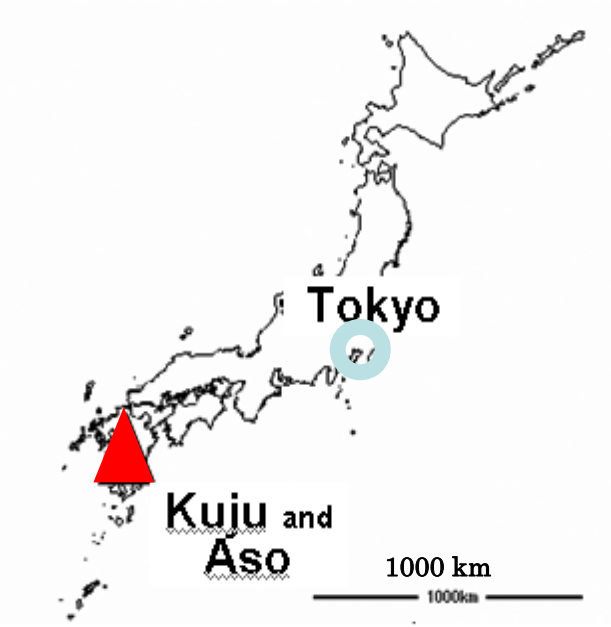
Lバンド干渉SARによる　くじゅう連山の観測

L-band Interferometric SAR Observations of Mt. Kuju, Kyushu

○大村　誠・梅田晃世（高知女子大）、小林茂樹（東海大）、
小池克明（熊本大）、冨山信弘（RESTEC）

○Makoto Omura, Teruyo Umeda (Kochi Women's Univ.), Shigeki Kobayashi (Tokai Univ.), Katsuaki Koike(Kumamoto Univ.), Nobuhiro Tomiyama(RESTEC)

○E-mail: omura@cc.kochi-wu.ac.jp

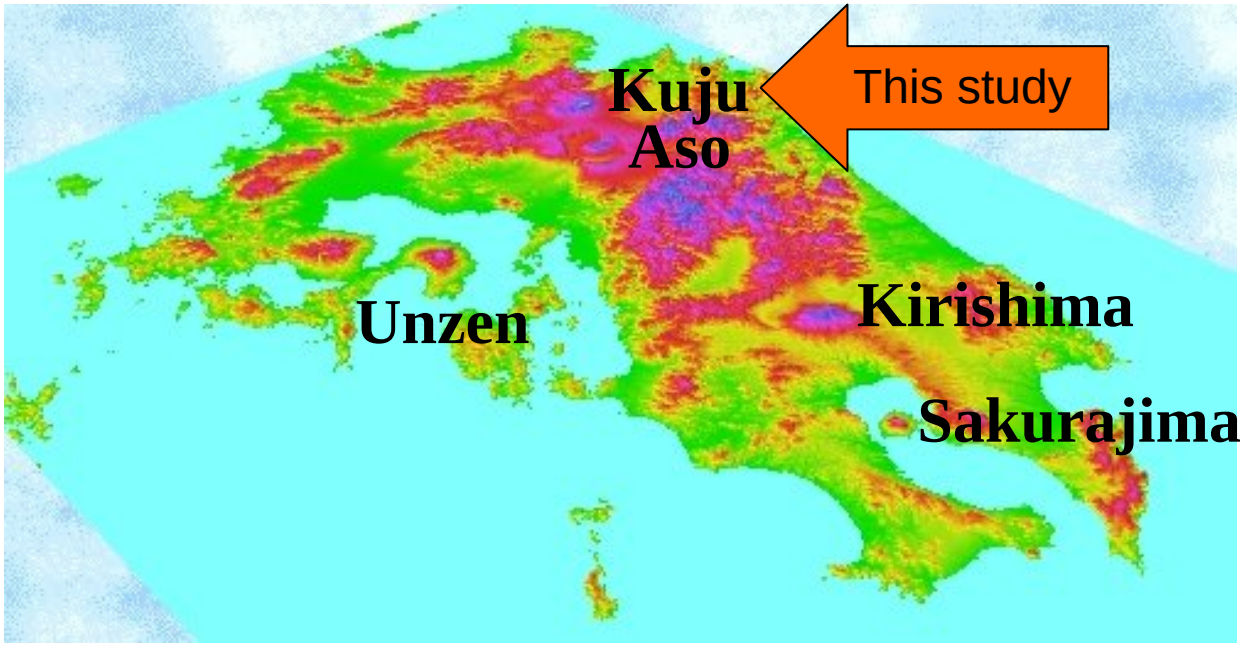


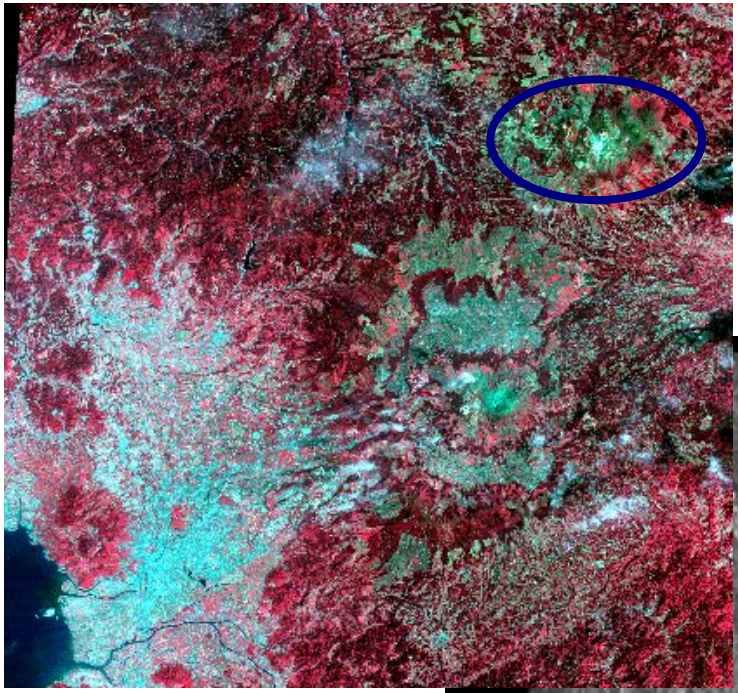
1. Introduction
2. Data and Software
3. Preliminary D-InSAR analyses for the Kuju volcano, Kyushu, Japan
4. Discussion
5. Concluding remarks

1. Introduction

There are some active volcanoes and geothermal fields in Kyushu, Japan .

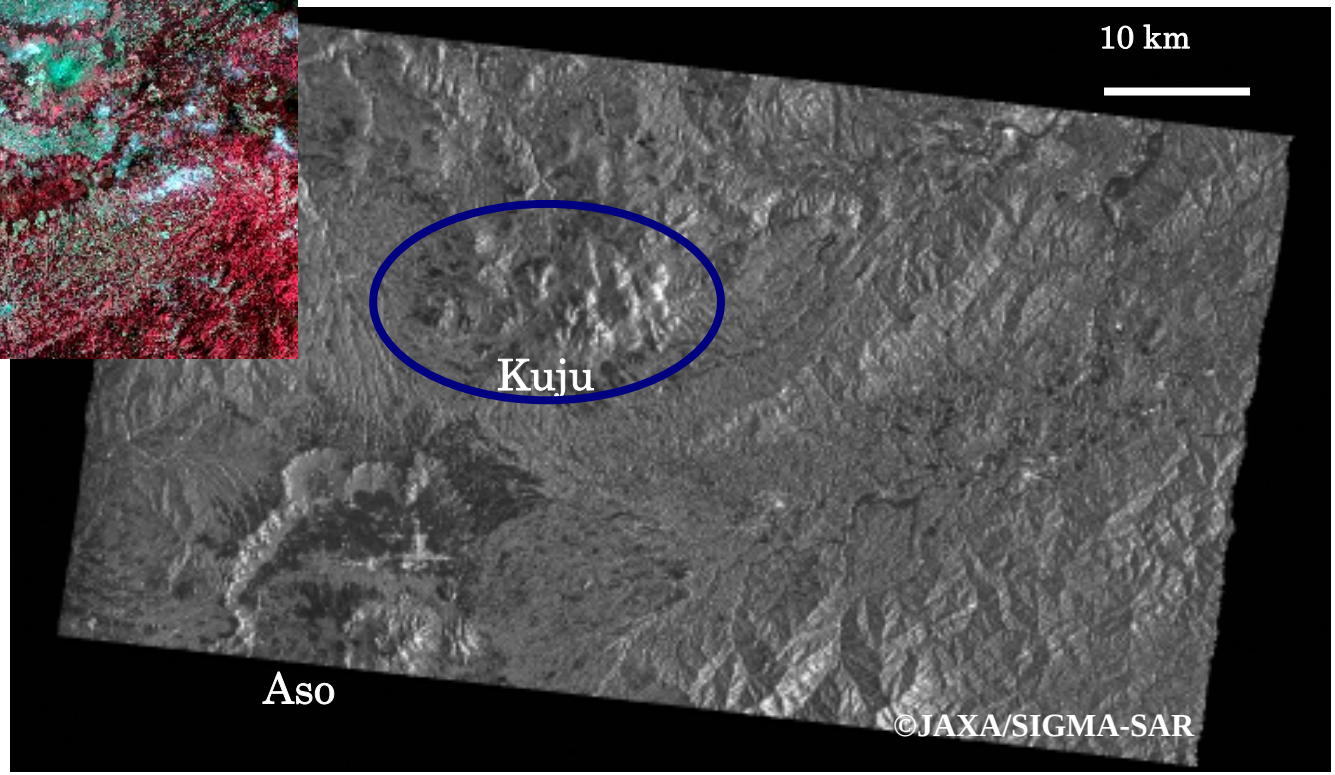
This study concerns on **Kuju** volcanic area.





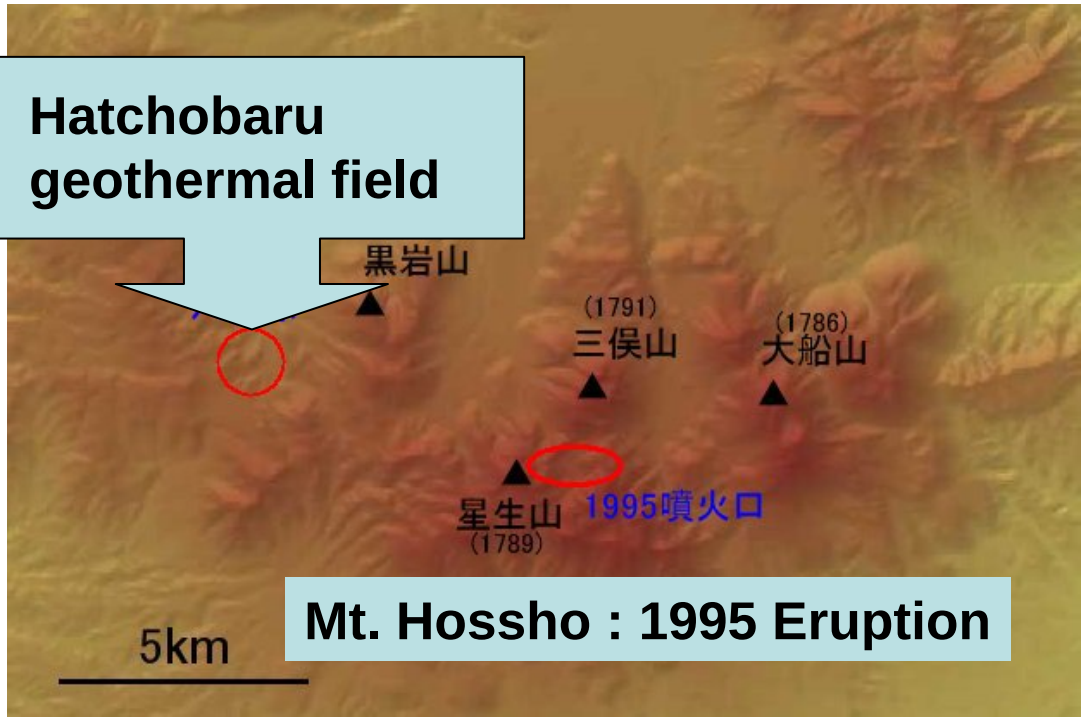
LANDSAT TM
(RGB=432)
25 Apr. 1998

Kuju volcanic area is located to NE of Aso volcano.



JERS-1 SAR: 14 March 1996

On 11 October 1995, Mt. Hossho erupted.
We carried out JERS-1 D-InSAR monitoring of ground deformations associated with the volcanic activity.
Ground deformations in the Hatchobaru geothermal field were also detected. There is the largest geothermal power plant (110MW) in Japan.

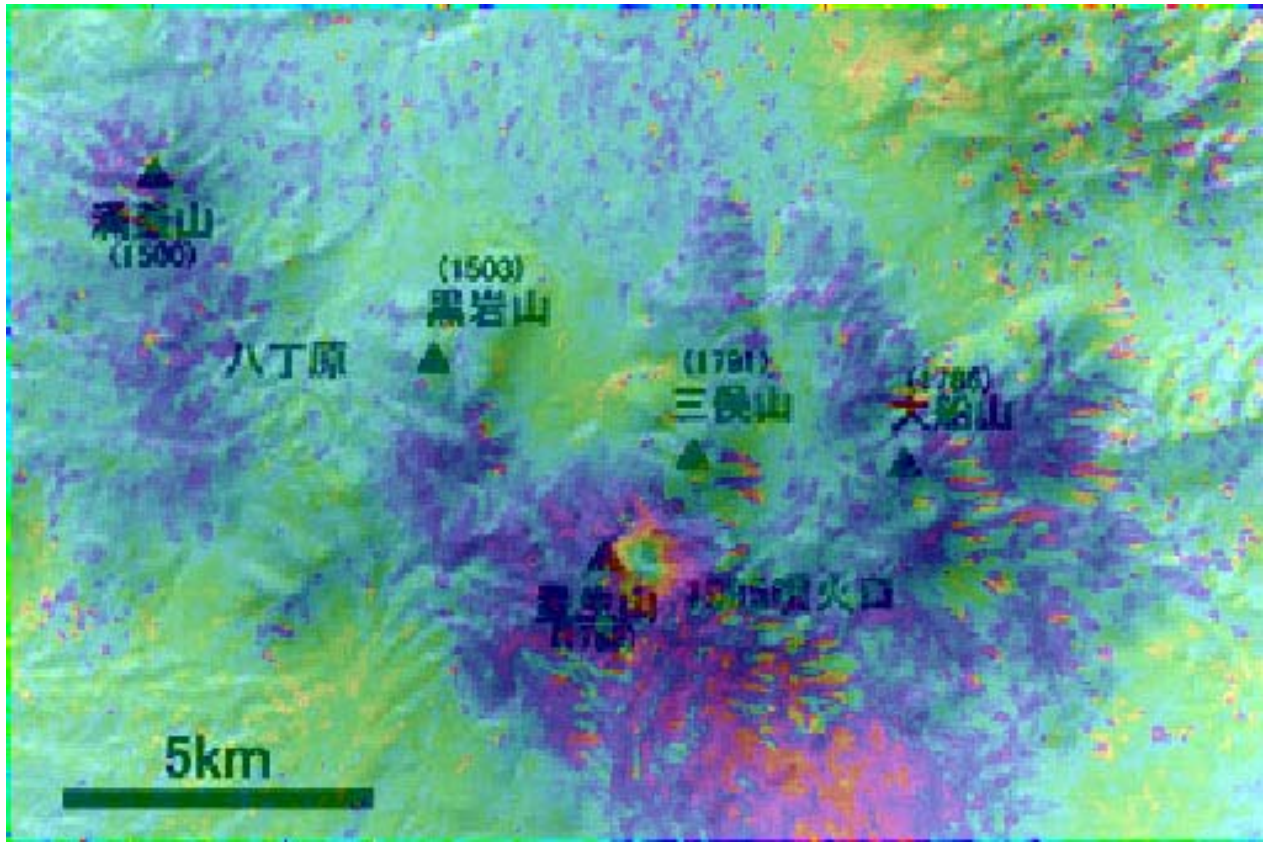


Fumarolic activity at Kuju Volcano
(Photo by Makoto Nakaboh)

