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Mapping deformation due to moderate/strong seismic events with Geohazards TEP - An overview of year 2018

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Extended abstract

Since 2015 ESA provides early access to an on-line processing platform for satellite data, the Geohazards Exploitation platform or GEP https://geohazards-tep.eu/ GEP aims to support the exploitation of satellite EO for geohazards. It follows the Supersites Exploitation Platform (SSEP), originally initiated in the context of the Geohazard Supersites & Natural Laboratories initiative (GSNL). The Geohazards platform has been expanded to address broader objectives of the geohazards community. In particular it is a contribution to the CEOS Working Group - Disasters to support its Seismic Hazards Pilot and terrain deformation applications of its Landslide & Volcano Pilots. GEP is sourced with elements – data, tools, and processing including INSAR – relevant to the Geohazards theme and related exploitation scenarios. It offers the following advantages: a) Rapid on-demand production as soon as satellite data are available (within few hours up to a few days) b) Semi-automatic production: the user can manipulate certain parameters, versatility in date and frame selections and c) Does not require advanced knowledge of methodologies from the user perspective, but enables a greater choice of products than pure automatic pipelines. The Geohazards TEP product analysis permits the user to obtain results on: a) Primary surface faulting and deformation, b) Earthquake Environmental Effects (sec. faulting, triggered ruptures, landslides), c) Coherence shadows and multi-temporal coherence evaluation and d) Line-of-Sight (LOS) displacement (InSAR data) and 2D horizontal displacement (Optical data).

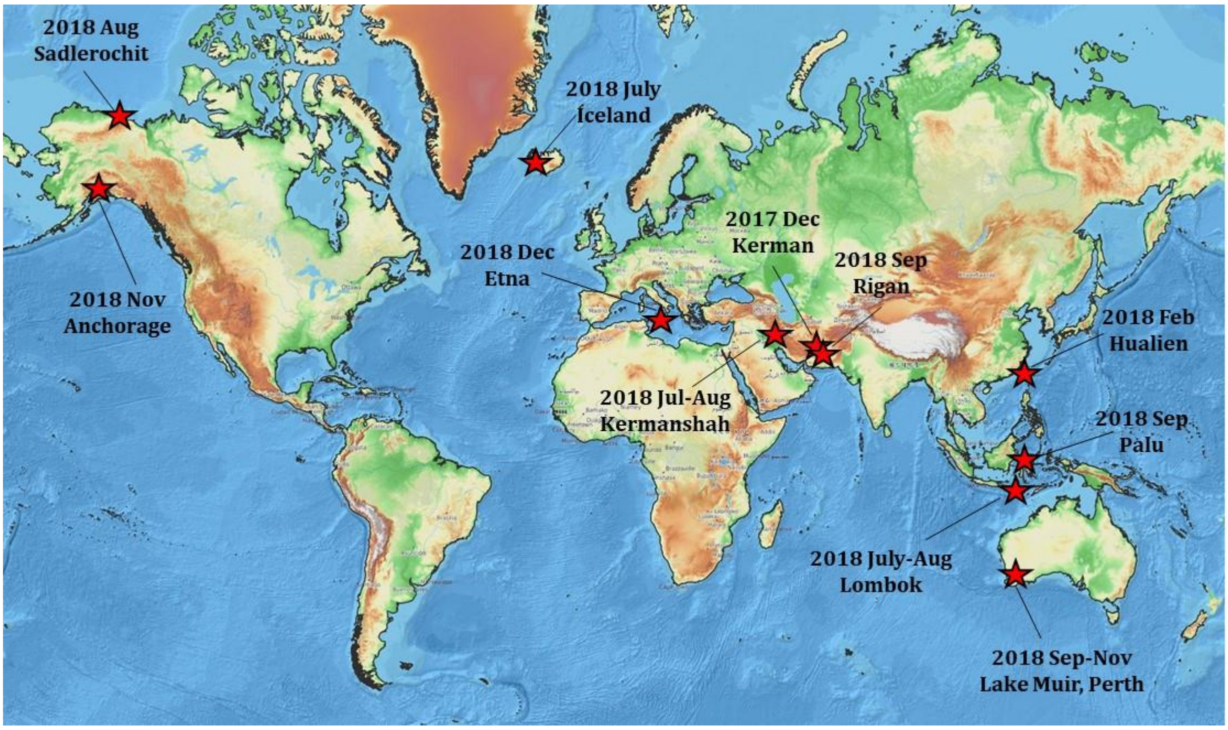

Figure 1. A) Global relief map showing the location of the 2018 seismic events examined in this study (red stars).

