

CEOS DRM Flood Pilot - Overview

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<p>CEOS Flood Pilot April 2014- end 2017 Theme area: floods</p>	<p>CEOS Proposal Development Lead: Stu Frye, National Aeronautics and Space Administration (NASA) Bob Kuligowski, National Oceanic and Atmospheric Administration (NOAA)</p>
<p>Geographic areas of focus: Global, with regional pilots in</p> <ul style="list-style-type: none"> • Caribbean (focus on Haiti) • Southern Africa (focus on Kavango/Okavango and Zambezi basins) • Southeast Asia (Mekong basin and Java) 	<p>User Implementation Lead:</p> <ul style="list-style-type: none"> • <u>Global</u>: NASA Goddard Space Flight Center (GSFC) • <u>Caribbean</u>: Caribbean Institute for Meteorology and Hydrology (CIMH) • <u>Southern Africa</u>: Namibia Dept. of Water Affairs and Forestry • <u>Southeast Asia</u>: Mekong - Mekong River Commission (MRC Technical Support Division), Asia Disaster Preparedness Center (ADPC), Java - Indonesian Ministry of Public Works <p>CEOS Implementation Lead: NASA and NOAA</p>
<p>Partners: <u>CEOS agencies:</u> NASA, NOAA, Agenzia Spaziale Italiana (ASI), Canadian Space Agency (CSA), European Space Agency (ESA), Centre National d'Etudes Spatiales (CNES), South African National Space Agency (SANS), United States Geological Survey (USGS), JAXA.</p> <p><u>Other partners:</u> CIMA, Hydrologic Research Center (HRC), Lippmann Institute, Deltares, Service Régional de Traitement d'Image at de Télédétection (SERTIT), University of Colorado, University of Maryland, Joint Research Centre (JRC), CIMH, ACRI, Global Facility for Disaster Reduction and Recovery (GFDRR), MRC-Technical Support Division, Government of Namibia, Kavango/Okavango River Commission, Government of Indonesia (Research Center for Water Resources - RCWC), UNESCO, Jet Propulsion Laboratory, (JPL).</p>	<p>Contributing projects:</p> <ul style="list-style-type: none"> • NASA SensorWeb • Group on Earth Observations (GEO) Caribbean Satellite Disaster Pilot • GEO Southern African Flood and Health Pilot • Lower Mekong River Basin Project (NASA, USGS) • ESA TIGER Initiative • RASOR (CIMA, SERTIT, CIMH, Deltares, Indonesian Govt., AG) • KAL-Haiti (CNES) • Dartmouth Flood Observatory (Univ. Of Colorado) • NASA near-real-time (NRT) Global Moderate resolution Imaging Spectro-radiometer (MODIS) Flood Mapping • Global Flood Monitoring System (U. of Maryland; Tropical Rainfall Measuring Mission (TRMM) and Global Precipitation Measurement (GPM)) • Global Flash Flood Guidance (HRC) <p>Other relevant projects: International Charter, SERVIR, GDACS</p> <p>Pilot objectives: The CEOS Flood Pilot aims to demonstrate the effective application of satellite earth observations (EO) to the full cycle of flood management at global and regional/local scales by:</p> <ul style="list-style-type: none"> • Objective A – Integrating information from existing near-real time global flood monitoring and modeling systems in a Global Flood Dashboard for hydro-meteorological modeling by science users and for flood monitoring by DRM practitioners, disaster managers, other end users, and even the general public; <i>(higher temporal and lower spatial resolution)</i> • Objective B – Delivering EO-based flood mitigation, warning and response products and services through regional end-to-end pilots in: <ul style="list-style-type: none"> ○ The Caribbean (with particular focus on Haiti); ○ Southern Africa, including Namibia, South Africa, Zambia, Zimbabwe, Mozambique and Malawi; ○ Southeast Asia (with particular focus on the lower Mekong Basin and Java, Indonesia). <i>(higher spatial and lower temporal resolution)</i> • Objective C – Encouraging at least base-level in-country capacity to access EO data and integrate into operational systems and flood