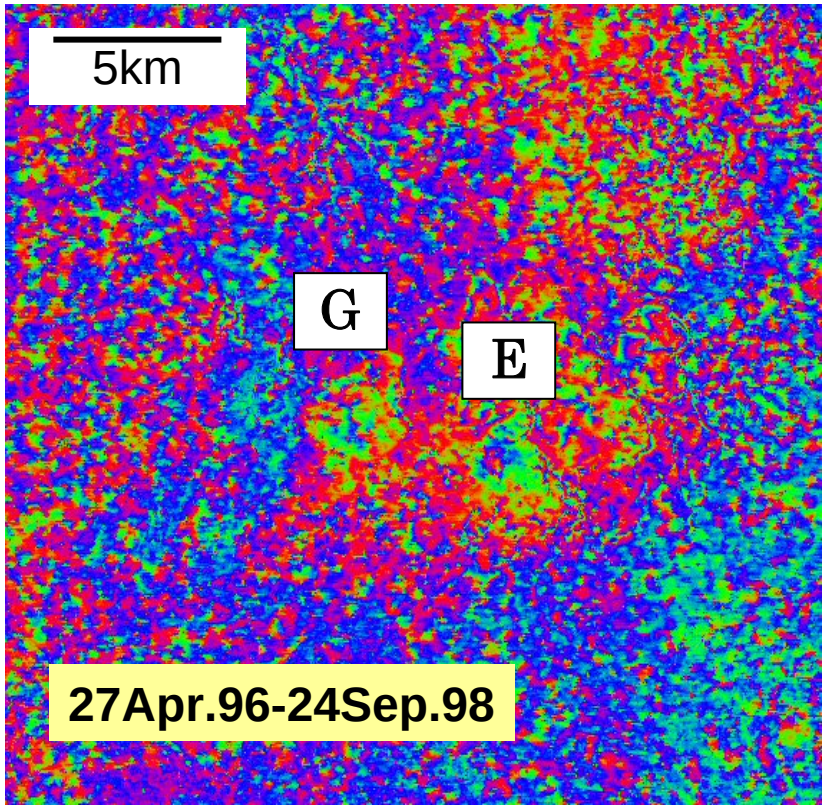
星生山付近（2008年8月2日）

星生山付近（2008年8月5日）

JERS-1



1995/11/3-1996/3/14



JERS-1

The L-band InSAR maintains rather high coherence even on the vegetated steep terrains in Kyushu.

27Apr.96-24Sep.98 : 2years 5 months

G: Geothermal area +8cm in LOS

E: Eruption of Mt. Hossho +18cm in LOS

2. Data and Software

We analysed 13 scenes JERS-1 L-band SAR data for the period between 1992 and 1998.

Year	Number of scenes
1992	1
1993	4
1994	0
1995	2
1996	3
1997	1
1998	2

JERS-1

78-245(+4)

78 pairs

(ownership of the JERS-1 SAR data: METI/JAXA)

We analysed 7 descending scenes ALOS/PALSAR L-band SAR data for the period between 2007 and 2008. More 4 ascending scenes will be analysed.

Year	Number of scenes
2007	2
2008	5

ALOS/PALSAR

73-2950

21 pairs

(ownership of the ALOS / PALSAR data: METI/JAXA)

ALOS/PALSAR データはPIXEL (PALSAR Interferometry Consortium to Study our Evolving Land surface）において共有しているものであり、JAXAと東京大学地震研究所との共同研究契約によりJAXAから提供されたものである。

SIGMA-SAR software (Shimada,1999)

Shimada M: Verification processor for SAR calibration and interferometry, Advances in Space Research, vol.23, No.8, pp.1477-1486, 1999.

GSI 50m mesh DEMs were applied for D-InSAR processing.

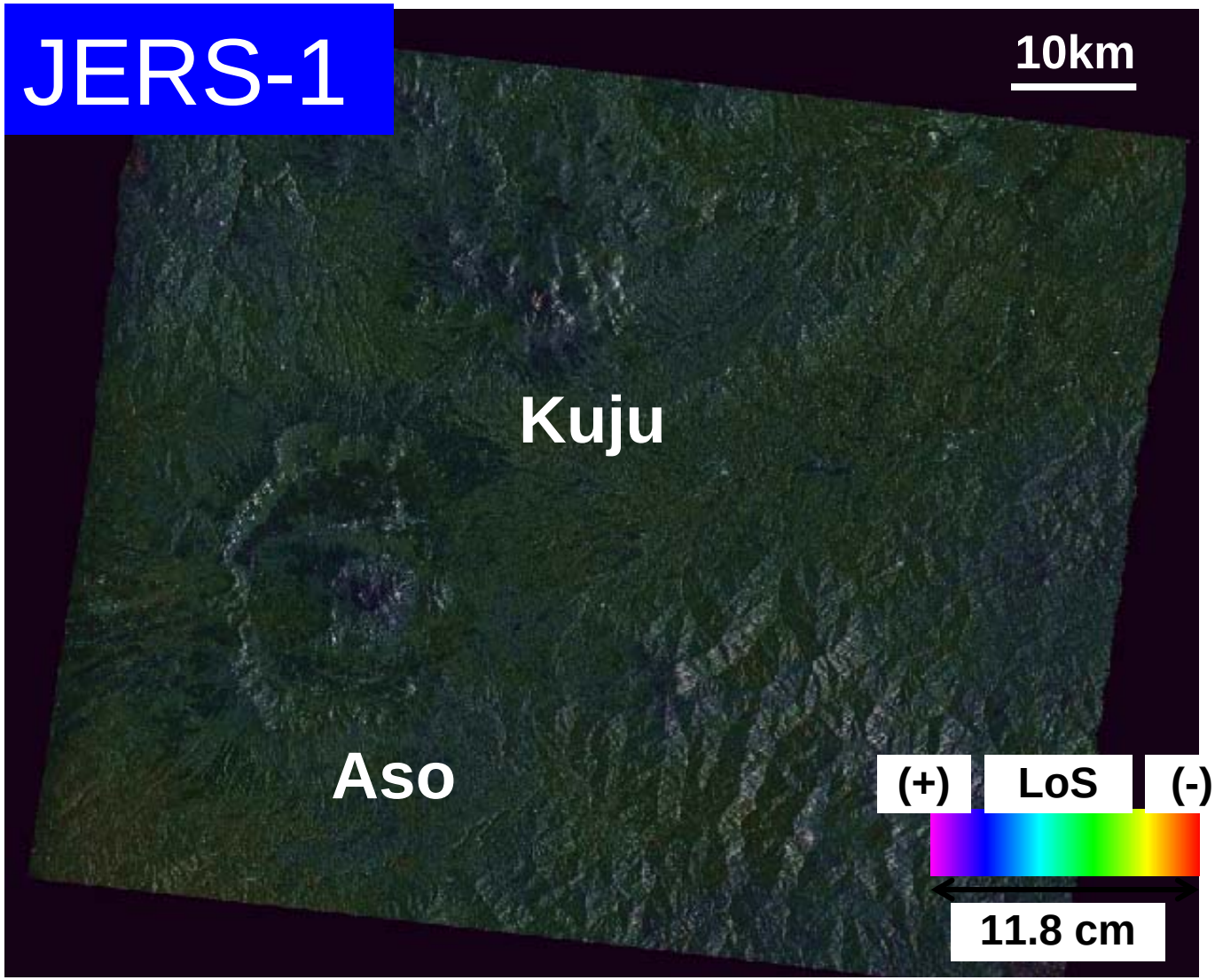
3. Preliminary systematic D-InSAR analyses for the Kuju volcano, Kyushu, Japan

We carried out D-InSAR analyses for 78 pairs of JERS-1 SAR data and 21pairs of ALOS/PALSAR data for the region.

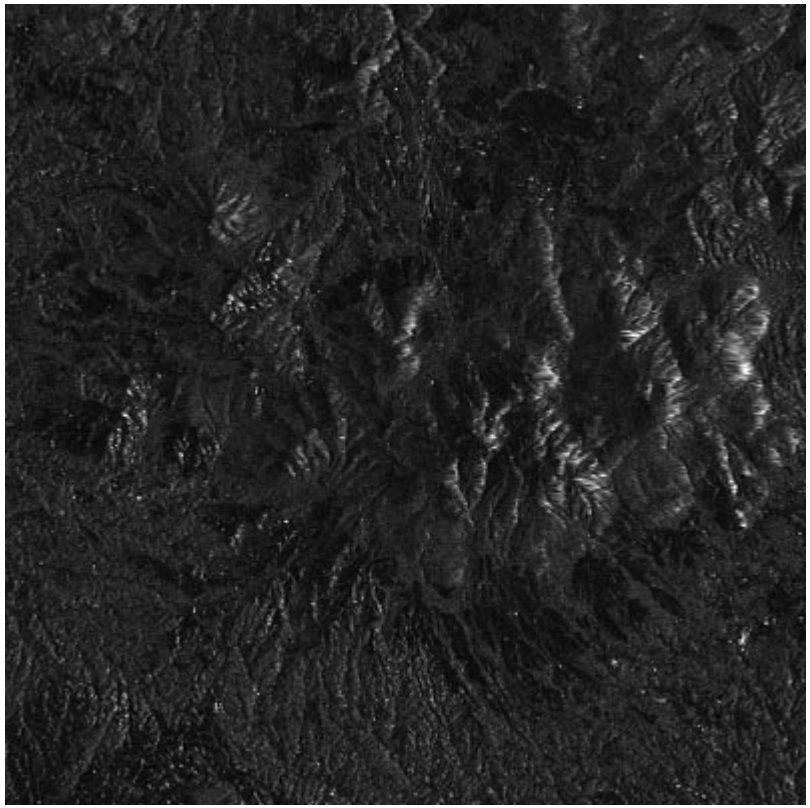
We obtained,

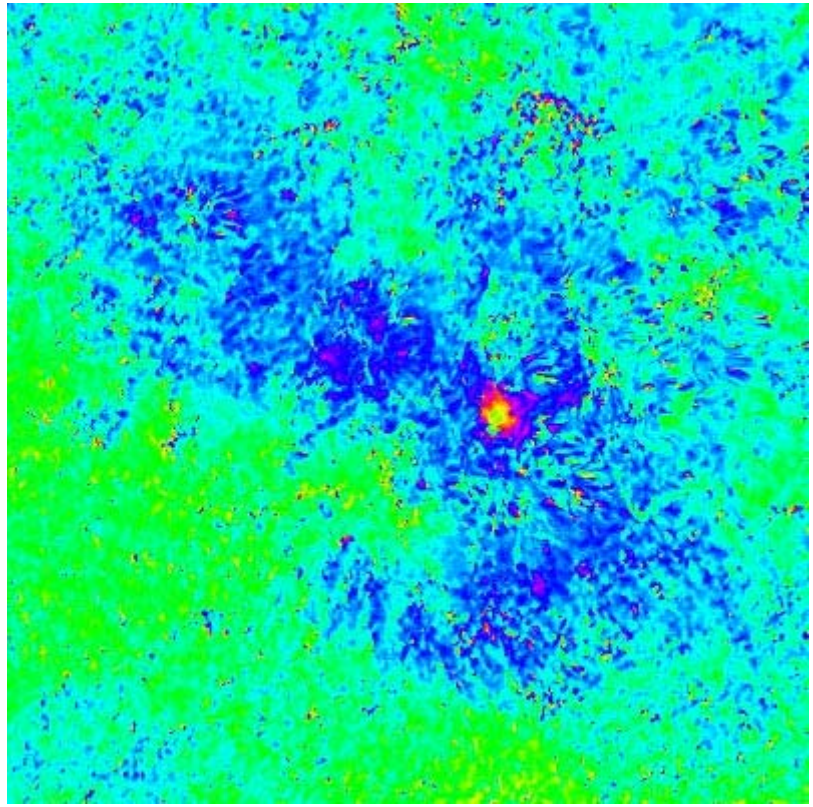
time series of JERS-1 D-InSAR images for 23 pairs including the data of 20 September 1995, which was observed just before the Mt. Hossho eruption on 11 October 1995.

and preliminary ALOS/PALSAR D-InSAR images for 10 pairs which have shorter Bperp than 1 km..



