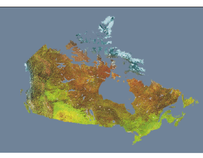
Geomatics Canada
Scientific Presentation 3

RADARSAT-2 FOR MAPPING NATURAL HAZARD EVENTS: CASE STUDIES FROM AROUND THE WORLD

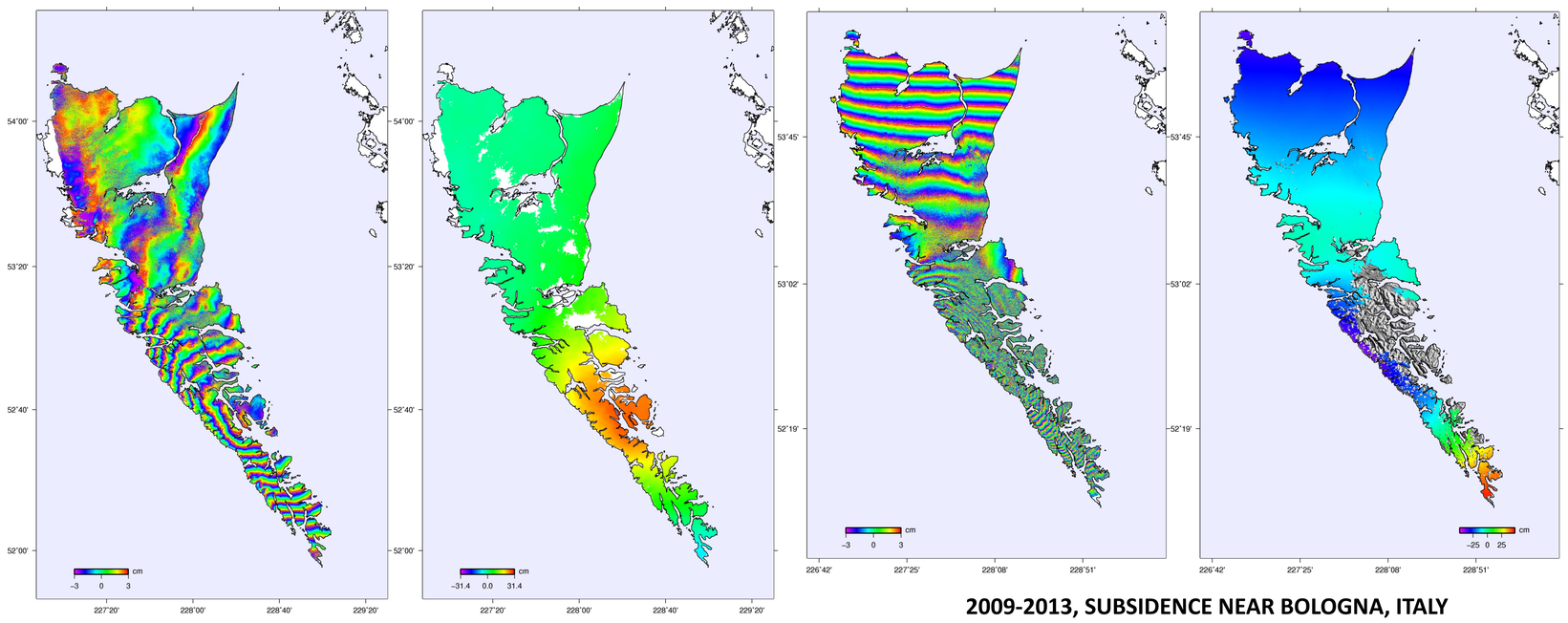
S.V. Samsonov[1], P.J. González[2], K.F. Tiampo[2], and M. Czarnogorska[1]



