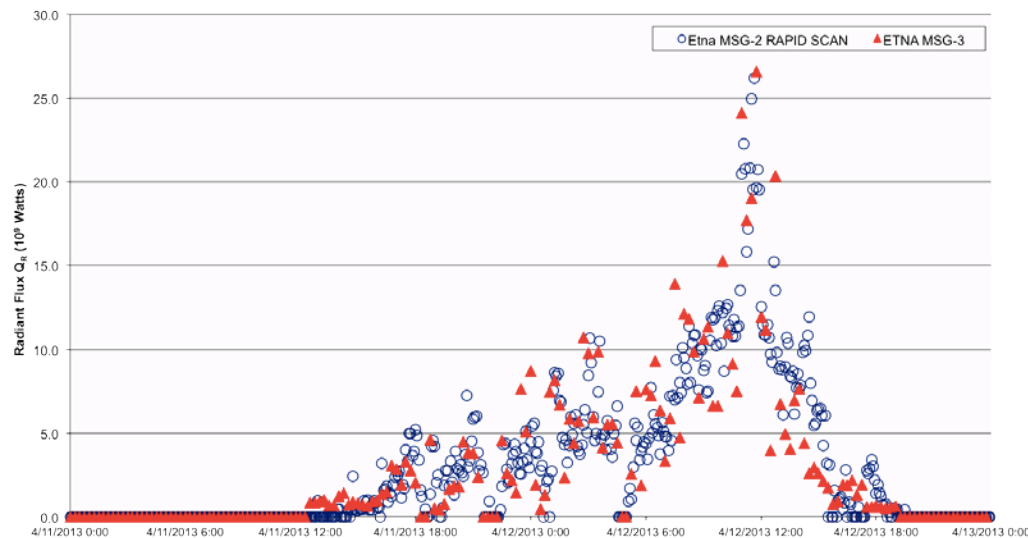
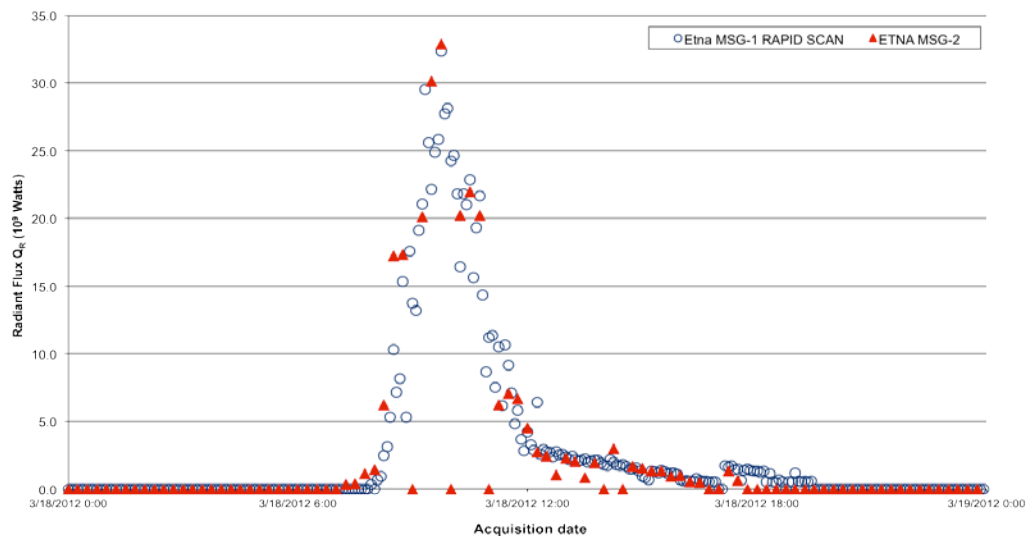