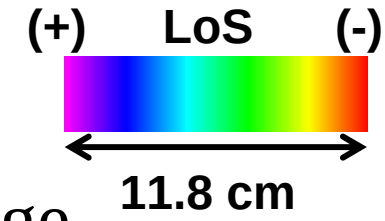
Power and D-InSAR phase image
(JERS-1 SAR:20 September 1995 and 14 March 1996)
Eruption of Mt. Hossho (11 October 1995)





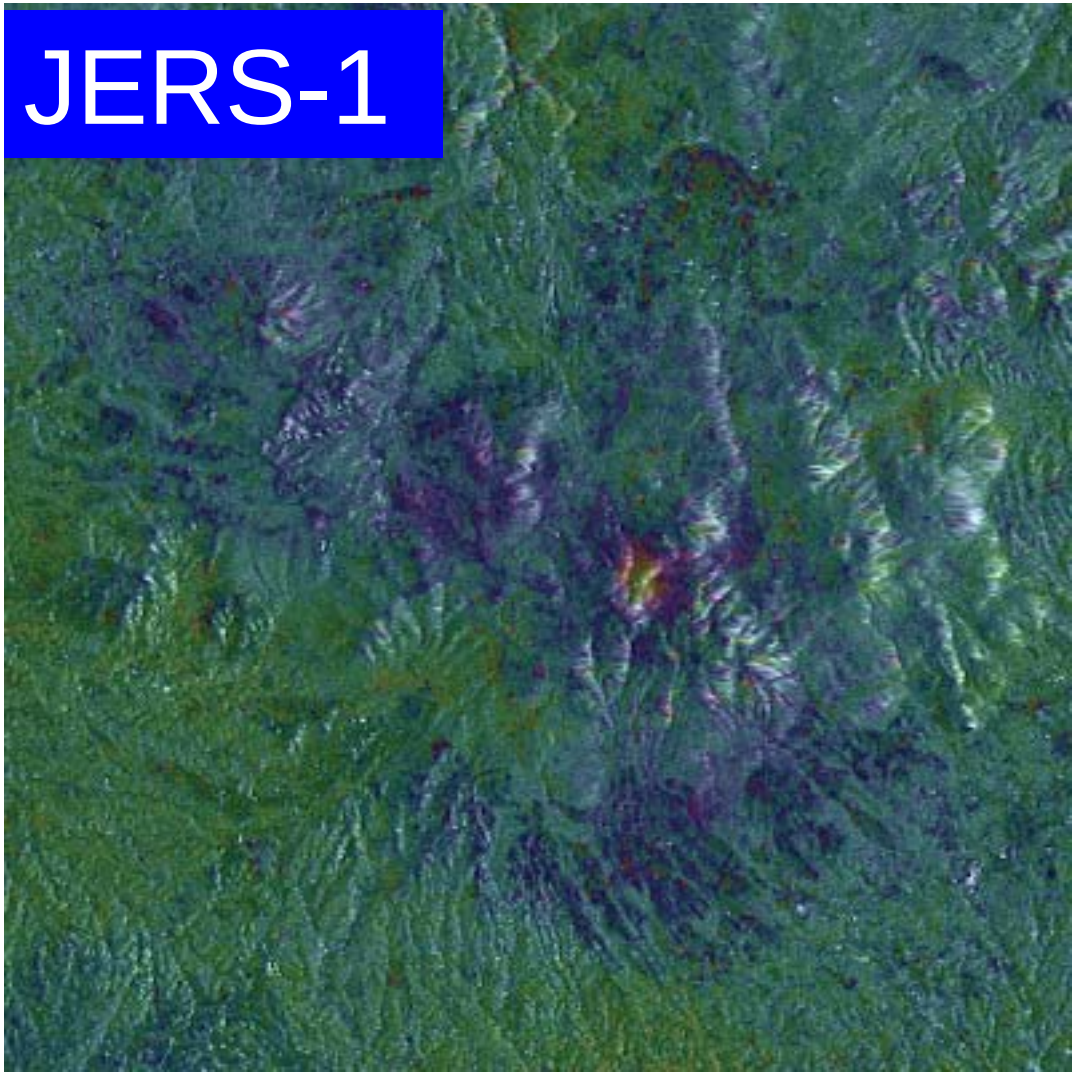
20km X 20km

JERS-1

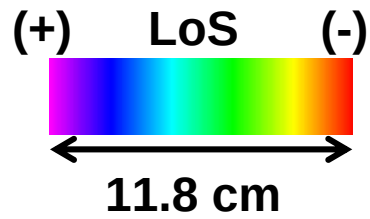


Power and D-InSAR phase image

(JERS-1 SAR: **20 September 1995 - 14 March 1996**)

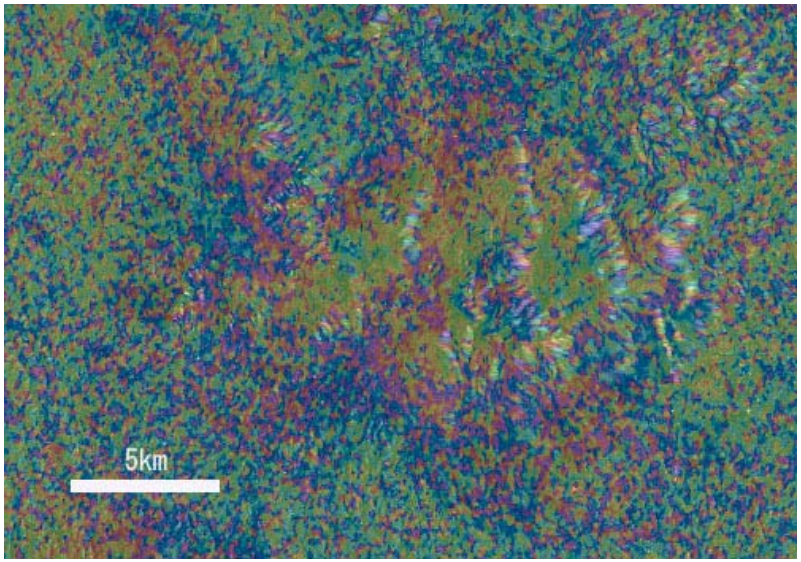


Remarkable subsidence is detected at the eruption site for the 176 days.

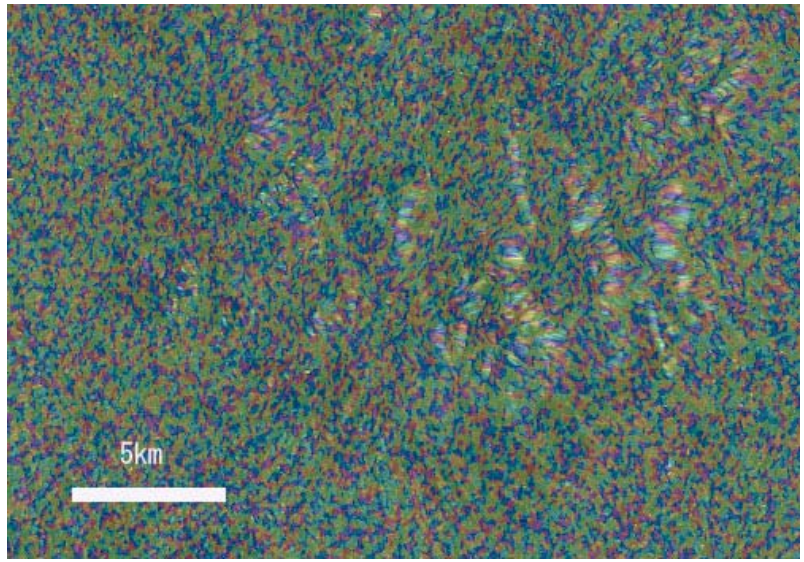


20km X 20km

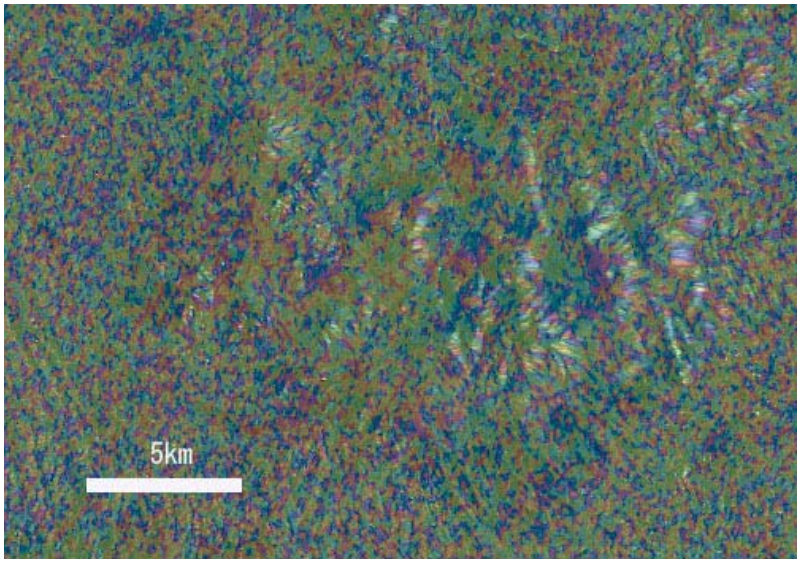
Power and D-InSAR phase image
(JERS-1 SAR: 20 September 1995 and 14 March 1996)