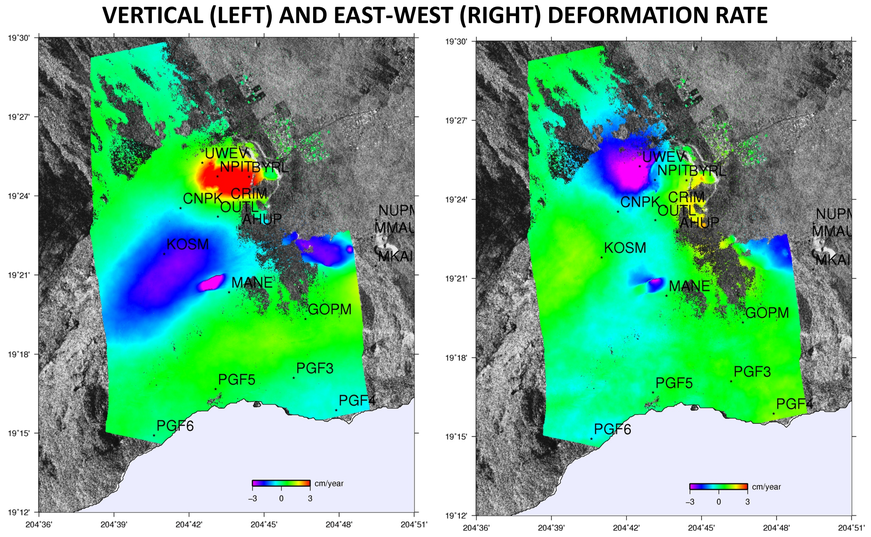
ABSTRACT

Natural hazard events such as earthquakes and volcanic eruptions can be successfully studied with the Synthetic Aperture Radar (SAR) that is capable of mapping sub-centimetre ground deformation over large areas using Interferometric SAR (InSAR) processing methodology. After the Japanese ALOS and European ENVISAT satellites completed their operation in 2011 and 2012 respectively, the only SAR sensors left in operation were the X- band German TerraSAR- X, Italian Cosmo-SKYMED and C- band Canadian RADARSAT-2. In this poster we present a number of case studies were RADARSAT-2 has proven to be the sensor with the best archived coverage and characteristics, including excellent spatial and temporal resolution and a wavelength that is superior for land observations. Using RADARSAT-2, we successfully mapped a number of large earthquakes in Canada, Central America, Iran, Italy, and Russia, and volcanic deformation in Chile, Hawaii, Italy, and Spain. Here we will present deformation maps for some of the natural hazard events that were studied and provide suggestions for future missions.

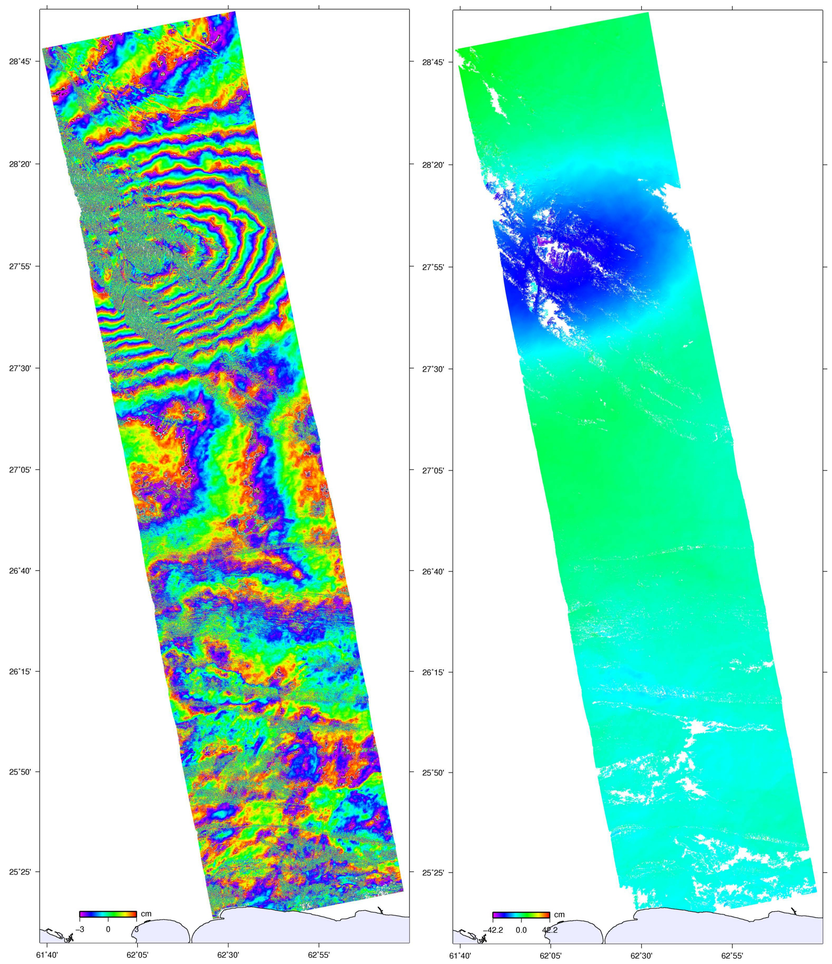
27 OCTOBER 2012, 7.8 MW HAIDA GWAII EARTHQUAKE, BRITISH COLUMBIA, CANADA
WRAPPED AND UNWRAPPED INTERFEROGRAMS FROM TWO BEAMS



