NASA Data Products

3 March 2016 CA Earthquake Clearinghouse Cascadia Rising Planning Meeting

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Introduction

✧ NASA response teams, include E-DECIDER, GeoGateway, UAVSAR, READI, and ARIA
✧ Provide satellite and airborne based deformation products, deformation modeling products, damage and loss estimation models, and aftershock forecasts for earthquake and disaster response
✧ Deliver products to the Clearinghouse and partners through XchangeCore
Example NASA Response Products

Exposed infrastructure overlays

Water conveyances or other structures affected by vertical motion/slope change

Tsunami arrival times

UAVSAR assessment of levees

Building damage
Infrastructure Database Service

- Enables user to access near 30 FEMA HAZUS critical infrastructure information layers with HSIP Freedom data overlaid upon map data products from E-DECIDER, GeoGateway, UAVSAR (or others)
- Supports spatial query for broader range of emergency situations: point (e.g. earthquake), line (e.g. tornado, fault rupture), and polygon (e.g. flood, wildfire), and user-specified search distance; bounding box search is now supported
- Supports KML output for Google Earth and Google Map, GeoJSON output for mobile web applications, and XchangeCore event adaptor is under development
- Data inventory hosted on third-party GIS server can be added through WFS chain service
Infrastructure Database Service

Infrastructure layers for Washington and Oregon
The tilt or slope change map indicates where vertical changes in the surface have occurred. This is indicated with a color scale showing areas of greater slope change and arrows indicating the direction of change.

Measurement of the change of slope and direction that can affect water distribution, drainage, and sewage services.

Critical infrastructure that was potentially exposed to damage can be viewed by specifying an epicenter or fault rupture parameters and radius and then listing the items of interest. The callout in the image shows a highway bridge.
Data Products – E-DECIDER in SpotOnResponse during 2015 May Capstone exercise
Airborne Radar Sensing of Levee Status

- Liquefaction & Levee Deformation / Failure in the Sacramento Delta can be a consequence of the M9 Cascadia quake.

- Deliver three products:
  - Interferogram
  - Surface Movement
  - Severe Damage polygons

Simulated Liquefaction (from South Napa earthquake)
Data Products – UAVSAR in SpotOnResponse during 2015 May Capstone exercise
READI Tsunami Arrival Times for Cascadia Scenario

- READI (Real-time Earthquake Analysis for Disaster Mitigation Network) leverages the 550+ station real-time GPS supernetwork in Western North America to prototype an accurate and timely earthquake and tsunami early warning system using GPS (GNSS) technology as well as GPS/seismic integration (seismogeodesy)
- Will partner with NOAA for the exercise to produce tsunami products
Data Products – READI in SpotOnResponse during 2015 May Capstone exercise

READI: PGD magnitude update based on peak ground displacement at 5 closest GPS stations with accelerometers

- Magnitude Estimate: 5.84
- Epicenter Location: 33.468, W115.740
- Number of Stations Triggered: 5
- Time since Origin: 8.0 s

Station arrival times are determined by an automated modified STA/LTA algorithm. We invert for the hypocenter using Geiger's Earthquake Location Method. Magnitude scaling relationships are detailed in Melgar et al. 2015, Geophysical Research Letters.
Damage Proxy Map (DPM)

✧ The DPM applies an automated change detection algorithm to Synthetic Aperture Radar (SAR) that has been demonstrated to detect:

- Building damage/collapse
- Liquefaction
- Landslides
- Flooding/inundation extent

✧ A DPM provides both a synoptic view and high spatial detail of damage.

✧ DPM’s are based on radar observations, which can be acquired day or night and can image through clouds, unlike optical imagery.

✧ DPMs can be provided in KML/KMZ, GeoTIFF, and Shapefile.
Damage Proxy Map: San Francisco

- Close-up of San Francisco from damage proxy map generated for Golden Guardian Exercise
- Red pixels indicate damaged structures in an earthquake. For example map, construction or other changes serve as proxy for damage.
- Map is generated for large region (80 km x 120 km footprint), providing synoptic view of affected areas with spatial details finer than building block scale (24 m x 30 m pixel).
Alaska Shield 2014 Exercise Products

M9.2 Megathrust Earthquake-induced Tsunami Inundation
Questions?

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http://e-decider.org
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http://uavsar.jpl.nasa.gov
http://sopac.ucsd.edu/readi.shtml
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