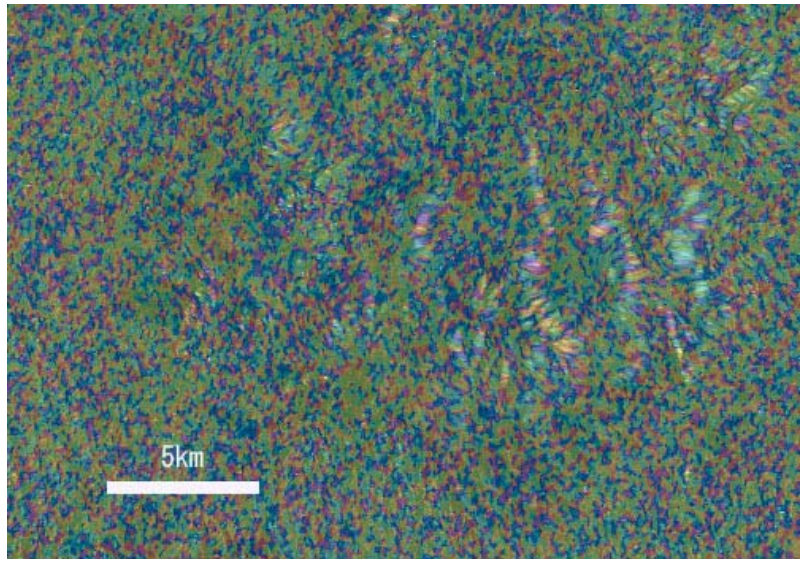
f-a 1995/9/20-1992/9/15



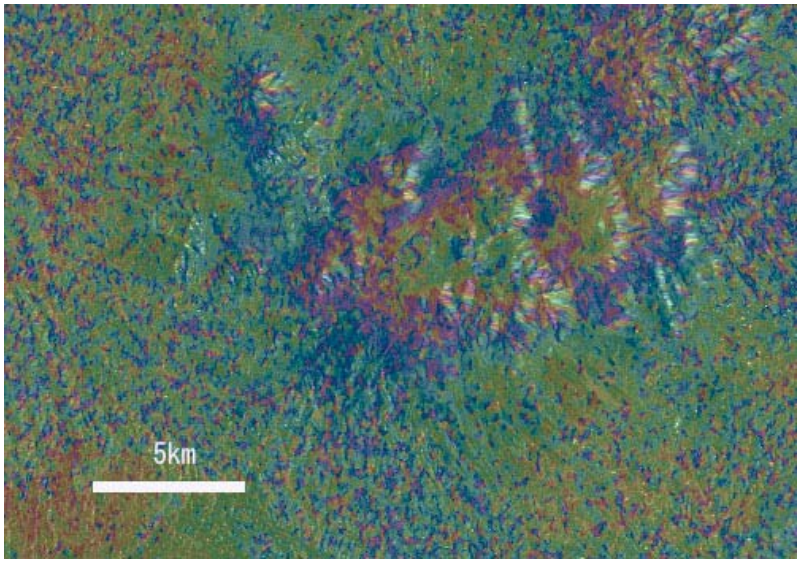
f-A 1995/9/20-1993/1/25



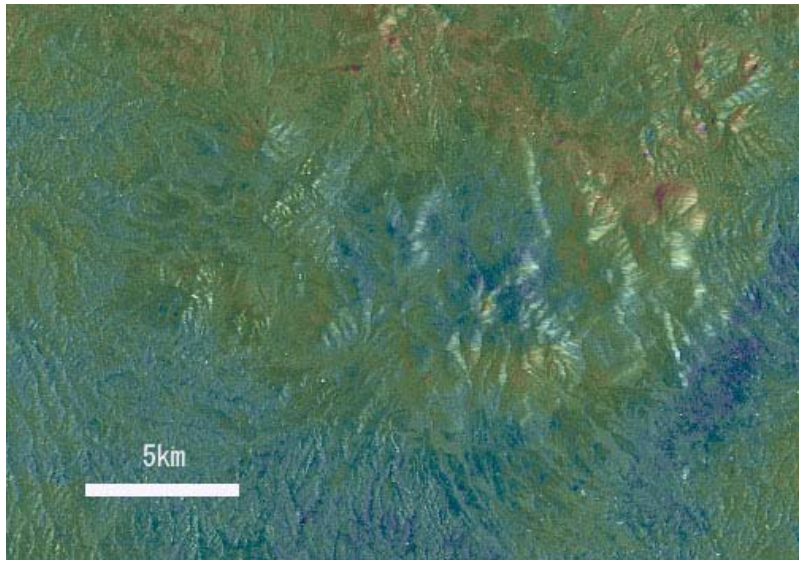
f-d 1995/9/20-1993/9/2



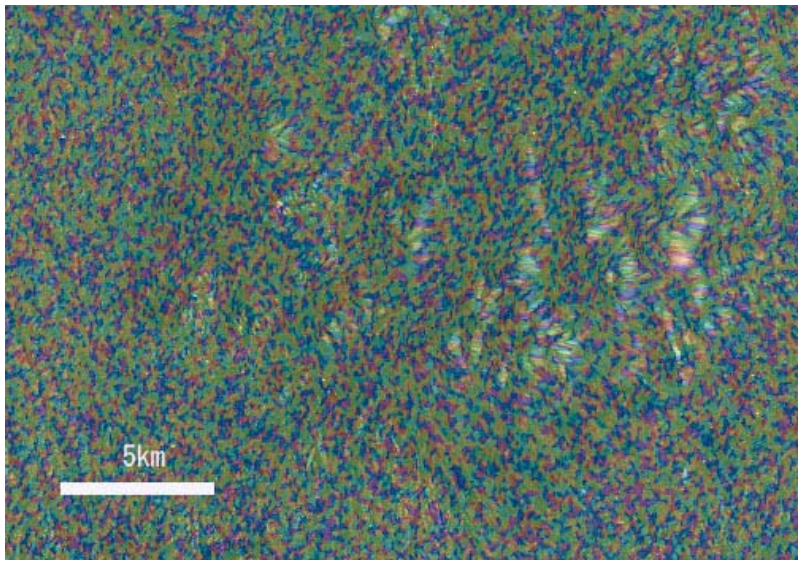
f-B 1995/9/20-1993/11/29



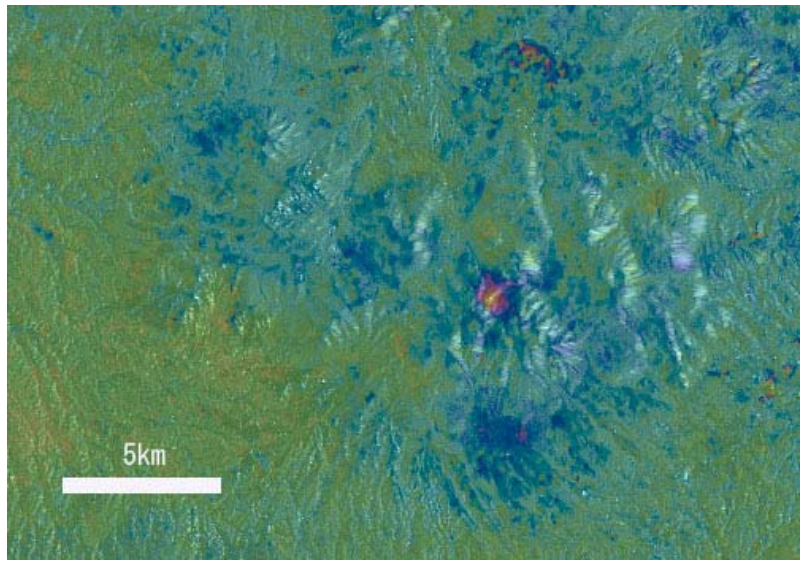
f-C　1995/9/20-1994/1/12



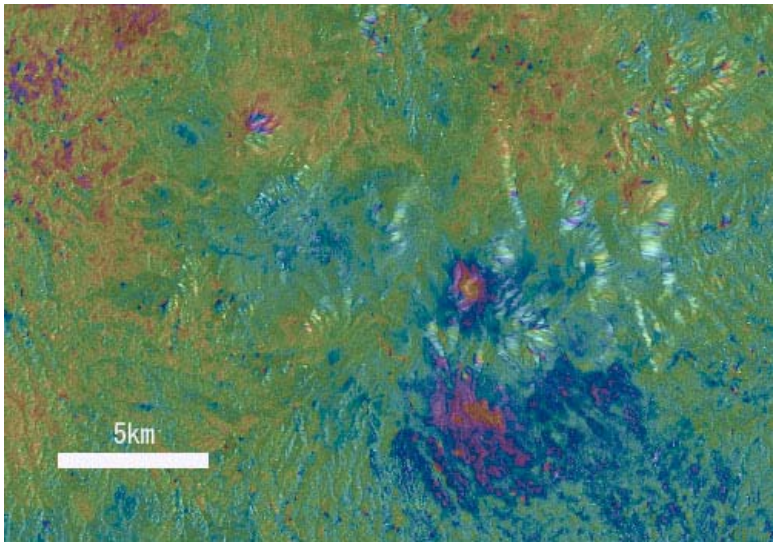
g-f　1995/11/3-1995/9/20



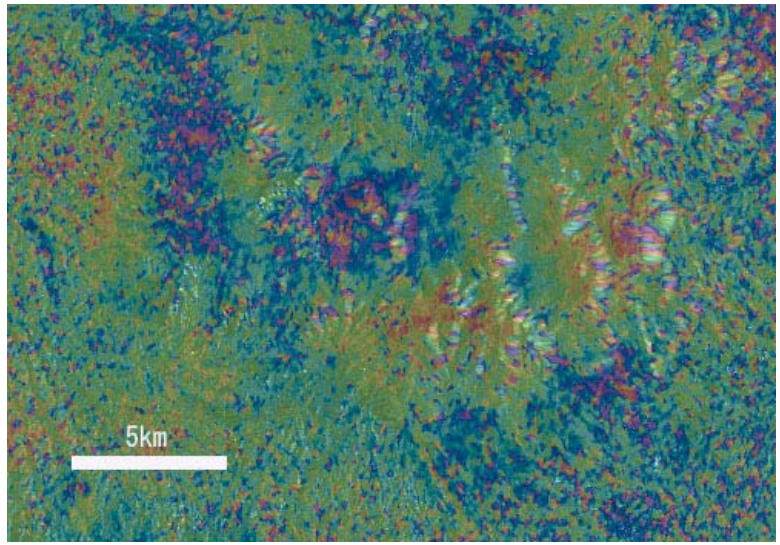
E-f　1996/1/30-1995/9/20



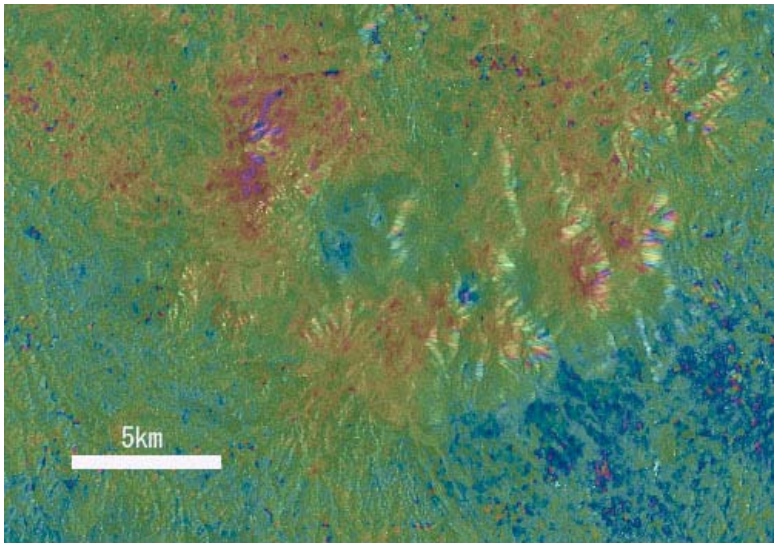
h-f 1995/11/3-1995/9/20



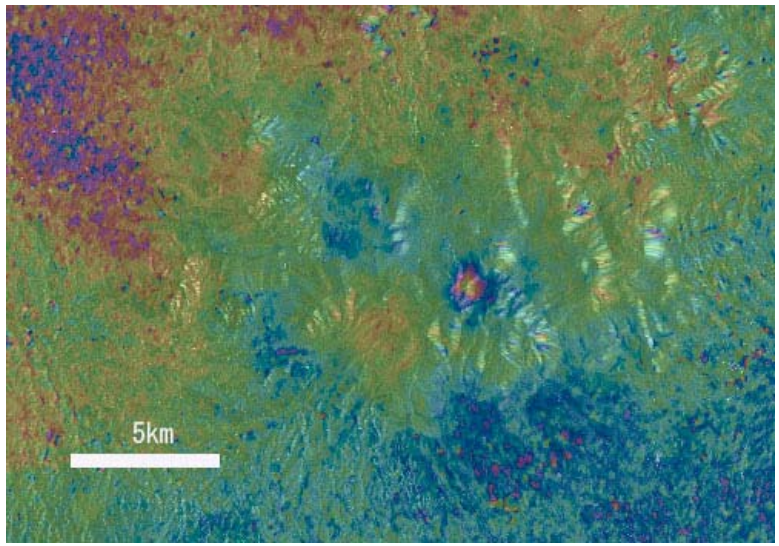
i-f　1996/4/27-1995/9/20



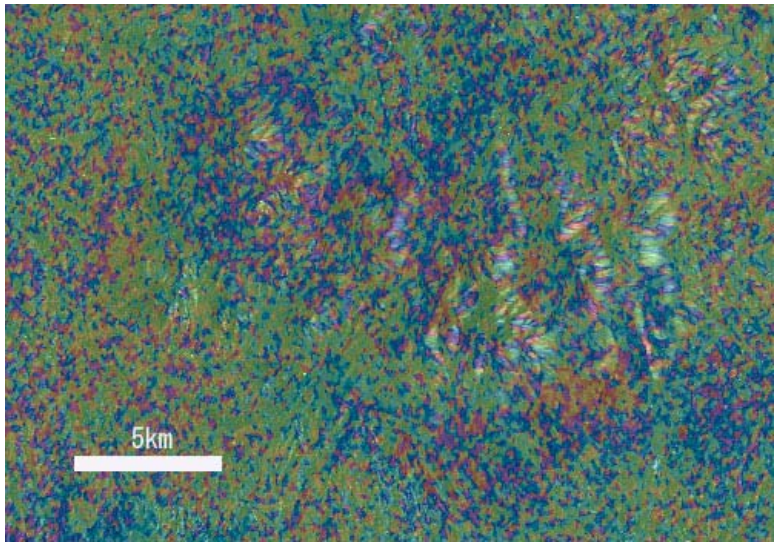
F-f　1996/6/10-1995/9/20



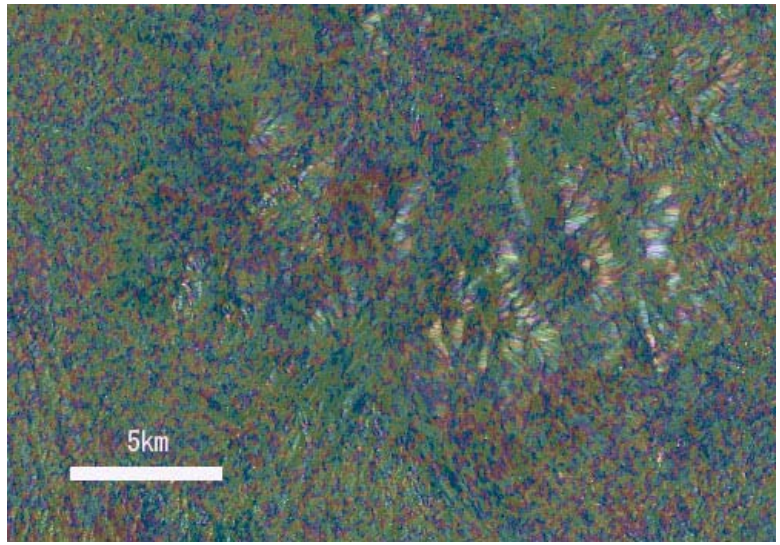
j-f　1996/7/24-1995/9/20



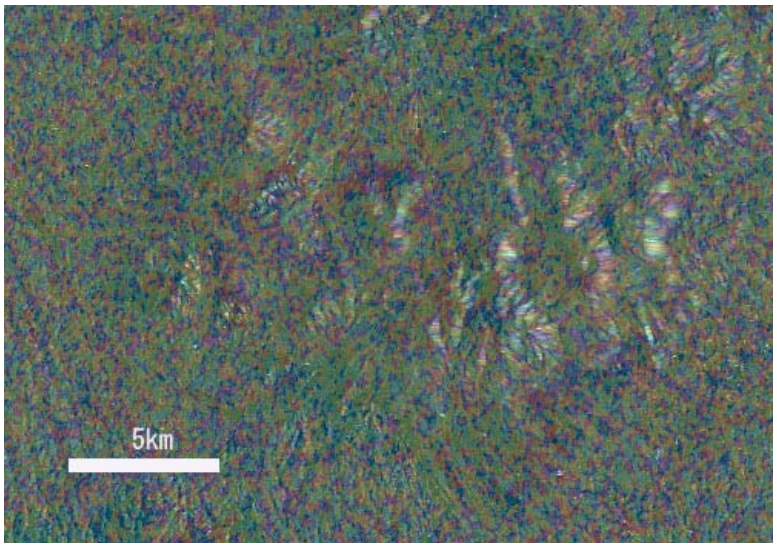