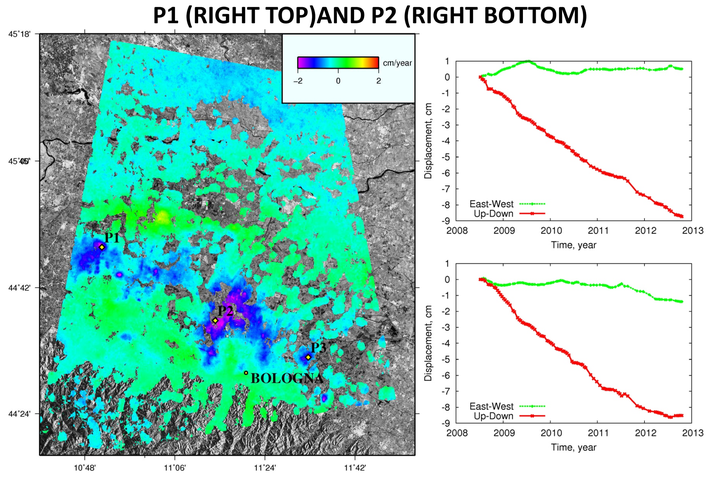
2009-2013, KILAUEA VOLCANO, HAWAII
VERTICAL (LEFT) AND EAST-WEST (RIGHT) DEFORMATION RATE



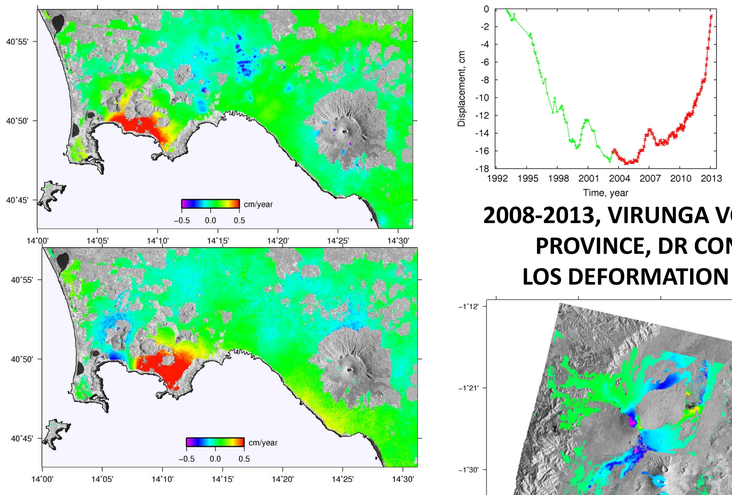
APRIL 16 2013, M7.7 KHASH EARTHQUAKE, IRAN
WRAPPED AND UNWRAPPED INTERFEROGRAM



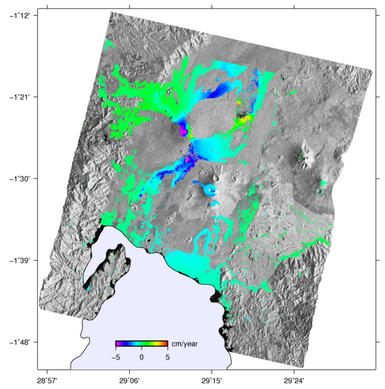
2009-2013, SUBSIDENCE NEAR BOLOGNA, ITALY
LINEAR DEFORMATION RATE AND TIME SERIES FOR POINTS P1 (RIGHT TOP)AND P2 (RIGHT BOTTOM)



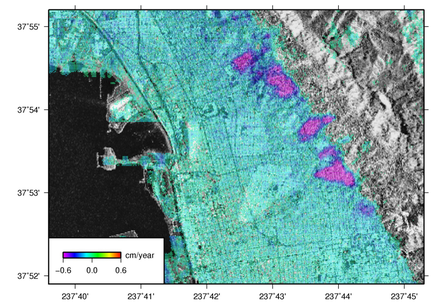
1992-2013, CAMPI FLEGREI VOLCANO, ITALY
VERTICAL (LEFT TOP), EAST-WEST (LEFT-BOTTOM) DEFORMATION RATE AND TIME SERIES (RIGHT)