	<p>management practices.</p> <p>CEOS objectives:</p> <ul style="list-style-type: none"> • Improve coordination of satellite data acquisitions in support of flood management; • Demonstrate the value of satellite EO in the context of integrated flood management practices (and including flood hazard mapping).
<p>Description:</p> <p><u>Component 1</u> – Global Overview and Regional Linkages: the capabilities of existing global flood systems will be combined in a “Global Flood Dashboard” that will provide users with a single point of entry for relevant data covering the full cycle of flood monitoring. Users will be able to evaluate larger-scale flood risk via archive flood and related products at moderate resolution (e.g., MODIS flood maps, flood vectors from UNOSAT). Current or predicted flooding (based on observed and/or predicted rainfall) will be depicted on a global map with moderate-resolution satellite flood products and forecasts (e.g., Sensor Web, U. of Maryland Global Flood Monitoring System), and particular regions of interest will be indicated (e.g., based on information from the Dartmouth Flood Observatory, Europe Media Monitor, and International Red Cross). Users will also be able to focus on specific regions of interest—the three regional Pilots (Caribbean/Central America, Southern Africa, or Southeast Asia) and any other regions where Charter products can be freely obtained—to view close-ups and overlays of estimated and predicted rainfall, predicted severity of flooding, available flood images (if flooding is in progress), and links to the relevant datasets. The portals of the three regional components of the Flood Pilot will be linked to and coordinated with the Global Flood Dashboard, allowing users to view the higher-resolution data sets available to the regional components. This capability will significantly facilitate validation of the coarser-resolution global flood products via the linkages with the regional Pilots and high-resolution Charter products. New end products developed at a regional scale will also be incorporated into the Global Flood Dashboard on a demonstration basis.</p> <p><u>Component 2</u> – The flood aspects of the existing regional end-to-end disaster pilots in the Caribbean/Central America and Southern Africa and the new flood component in Southeast Asia will provide full-cycle flood monitoring products and develop a common presentation for flood related information, based on the “flood dashboard” developed in Namibia (http://matsu-namibiaflood.opensciencedatacloud.org/) . These regional dashboards will provide information in a standard format from various high resolution assets and in-situ data sources based on requests from users who determine polygons of interest through a standard query interface. Each flood component “dashboard” will be linked to the global systems (see component 1). New end products will be developed based on the expertise of partners, building on the Charter (the concept, not the actual Charter data but rather freely accessible products) and rapid mapping experience and extending beyond the Charter two-week cut-off (activation) period. CEOS agencies will contribute data in each region to enable product generation and demonstration; some CEOS agencies will also develop products on a best-efforts basis. Some non-CEOS partners will develop products/services as well that will be linked through the common interface for each regional component.</p> <p><u>Component 3</u> – CEOS agencies will sponsor local organizations in capacity building initiatives tied to the project, in cooperation with donor agencies such as the World Bank, UNDP and national donors (USAID, CIDA, EC's ECHO, etc).</p> <p>In the Caribbean, CIMA will work with the RASOR end users (Haiti, CIMH) to develop specific training tied to the CEOS Pilot activities (RASOR multi-hazard risk analysis and management). Annual Donor meetings sponsored by regional authorities will be tracked and attended by CEOS Flood pilot representatives to influx remote sensing thrusts into the planning activities of that body. Similar approaches will be pursued at the regional level of World Bank donor conferences working through national representatives that attend the regional WB conference.</p> <p>In Southern Africa, ESA's TIGER initiative will make specific linkages between the pilot activities and local capacity building including training in Namibia, Zambia and possibly South Africa (2014-15).</p>	

In the Mekong, NASA will develop specific training tied to CEOS Pilot activities and provide end users with EO data products that complement existing Mekong River Commission (MRC) flood management efforts in the Lower Mekong River Basin. In Indonesia, end users will receive training for RASOR platform use and integration of satellite EO for flood risk management.

CEOS contribution to pilot: CEOS will act as the coordinating body to ensure the support and participation of member agencies in executing this project. The main contribution of CEOS agencies is:

- a) maintenance and improvements to existing global-scale efforts;
- b) coordinated higher spatial resolution satellite observations before, during and after floods in the three regions of interest.

In some cases, agencies are providing value-added products and services, as well as modeling support and product validation work. CEOS agencies are providing project management support to oversee the implementation of the pilot.

Key pilot outputs/deliverables:

Component 1 – Global Flood Dashboard providing a single point of entry that links existing global initiatives and three regional components;

Component 2 – Three regional flood dashboards; standard new end products building on Charter and rapid mapping experience, extending beyond the Charter two-week cut-off (activation) period.

Component 3 – Capacity building initiatives tied to the project, in cooperation with local organizations and donor agencies such as the World Bank, UNDP and national donors (USAID, CIDA, EC's ECHO, etc).