G-f　1996/10/20-1995/9/20



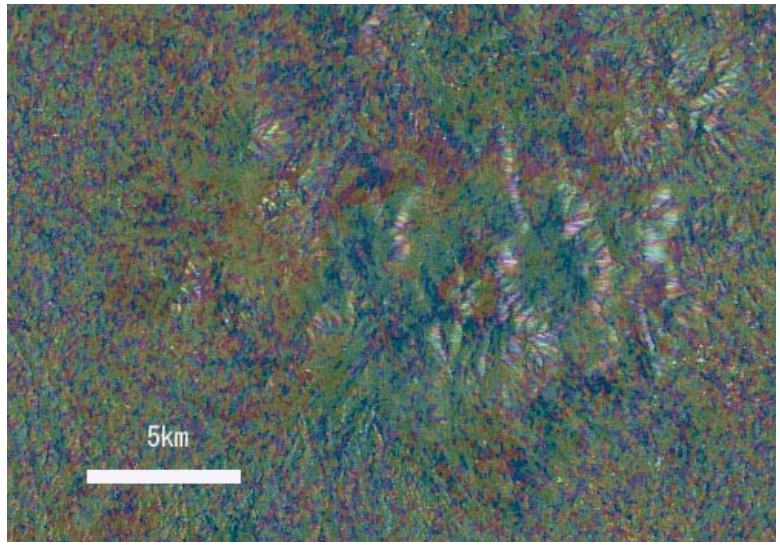
H-f　1996/12/3-1995/9/20



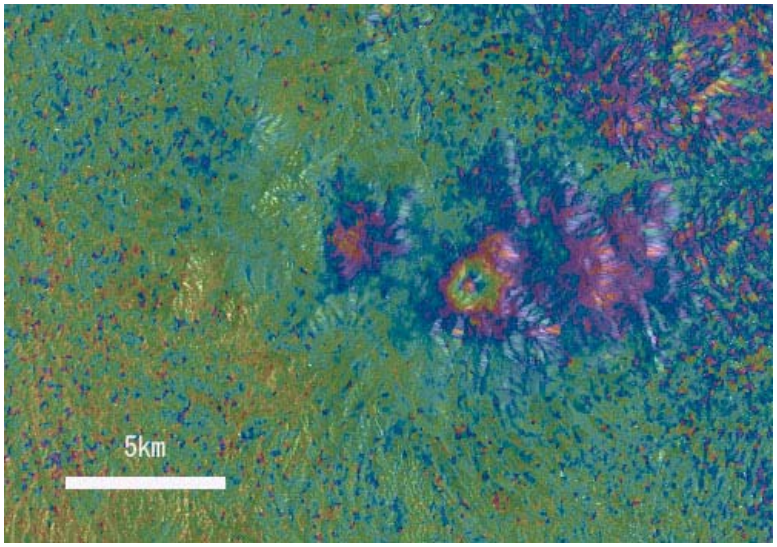
k-f　1997/1/16-1995/9/20



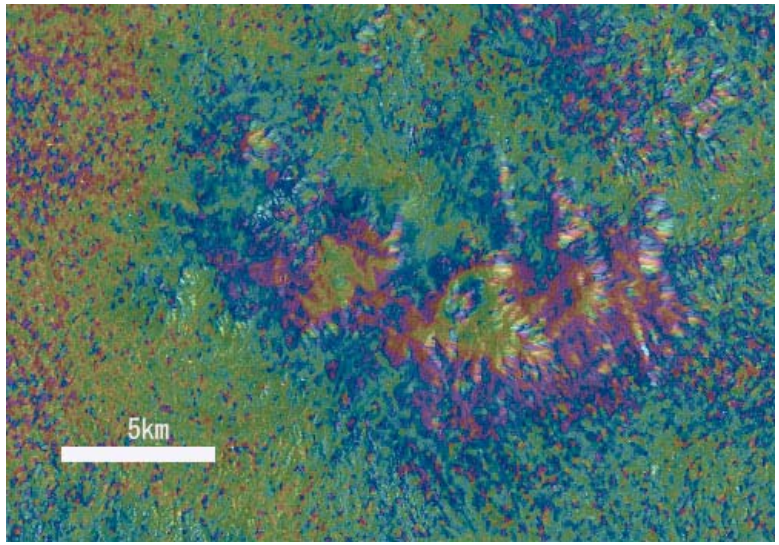
I-f　1997/7/11-1995/9/20



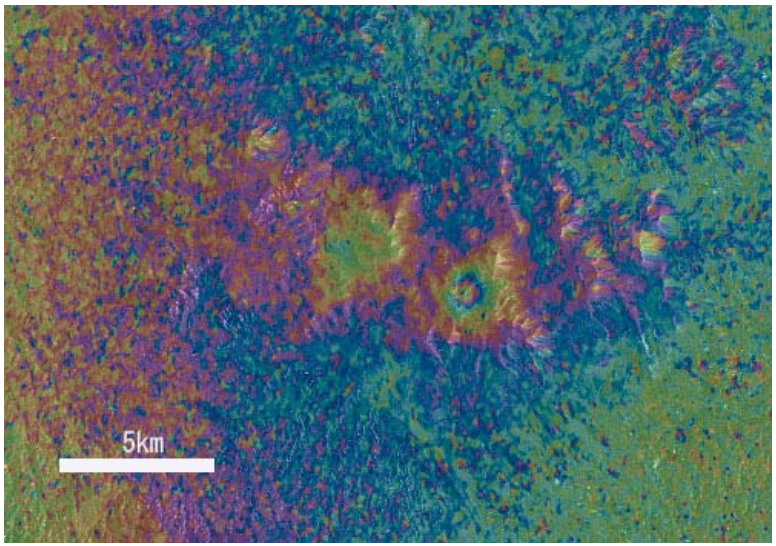
J-f　1997/8/24-1995/9/20



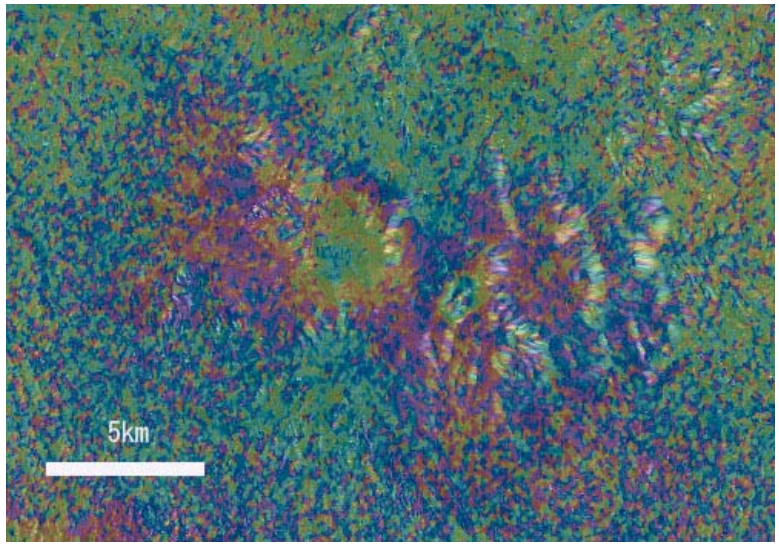
K-f　1997/11/20-1995/9/20



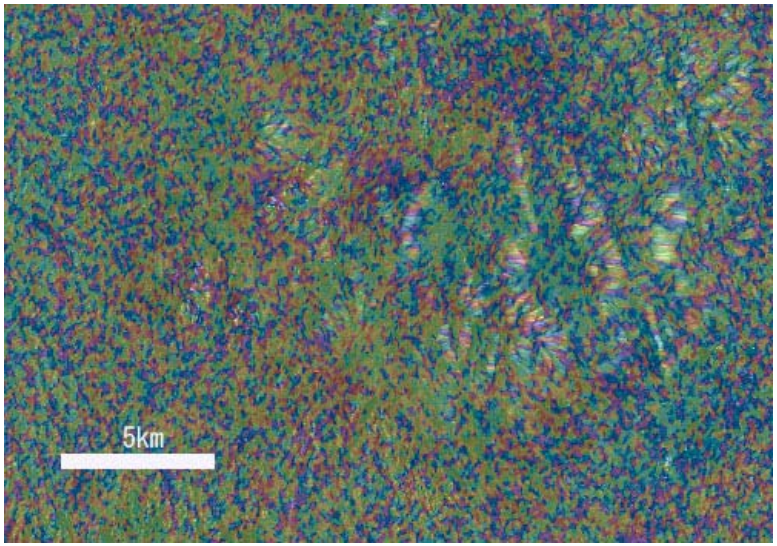
L-f　1998/1/3-1995/9/20



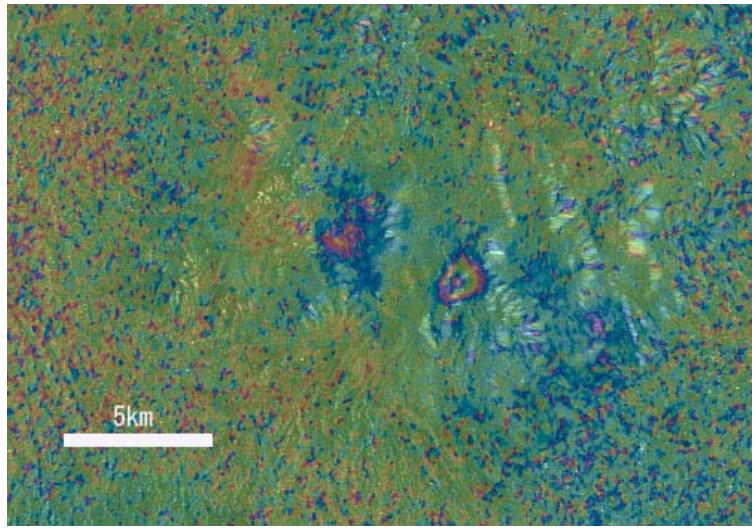
l-f　1998/2/16-1995/9/20



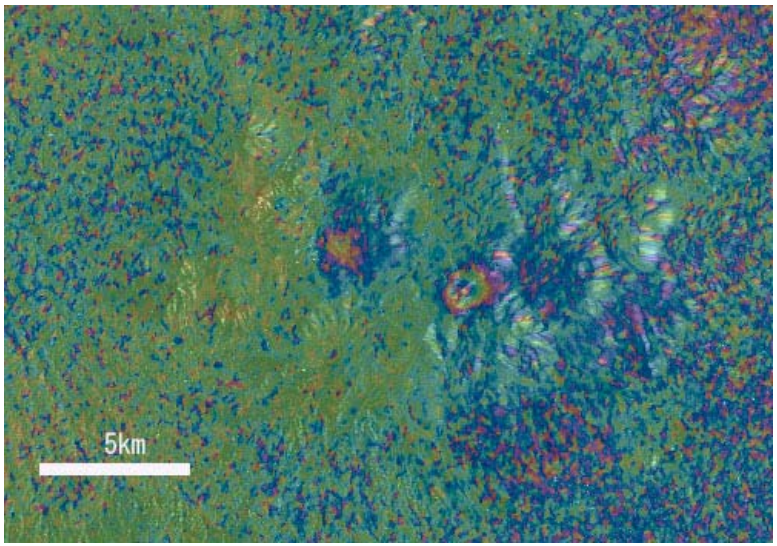
M-f　1998/5/15-1995/9/20



N-f　1998/6/28-1995/9/20



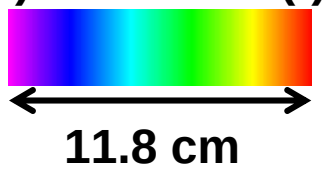
O-f　1998/8/11-1995/9/20



m-f　1998/9/24-1995/9/20

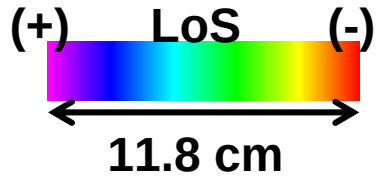
JERS-1

(+)　LoS　(-)