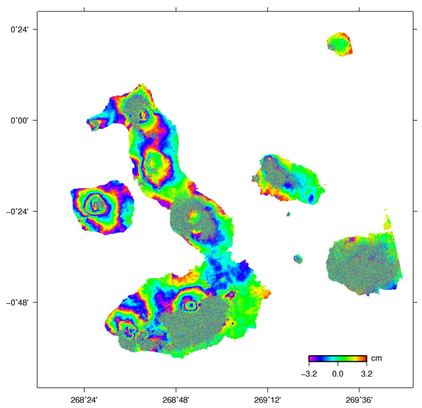
2008-2013, VIRUNGA VOLCANIC PROVINCE, DR CONGO
LOS DEFORMATION RATE



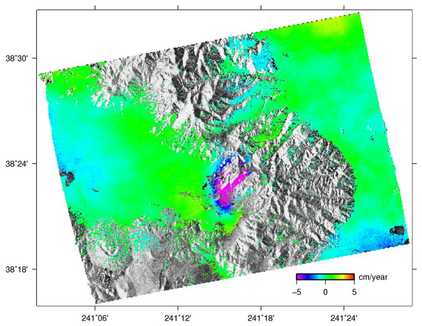
2008-2013, BERKLEY LANDSLIDES, CALIFORNIA
AVERAGE DEFORMATION RATE



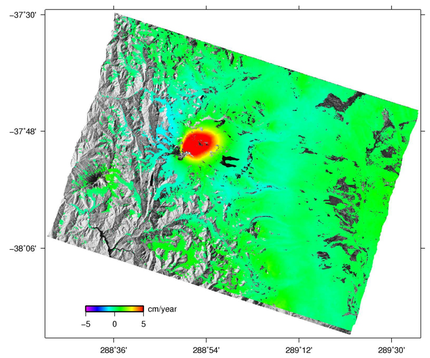
2012-2013, GALAPAGOS
6M SPAN INTERFEROGRAM



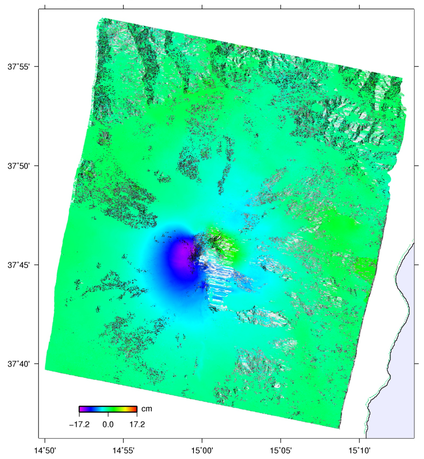
APRIL 2011, HAWTHORNE EARTHQUAKE SWARM, NEVADA
AVERAGE DEFORMATION RATE



2008-2013, COPAHUE VOLCANO CHILE/ARGENTINA
AVERAGE DEFORMATION RATE



2008, MT ETNA ERUPTION, ITALY
CO-ERUPTIVE INTERFEROGRAM



RECOMMENDATIONS FOR FUTURE MONITORING

- For ground deformation monitoring of natural and anthropogenic hazards with RADARSAT-2 InSAR Single Look Complex (SLC) data that contains phase information is required. This means that SCANSAR mode is absolutely of no use for InSAR. It is suggested substituting SCANSAR beams by Wide, Wide Fine or any other beams.
- SCANSAR beams can be used over the water.
- Repeatability of background acquisitions must be adjusted to land cover type. For densely vegetated regions 24 days repeatability is required. For sparsely vegetated regions like deserts 12 months repeatability is sufficient.
- For background monitoring the trade-off between spatial coverage and spatial resolution needs to be balanced. Wide and Wide Fine beams are suggested for the global coverage. Wide Ultra-Fine or Multi-Look Fine beams are suggested for urban and infrastructure monitoring.
- In case of disaster, such as earthquake or volcanic eruption, commercial and governmental clients should be advised to request data with beams that match previous acquisitions avoiding at any coast SCANSAR beams as they cannot be used for InSAR!
- The probability of disaster event occurring on weekend is 2/7 ~ 30%. It is beneficial to have 24H 7 days/week scheduling capability.

[1] Canada Centre for Mapping and Earth Observation, Natural Resources Canada, 560 Rochester Street, Ottawa, Ontario
[2] Department of Earth Sciences, University of Western Ontario, London, Ontario

For more information, please contact S.V. Samsonov (Sergey.Samsonov@NRCan-RNCan.gc.ca).

2014

Publications in this series have not been edited; they are released as submitted by the author.

doi:10.4095/295562

This publication is available for free download through GEOSCAN (http://geoscan.nrcan.gc.ca/).

Presented at the 34th Canadian Symposium on Remote Sensing Victoria, British Columbia
Date presented: August 2013

Recommended citation
Samsonov, S.V., González, P.J., Tiampo, K.F., and Czarnogorska, M., 2014. RADARSAT-2 for mapping natural hazard events: case studies from around the world; Geomatics Canada, Scientific Presentation 3, poster. doi:10.4095/295562