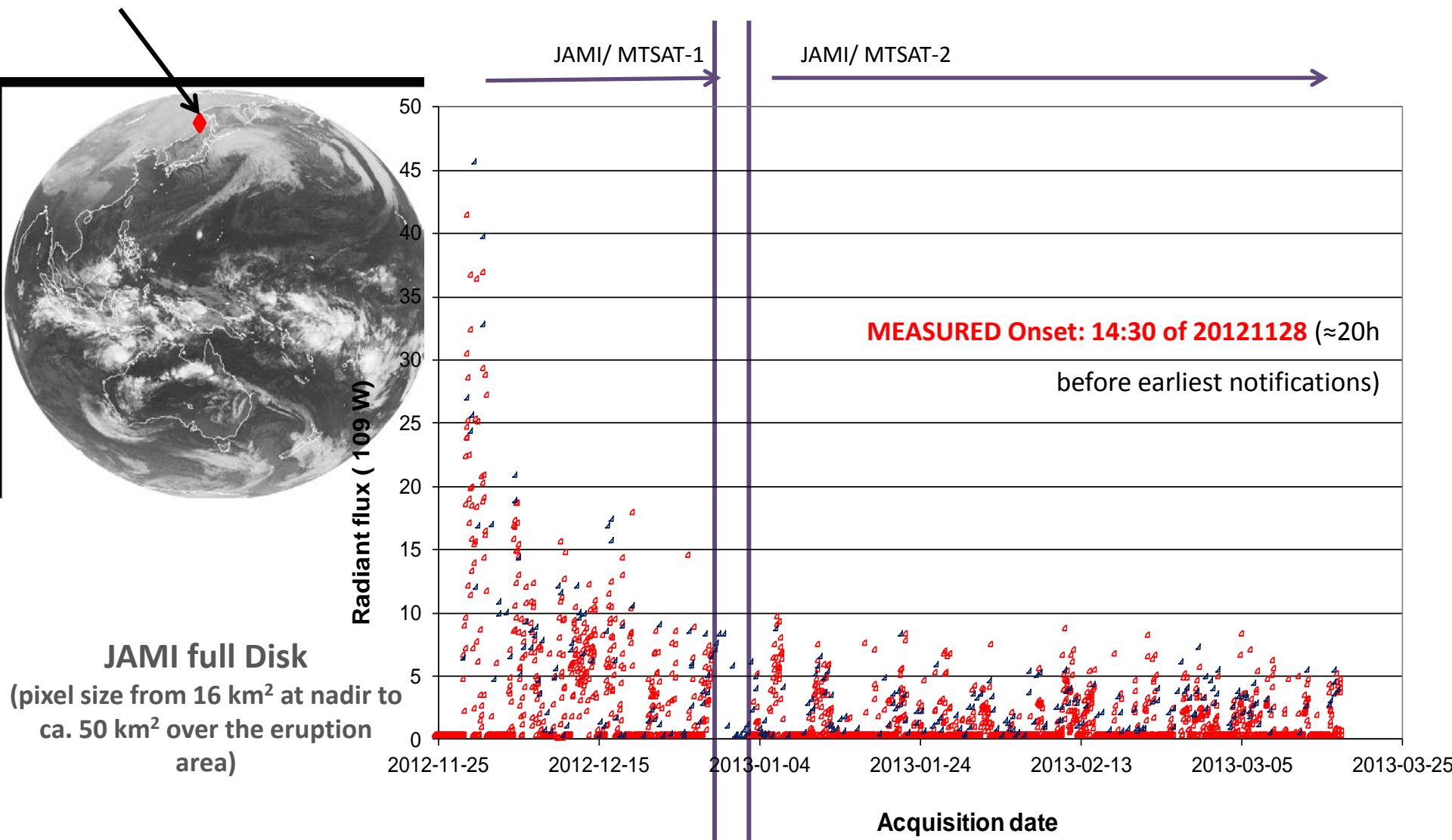
↑ **Mt. Etna - Mar 18, 2012**

(MSG-2 + RSS MSG-1)

Mt. Etna - Apr 12, 2013 →

(MSG-3 + RSS MSG-2)





○ JAMI (MTSAT-1 & -2, hourly → pixel $\approx 50 \text{ km}^2$) vs. ◆ MODIS (Terra & Aqua, 4 daily → 1 km^2)

- ✧ The EC project started on March 1, 2010, held the KO meeting on April 15, 2010, formally finished on July 11, 2013. The system is still running in its more sustainable and robust component.
- ✧ The development was faster than expected - almost all methods proved more robust than expected. This allowed EVOSS going operational between To+16 and +22, instead of To+24 and beyond
- ✧ The system proved extremely reliable, as the percentage of failure (non-operational time) keeps steadily under 1%, despite the wide areal distribution of product makers and the huge Region of Interest
- ✧ In consideration of the system's reliability and the controlled cost of multidisciplinary unsupervised operations, upon request of major stakeholders (the Government of Djibouti, the Observatory of Goma, the Observatory of Karthala, the Geological Survey of Tanzania) and with the agreement of relevant EC entities, the system was kept running beyond its formal expiry because it is exploited and is – at least partly – sustainable.

[EVOSS](#) Virtual Volcano Observatory

2010 – 2013....



....and more