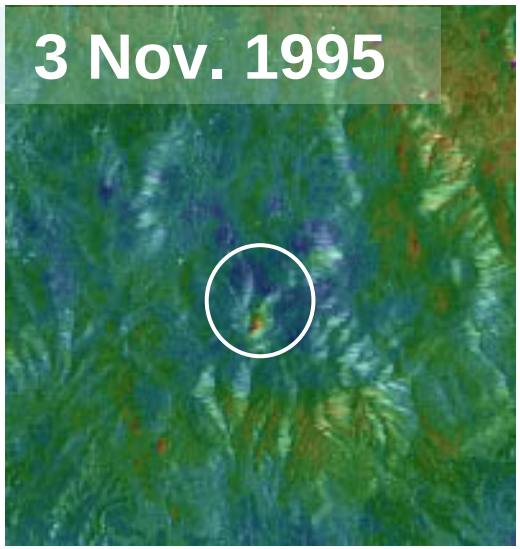


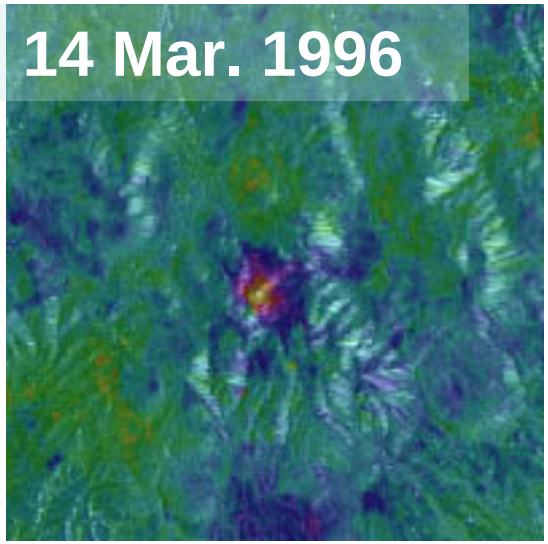
11.8 cm

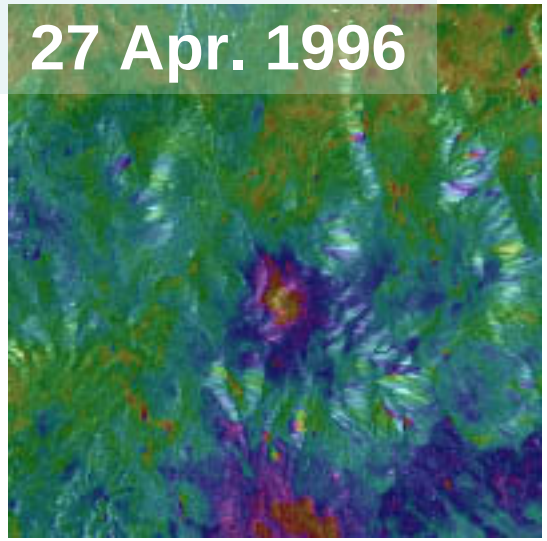
based on 20 Sept. 1995

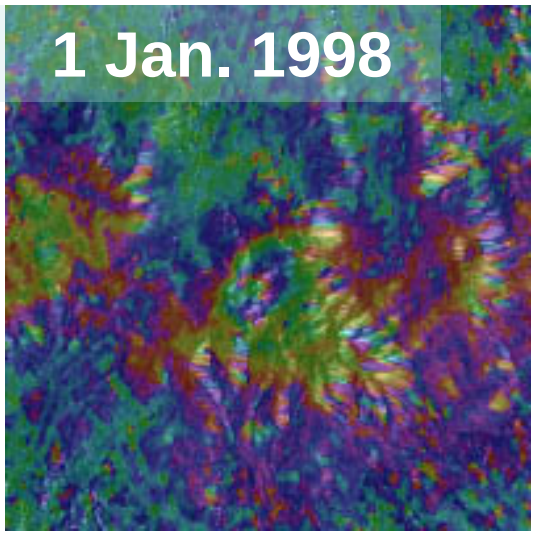


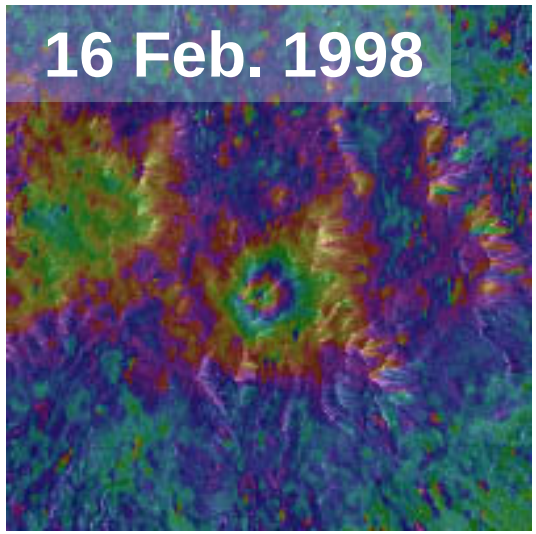
Eruption

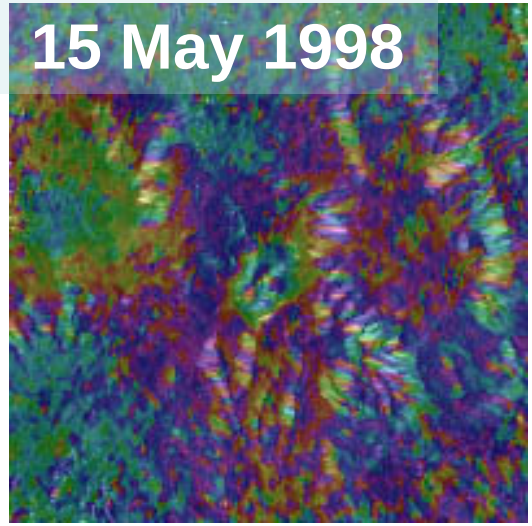


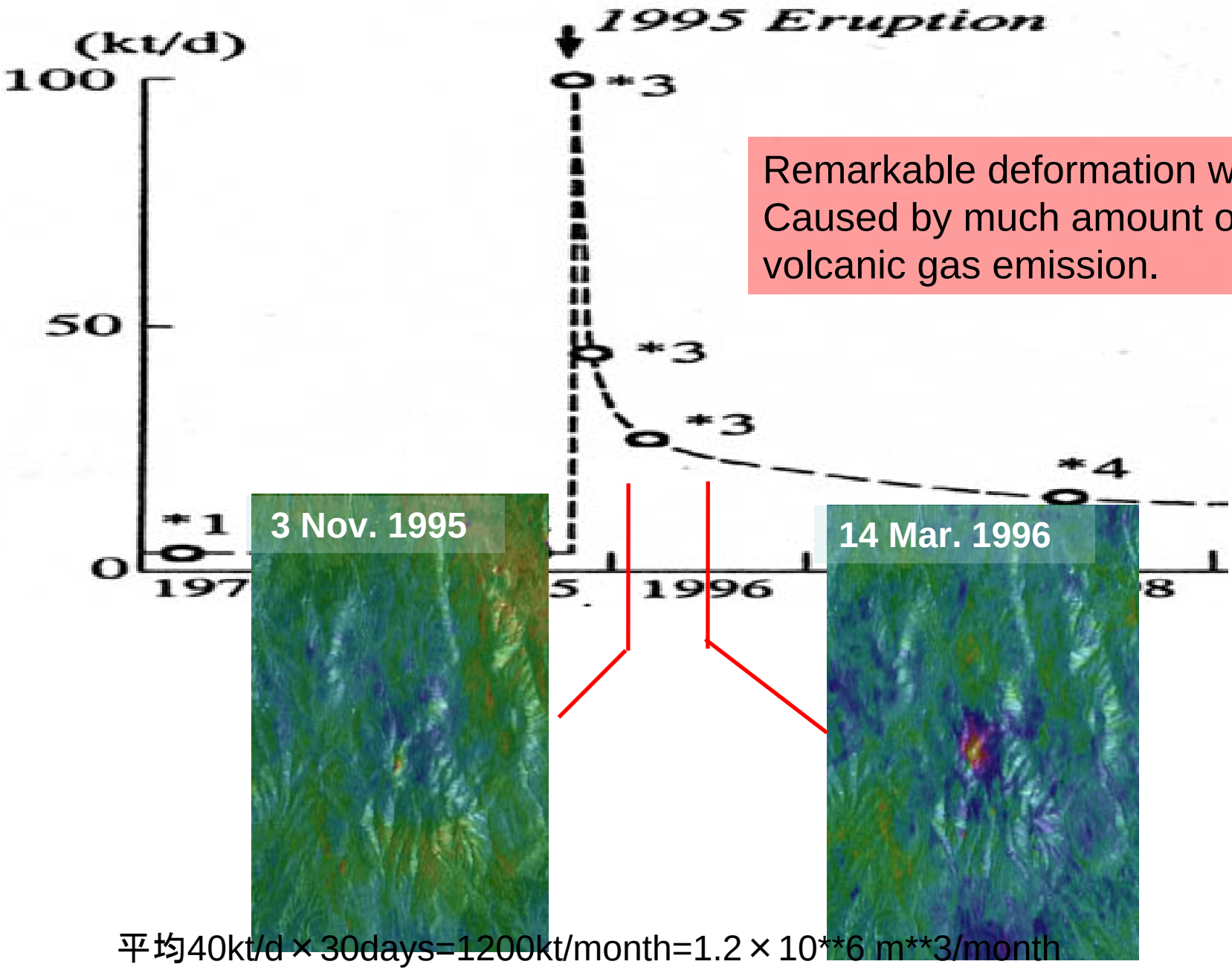






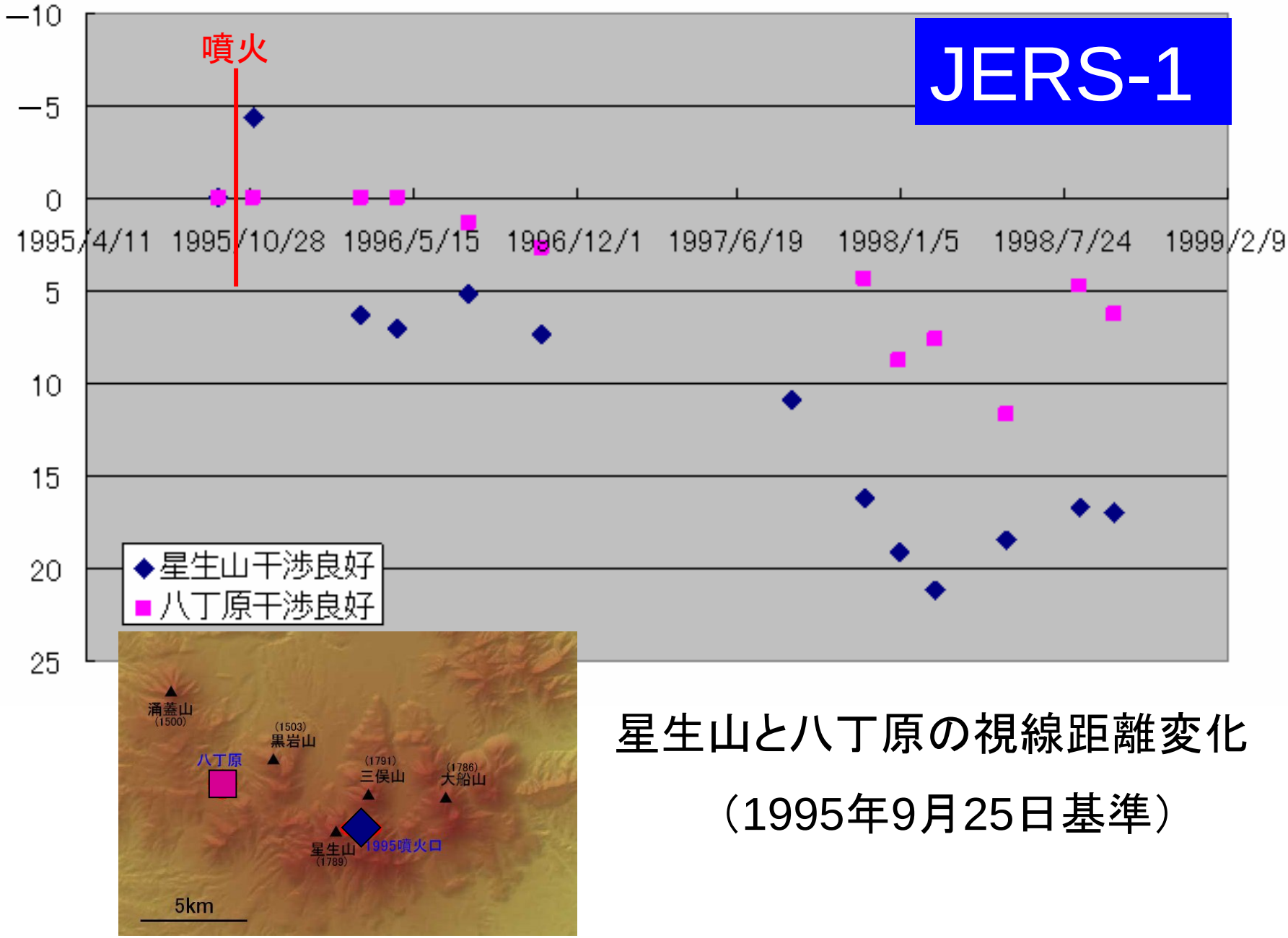






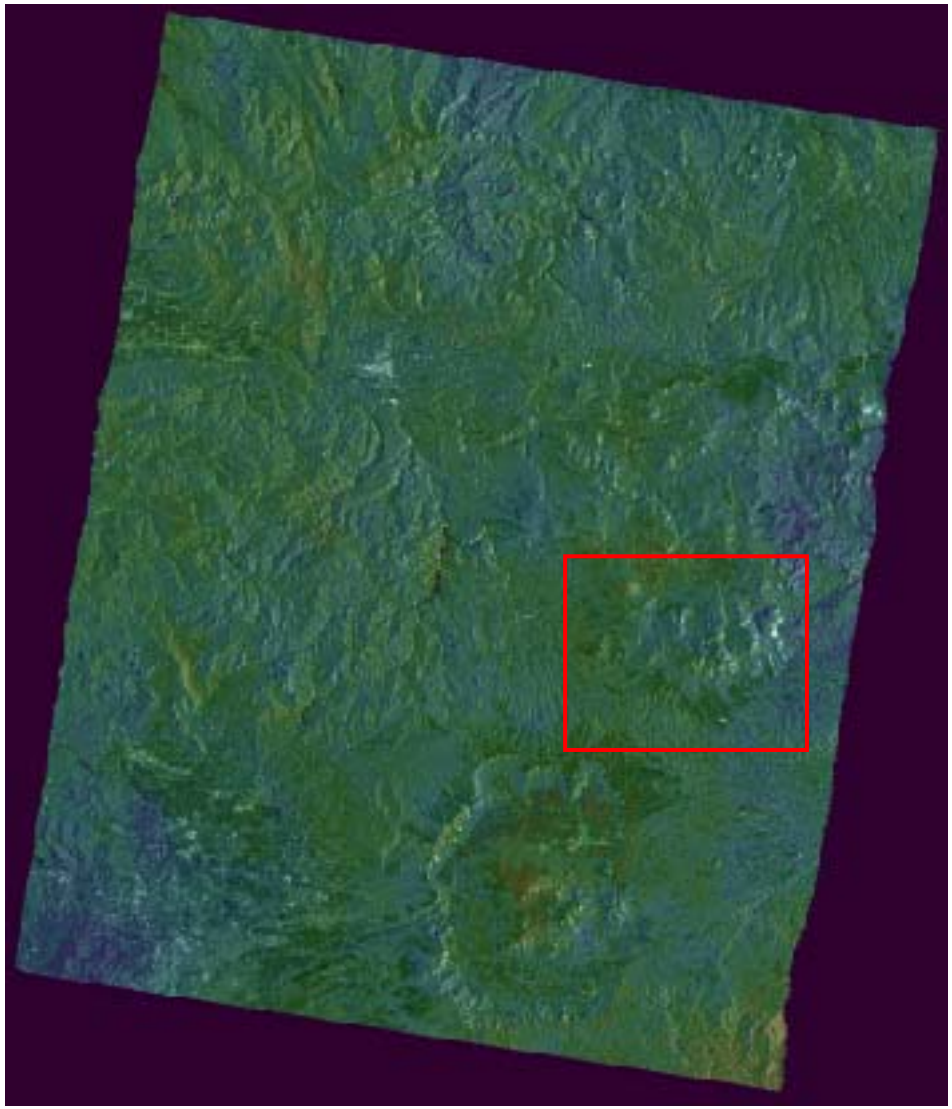
Remarkable deformation was Caused by much amount of volcanic gas emission.

平均40kt/d×30days=1200kt/month=1.2×10**6 m**3/month



星生山と八丁原の視線距離変化

（1995年9月25日基準）

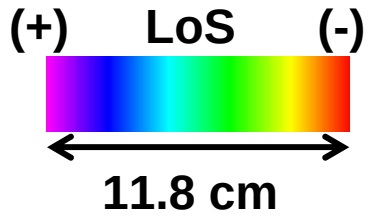


ALOS/PALSAR

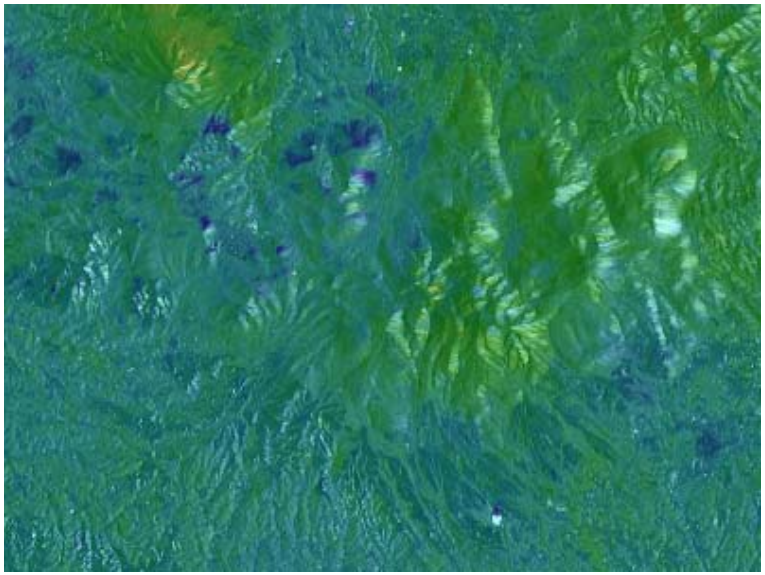
Power and D-InSAR phase image

85 km x 100 km

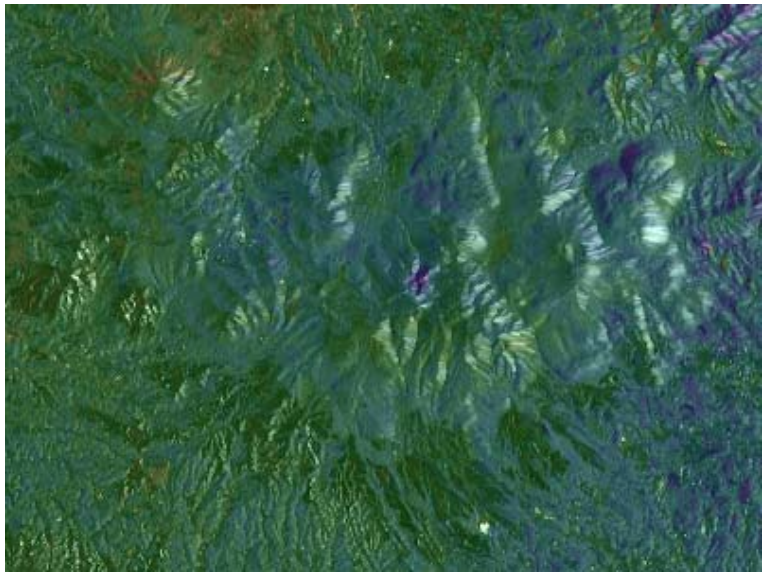
(10 Jan. 2008 - 07 Jan. 2007)



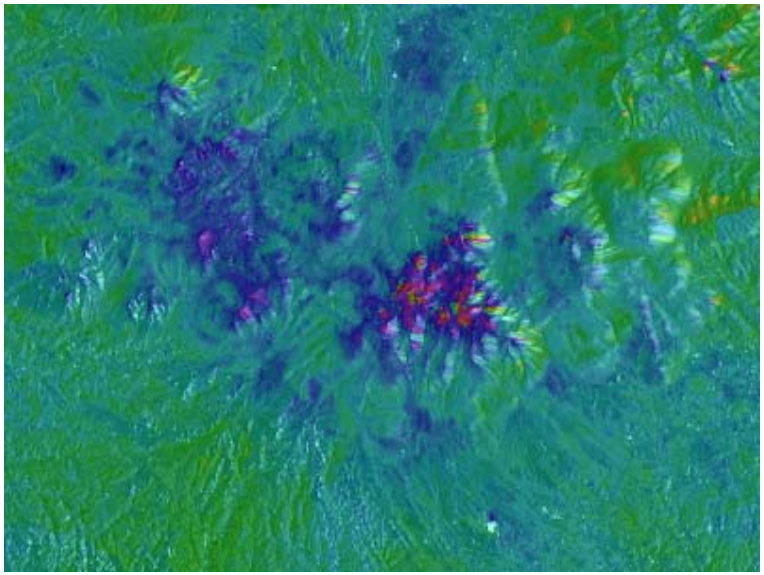
Power and D-InSAR phase image (20 km x 15 km)
(10 Jan. 2008 - 07 Jan. 2007)



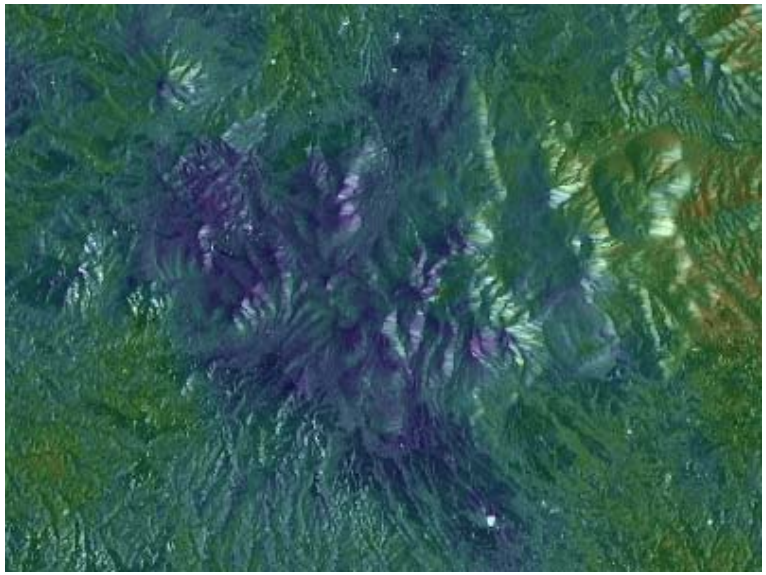
KJ01(10 Jan. 2008 - 25 Nov. 2007)



