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E-DECIDER: Earthquake Disaster Decision Support and Response Tools – Development and Experiences

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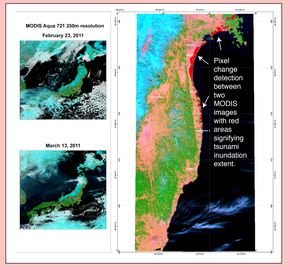
Earthquake Data Enhanced Cyber-Infrastructure for Disaster Evaluation and Response (E-DECIDER) is a NASA-funded project developing new capabilities for decision-making utilizing remote sensing data and modeling software to provide decision support for earthquake disaster management and response. The overall goal of the project is to deliver these capabilities as standards-compliant Geographical Information System (GIS) data products through a web portal/web services infrastructure that will allow easy use by decision-makers; this design ensures that the system will be readily supportable and extensible in the future.

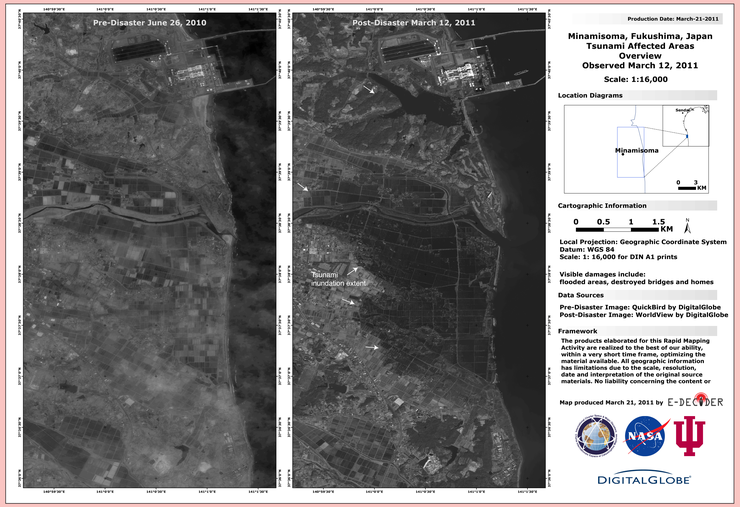
11 March 2011 Tohoku-oki Japan Earthquake Response

The M 9.0 Tohoku-oki earthquake struck off the northeast coast of Honshu, Japan on March 11, 2011. This earthquake was the largest on record in Japan and one of the top five recorded on Earth. It generated a tsunami with maximum heights of 30 m, which devastated a number of coastal communities.

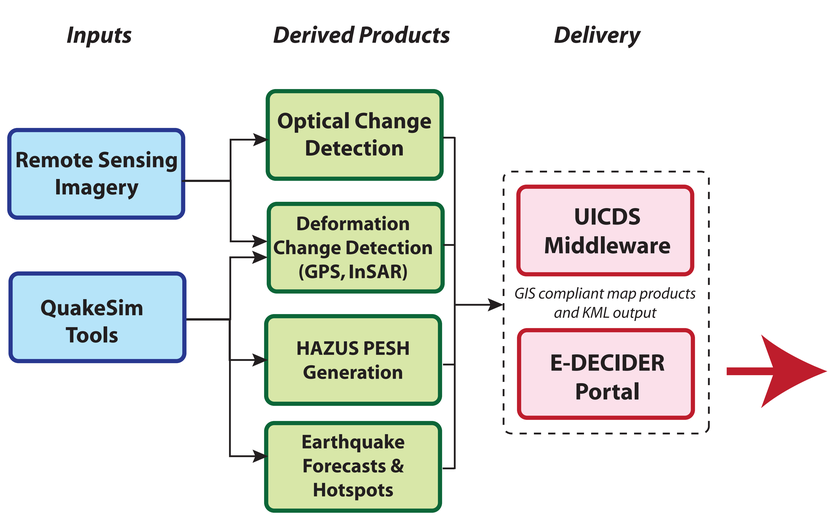
The International Charter, which provides a unified system of space data acquisition and delivery to those affected by natural or man-made disasters through Authorized Users, was quickly invoked. This allowed the E-DECIDER project to participate in the disaster response and provide the Japanese government with pre- and post-disaster imagery for damage assessment.

The image to the right is an example of a change detection product produced from MODIS data that shows the extent of tsunami inundation in red. The images below show a pre- and post-disaster image pair provided by DigitalGlobe through the International Charter. In the right image, the tsunami inundation can be observed as far as 3 km inland and damaged homes and bridges are even visible.





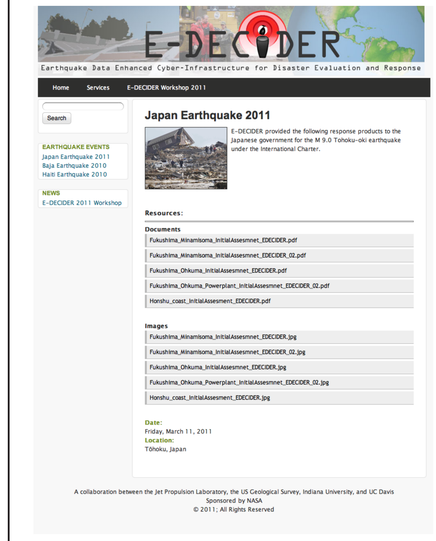
Approach



By utilizing geophysical modeling tools and earthquake forecasting methodology developed under NASA's QuakeSim project along with remote sensing and geodetic data and analysis techniques, E-DECIDER provides both long-term planning information for disaster management decision makers as well as short-term information following earthquake events, such as identifying areas where the greatest deformation and damage has occurred and emergency services may need to be focused. We will deliver our products both as web services through the E-DECIDER portal and plan to implement the FEMA Unified Incident Command and Decision Support (UICDS) framework.

Acknowledgements

This work was carried out at the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration and supported by the Applied Sciences Programs.



http://e-decider.org

E-DECIDER delivers geophysical modeling tools and remote sensing products through a web portal (under development at http://e-decider.org). Illustrated at the right is an example page with event information related to the 11 March 2011 Tohoku-oki Japan earthquake. The web services under development can also be accessed under the "Services" tab.

The first of a series of end-user workshops was held in October of 2011 at the Jet Propulsion Laboratory in Pasadena, CA. The workshop gathered a number of participants including representatives from government agencies such as the USGS, the California Geological Survey, the US Bureau of Reclamation, and NASA, experts from related industry, and remote sensing and computer science experts to discuss and produce a set of recommendations for the needs of the end-user community and the direction for the development of E-DECIDER products and services.

We identified a number of key issues, including the need for greater coordination between decision support providers and decision makers, a more unified mechanism for product delivery (such as the Unified Incident Command and Decision Support, UICDS, system being developed by FEMA), a standardized data product, and better leveraging of NASA capabilities and resources for earthquake disaster response.

Lessons Learned

- Data availability has led to a reassment of what remote sensing products can be most readily delivered following an earthquake; in most cases optical and multispectral data is more readily available than radar (especially with invocation of the International Charter).
- Recent experiences with large, devastating earthquakes highlighted the lack of collaborative infrastructure (including easy data sharing) - this made response difficult, even in a highly instrumented country like Japan.
- Additionally, there is a lack of a world-wide hazard modeling service, which limits rapid earthquake response.
- There is an identified need for standardized delivery (such as the UICDS), standardized products, and better coordination between decision support providers and decision-making agencies and responders.

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