Geohazards TEP provides an effective platform to study earthquakes using InSAR & optical analysis. The Sentinel-1 and GEP tools (SNAP, DIAPASON, GMTSAR, MPIC-OPT etc.) captured surface deformation due to many strong events during 2018, with a threshold as low as M_W 4.9 (Catania, Italy Dec 26 2018). The semi-automatic nature of GEP platform is extremely useful to a Geoscientist End-User, with versatility in parameters and product selection. It was also demonstrated that optical displacement data (Sentinel-2/MPIC-OPT) are not an alternative to SAR geodesy, but have a complimentary role, for better capturing near-fault displacement than InSAR.

We examine the most significant shallow earthquake events between December 2017 and December 2018 (Fig. 1). The GEP tools and Sentinel1/2 imagery products are used to identify and examine earthquake surface ruptures, co-seismic landslides and other earthquake environmental effects. The majority of moderate/strong shallow events were identified in Sentinel-1 InSAR products and examples are presented for each single event or earthquake sequence (Fig. 2). Using

GEP we identified coseismic deformation of moderate-magnitude events like Perth, Australia and Catania, Italy (Valkaniotis 2018), strong earthquake sequences with multiple events like Lombok, Indonesia (Ganas et al. 2018), as well as in large plate boundary events such as the M_W 7.5 Palu, Indonesia earthquake (Valkaniotis et al. 2018). In addition, optical image correlation from Sentinel-2 imagery through the MPIC-OPT service (Stumpf et al. 2017) assisted in measuring near-fault large displacements, where InSAR is difficult to be applied due to lack of correlation and lack of coherence.

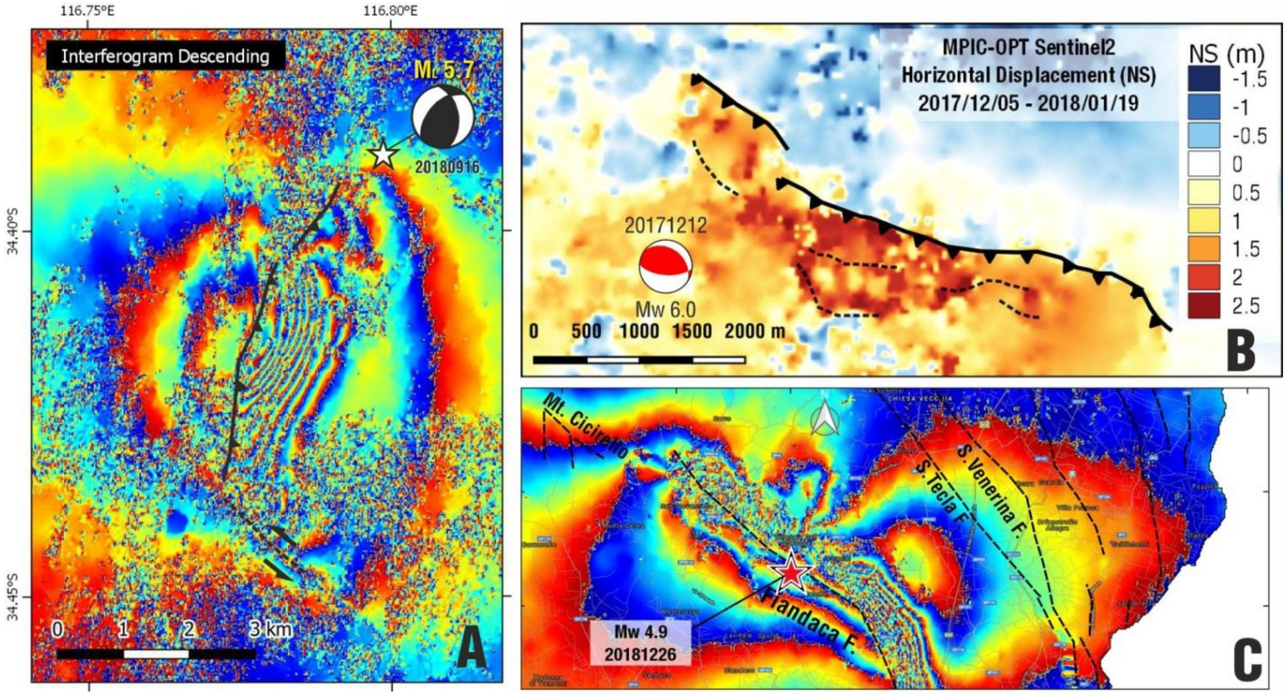

Figure 2. A) Coseismic interferogram of the M_L 5.7 Sep 16 2018 Lake Muir, AUS earthquake with surface faulting along a reverse/oblique fault. B) Horizontal displacement (N-S component) from Sentinel-2 optical images of the M_W 6 Dec 12 2017 earthquake in Kerman, SE Iran. C) Co-seismic interferogram of the Dec 26 2018 M_W 4.9 Catania, Italy earthquake at the SE flank of Etna volcano. Each color fringe on interferograms represent ~2.8 cm of displacement.

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