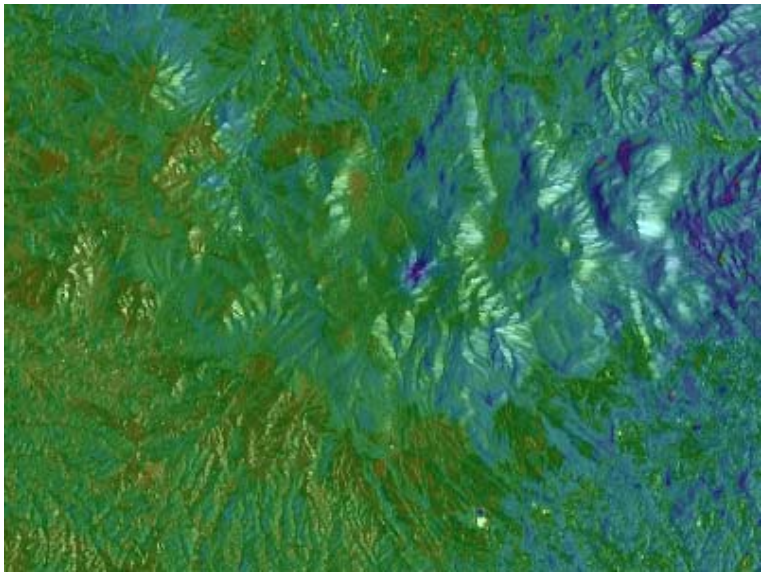
KJ02(10 Jan. 2008 - 07 Jan. 2007)



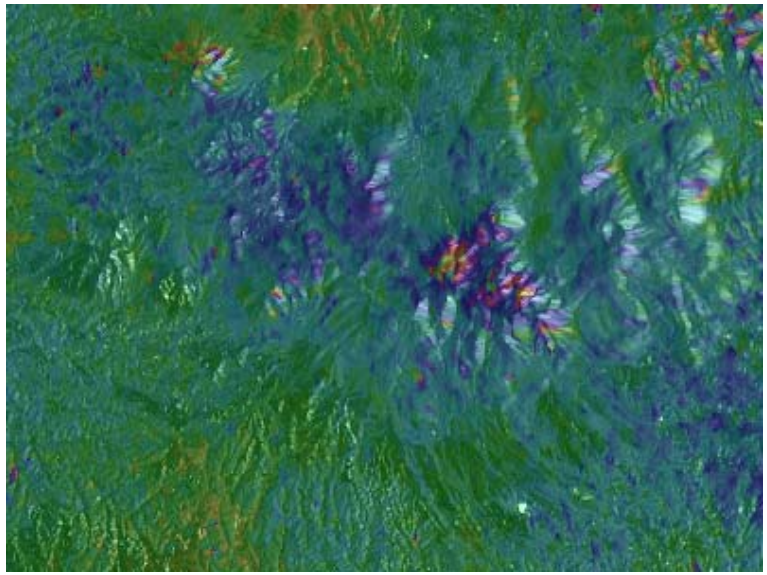
KJ03(25 Feb. 2008 - 10 Jan. 2008)



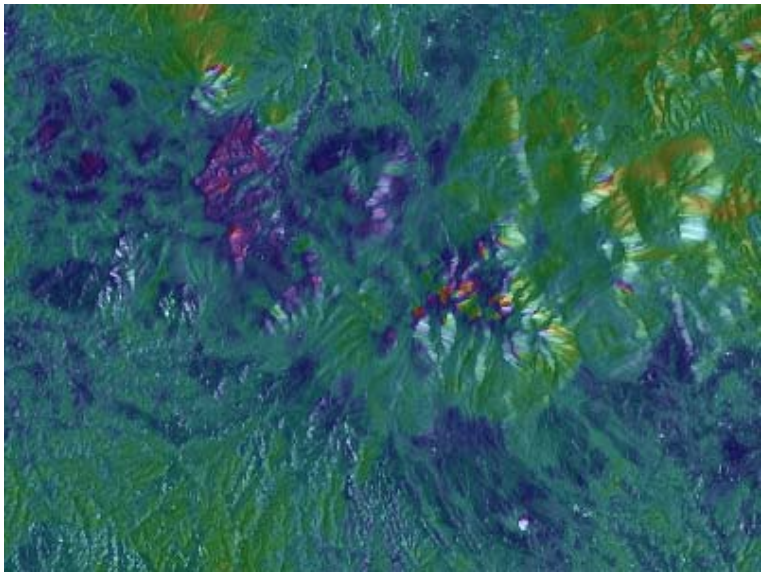
KJ04(11 Apr. 2008 - 10 Jan. 2008)



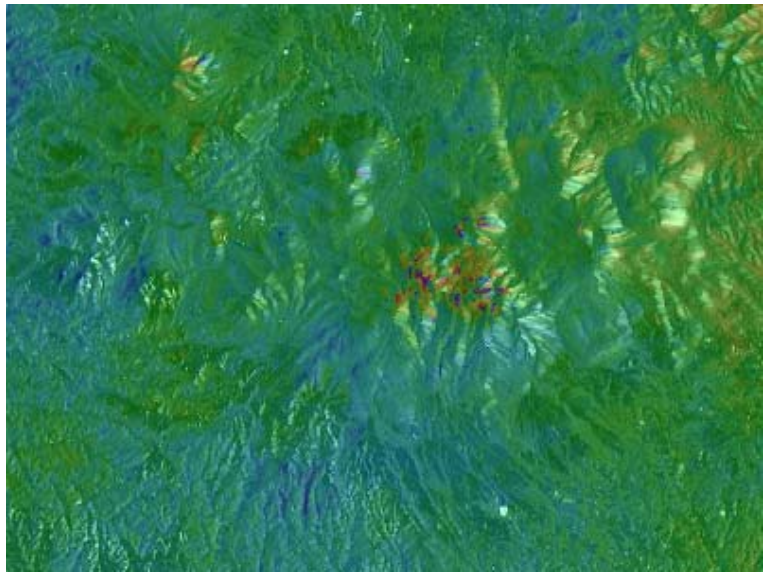
KJ07(25 Nov. 2007 -07 Jan. 2007)



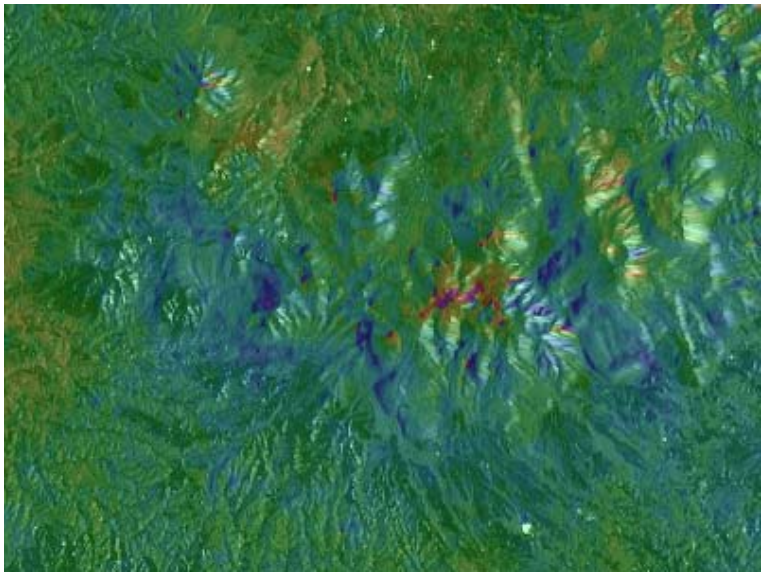
KJ08(25 Feb. 2007 -07 Jan. 2007)



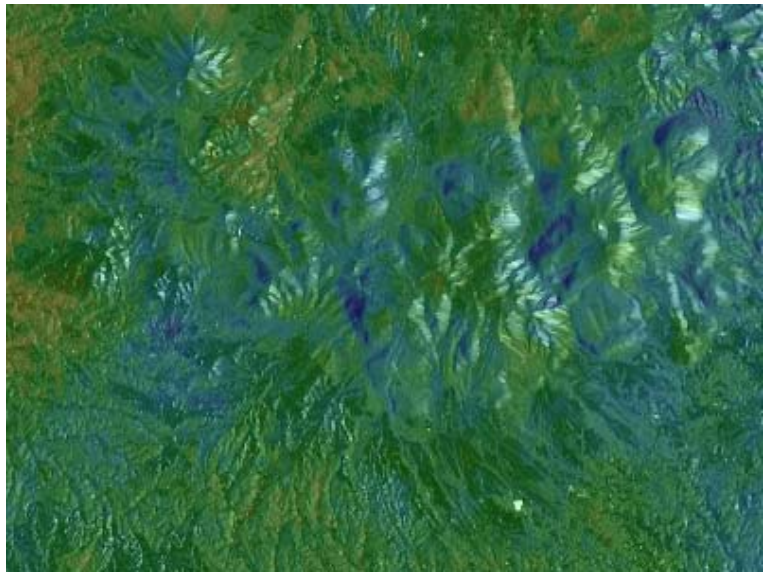
KJ12(25 Feb.2008 -25 Nov. 2007)



KJ16(11 Apr.2008 -25 Feb. 2007)

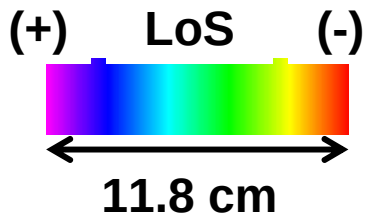


KJ17(27 Mar.2008 -25 Feb. 2008)



KJ19(27 Mar.2008 -11 Apr. 2008)

ALOS/PALSAR

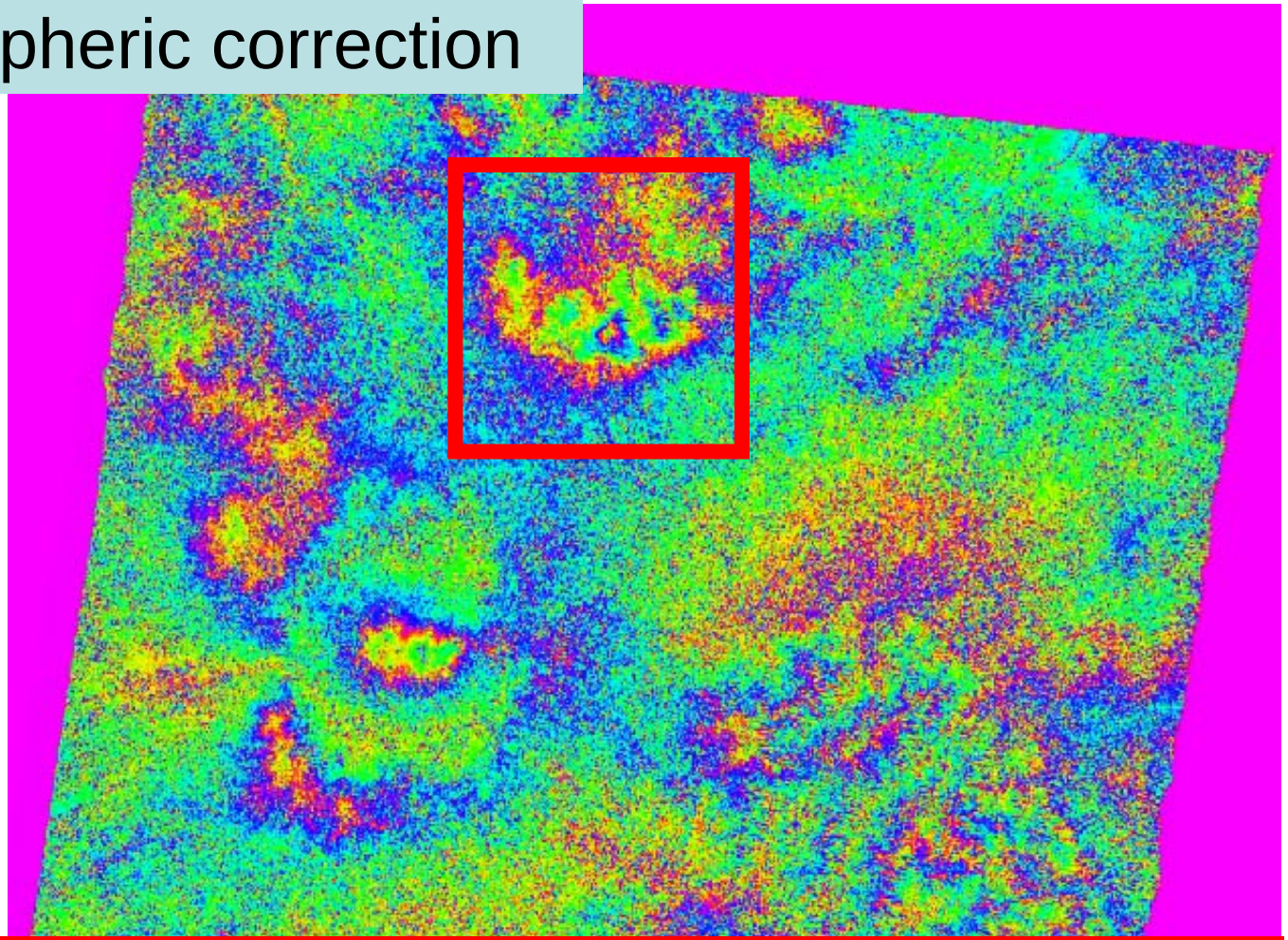


4. Discussion

Atmospheric disturbance is sometimes remarkable.

