IAVCEI 2013 Scientific Assembly - July 20 - 24, Kagoshima, Japan
Forecasting Volcanic Activity - Reading and translating the messages of nature for society
4W_2E-P12   Date/Time: July 24 Poster

IAVCEI 2013
Kagoshima

The NASA Volcano Sensor Web (VSW): recent observations, activity and network expansion

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Spaced-based assets, ground-based sensors and automatic data processing algorithms have been incorporated into a sensor web that is capable of volcano monitoring with global coverage [1-4]. The NASA Volcano Sensor Web (VSW) uses the Earth Observing-1 (EO-1) spacecraft as the principal space-based observation platform to quickly react to detections of pending or ongoing volcanic activity. EO-1 is also used as a test bed for testing new onboard data processing and flight operations software [1,3]. This successful autonomy initiative has demonstrated that re-tasking of spacecraft can be very fast and completely automated, and the additional use of advanced autonomy and improvements in data transmission from EO-1 have greatly increased the speed at which data is acquired, downlinked and processed, and the resulting products (including hot pixel location, and the distribution and magnitude of thermal emission) created and delivered to end-users. The VSW was linked into the Icelandic Meteorological Office SIL seismic network [6] in 2011 and was triggered by increased seismic activity at the start of the Grimsvötn 2011 eruption [5]. In late 2012 the VSW incorporated seismic alerts for the Ecuadorian volcanoes Reventador, Tungurahua and Cotopaxi, with expansion to other volcanoes under evaluation. Also since late 2012, acoustic sensors on Etna [7] generate regular activity status alerts which are used to autonomously trigger requests to the EO-1 observation planner. The streamlining of EO-1 operations (a result of the autonomy initiative) means that re-tasking spacecraft manually is now a quick and easy task. This has led to multiple observations of eruptions around the world, including over 50 observations during the 2010 Eyjafjallajökull, Iceland, eruption, and observations of Puyehue Caulle Cordon, Chile, during 2011 and 2012, and the ongoing (at time of writing) eruption of Tolbachik, Kamchatka, and many others. Since mid-2004 over 4000 EO-1 observations of volcanoes have been obtained via ASE, VSW, and other scheduled requests. The VSW is responsible for over 1750 of these observations. The autonomous systems, data processing techniques, and workflows developed for the VSW will enable more efficient operation of future missions, and increase mission science return. References: [1] Chien, S. et al. (2005) JACIC, April 2005, pp. 196-216. [2] Chien, S. et al. (2005) IEEE Intelligent Systems, 20, no. 3, 16-24. [3] Davies, A.G., et al. (2006) RSE, 101, no. 4, 427-446. [4] Davies, A.G. et al. (2006) EOS, v. 87, no. 1, 1-5. [5] Davies, A.G., et al. (2013) JGR, under revision. [6] Böðvarsson, R. et al. (1999) Phys. Earth Planet Inter., 113, 89-101. [7] Marchetti, E., et al. (2009) GRL, 36, no. 19, L19308. Acknowledgements: Part of this work was performed at the Jet Propulsion Laboratory, California Institute of Technology, under contract to NASA. © 2013 Caltech. EO-1 is managed by the NASA Goddard Space Flight Center.