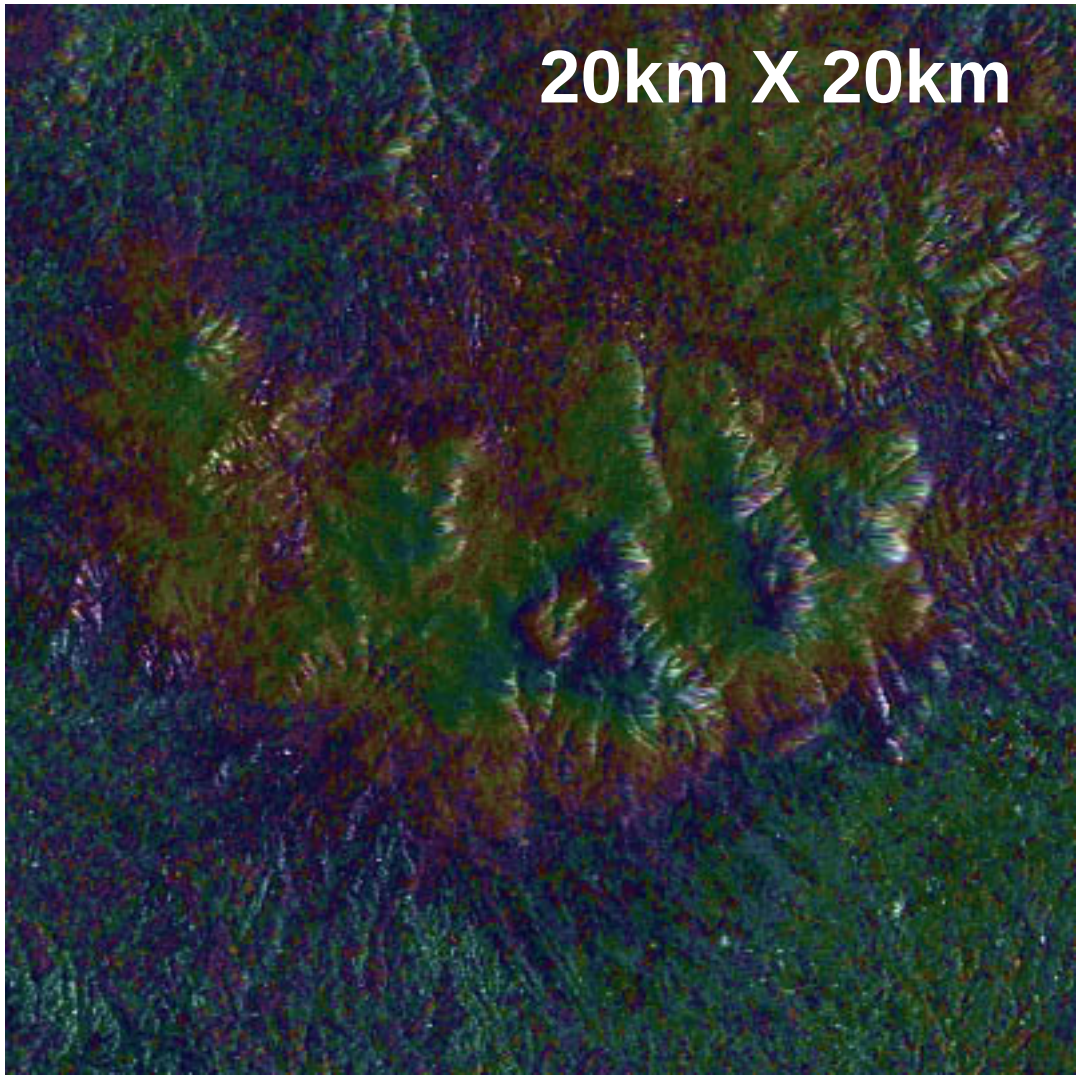
Preliminary atmospheric correction will be demonstrated.

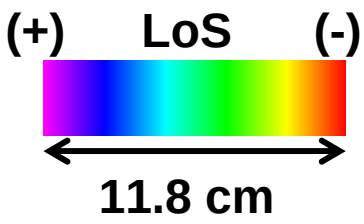
Atmospheric correction



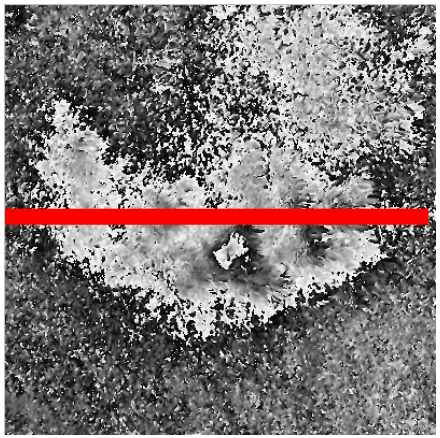
Good, but severe atmospheric disturbance.

D-InSAR phase image
(JERS-1 SAR: 24 July 1996 and 16 February 1998)
After the Eruption of Mt. Hossho.





Power and D-InSAR phase image
(JERS-1 SAR: 24 July 1996 and 16 February 1998)
After the Eruption of Mt. Hossho.

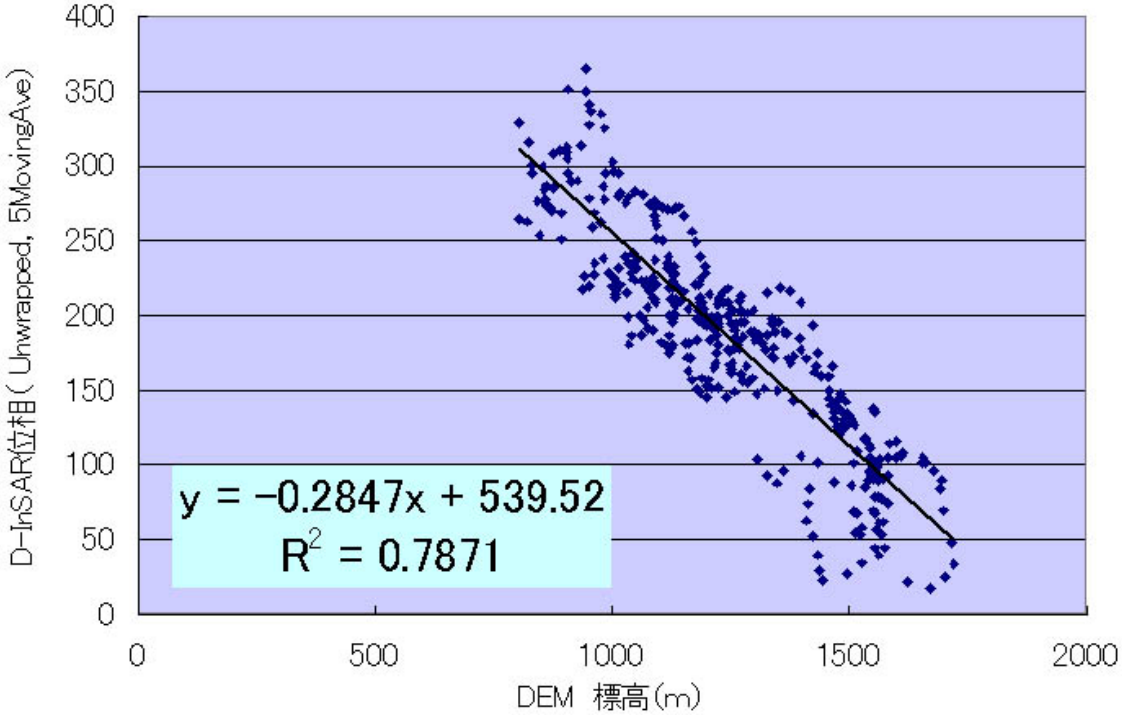


D-InSAR Phase

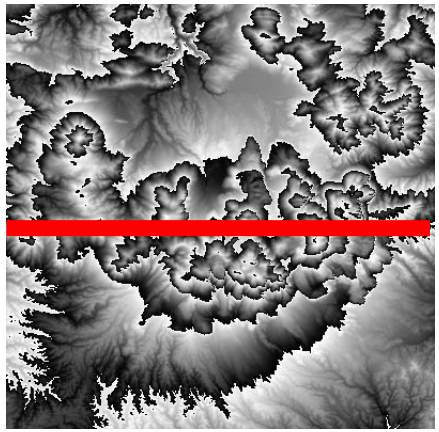
$256 = 2\pi$

Unwrapped

5 Point Moving Average



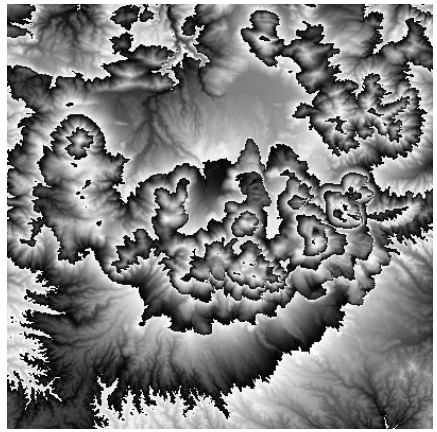
Coefficient for atmospheric correction is obtained **along a E-W cross-section.**



GSI 50m-mesh DEM

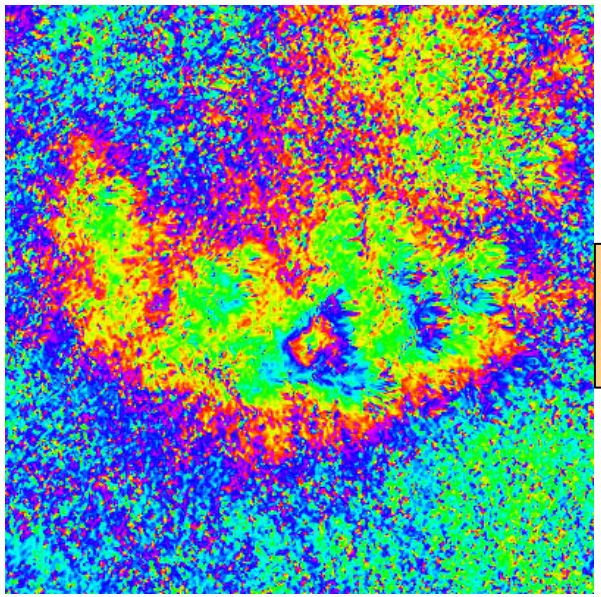
Preliminary Atmospheric Correction

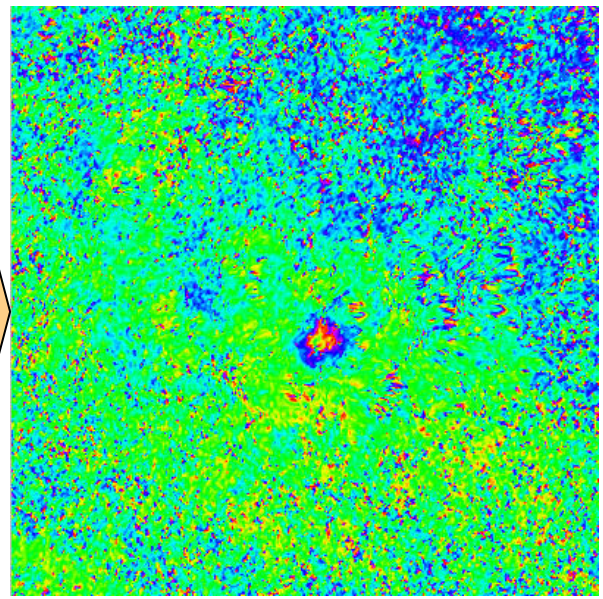
-



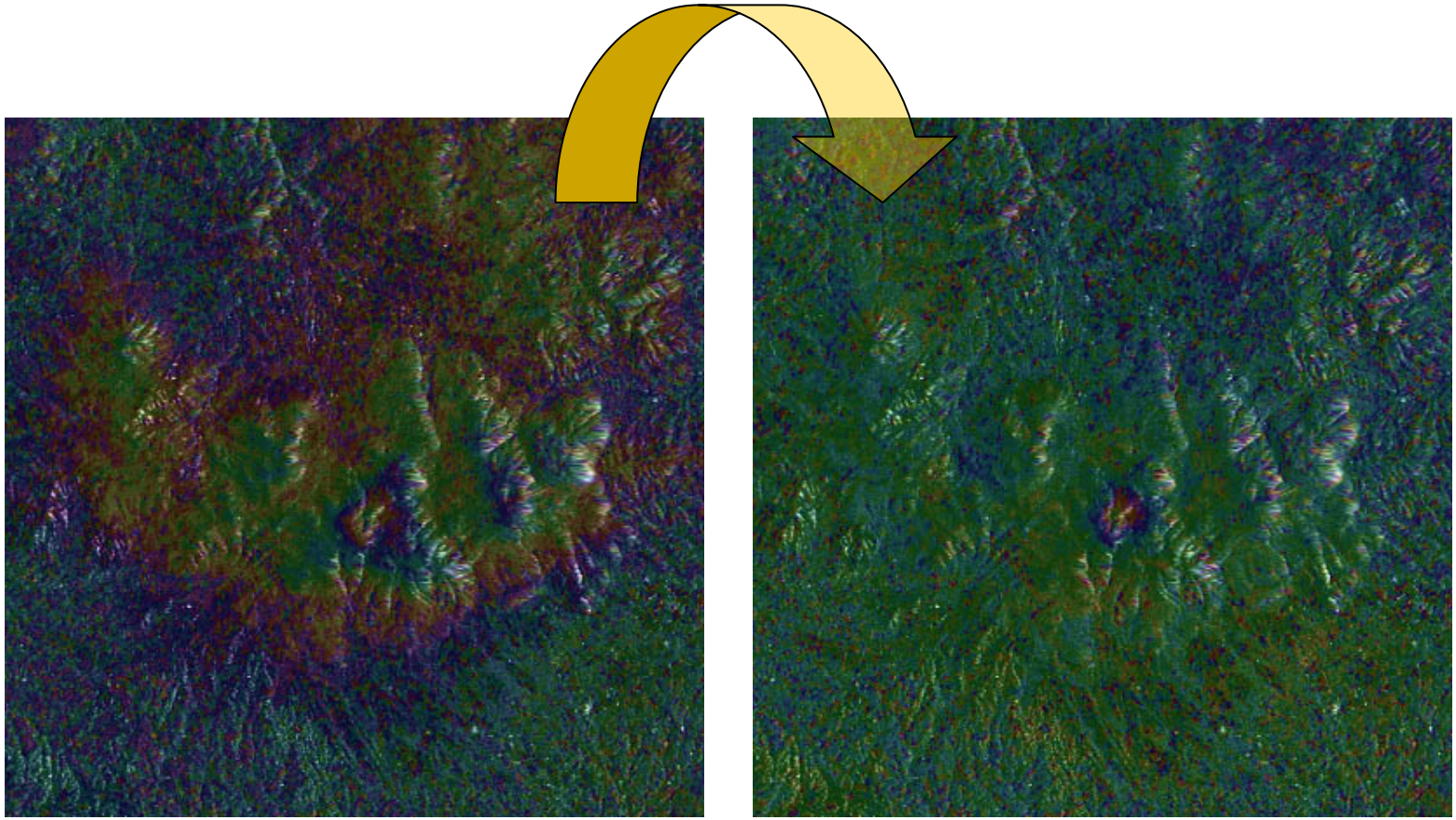
× (- 0. 2847)

+ bias =





Preliminary Atmospheric Correction



Power and D-InSAR phase image
(JERS-1 SAR: 24 July 1996 and 16 February 1998)
After the Eruption of Mt. Hossho.

5. Concluding remarks

Preliminary systematic L-band D-InSAR analyses for the Kyushu, Japan, were carried out for 13 JERS-1 SAR and 7 PALOS/PALSAR data by SIGMA-SAR (Shimada, 1999).

Some pairs for good interferogram were obtained. But, severe atmospheric disturbance prevent us from detecting the surface deformations. Preliminary atmospheric correction was demonstrated.

Future detailed search for the crustal deformations in the Kyushu is required to find out unexpected ground deformations by using the L-band ALOS/PALSAR.