CEOS outputs/deliverables:

- Coordinated satellite EO data acquisitions to support integrated flood management in three regions, and to reinforce global flood monitoring efforts
- Plan for satellite data acquisitions to support global flood monitoring beyond 2016

Key user communities:

- Users: local governments, civil protection agencies, river basin authorities, meteorological services, land use planning decision makers, disaster risk reduction specialists with NGOs and international organisations, insurance sector
- Practitioners: flood modelers, scientists and hydrological engineers in hydrology, water and environment ministries, meteorological services, satellite data providers, value added service companies
- Institutional bodies responsible for communication of risk to communities (gap between technical level and shared information with communities): research institutions with operational responsibilities.
- General public: some information will be made available to the general public, although the main focus of the pilot is on specialized users.

The pilot recognizes that users of the pilot outputs and products may be different according to global or regional interests, and will endeavor to build stronger relationships with both categories of users through outreach activities.

Key outcomes:

1. Simplified access to existing global flood modeling and monitoring systems for users;
2. Improved understanding of how satellite EO can be used to support integrated flood management;
3. Increased local capacity to adopt satellite EO solutions;
3. Best practices and lessons learned for regional flood management using EO.

Milestones and schedule:

Global systems

2014: initial pilot Global Flood Dashboard website with linkages to major global projects and systems (e.g., Sensor Web, U. of Maryland Global Flood Mapping System, Dartmouth Flood Observatory) and archive flood products (e.g., MODIS, UNOSAT flood vectors);

2015: functional linkages between the Global Flood Dashboard and the three regional flood component areas; indication of regions of interest based on reports of flooding (e.g., International Red Cross, Europe Media Monitor); showcase at World Conference on Disaster Risk Reduction

2016: continue 2015 services and draft a plan for longer-term sustainability for beyond 2016 for satellite products to support global flood monitoring, if Charter data availability supports it, functional linkages to additional user-selected polygons of interest beyond the three regional pilot areas. Provide for synchronization of global flood record database with regional versions that have been validated by local/national agencies.

Caribbean

2014: flood dashboard based on Namibia pilot adapted to Caribbean users; flood monitoring (i.e., targeted EO data acquisitions); contributions of data to KAL Haiti data base;

2015: flood monitoring during 2015 season; RASOR risk management platform operational for flood risk and landslide risk analysis in Haiti; 10-year flood archive over region based on Deltares Flood Monitoring Programme;

2016: continue 2015 services and draft a plan for longer-term sustainability.

Southern Africa

2014: flood monitoring during early 2014; training and capacity development; Windhoek workshop; updates to flood dashboard;

2015: flood monitoring during early 2015; 10-year flood archive over region based on Deltares Flood Monitoring Programme;

2016: continue 2015 services and draft a plan for longer-term sustainability.

Southeast Asia

2014: flood dashboard based on Namibia pilot adapted to SEAsia users.; user consultations on new pilot products; establishment of regional GEO pilot and new SERVIR Hub; test TRMM/GPM-based high resolution flood monitoring product over the Lower Mekong Basin (contingent on river gauge data being obtained); flood dashboard development based on Namibia pilot adapted to SE Asia users;

2015: operational test bed for RASOR risk management system for test sites in Java; integration of flood dashboard with global dashboard; initial services for Mekong River Commission; 10-year flood archive over region based on Deltares Flood Monitoring Programme; 1st new TRMM/GPM and other flood monitoring products;

2016: continue 2015 services and draft a plan for longer-term sustainability.

EO data requirements:

The CEOS flood thematic team has developed detailed EO data requirements, which identify specific polygons of interest and frequency of observations for various satellite types and specific satellite sensors. Data provided must be ortho-rectified and geolocated for integration into user systems and products, which in turn are designed with open standards to encourage transmission and sharing across regions. The EO data requirements were presented in draft form to the CEOS SIT in fall 2013. Agreement in principal to provide certain data reached within CEOS Disasters Working Group March 2014. Detailed agreements between Flood Pilot team members and agency representatives on the Data Coordination Team being finalized September – November 2014 The EO data requirements include both archived data from past and existing missions (Envisat MERIS and ASAR, Terra and Aqua MODIS, S-NPP, TRMM and GPM, Radarsat-1 and 2, ALOS-1 and 2, COSMO-SkyMed, TerraSAR-X, Proba-V, Landsat-8, EO-1, Pleiades, SPOT-5, Aqua AMSR-E, GCOM-W1 AMSR-2, Sentinel-1, GRACE, etc.) and new data from upcoming missions (Sentinel-2,, SMAP).

Main contribution by partner:

- NASA: support the DRM Flood effort by funding the implementation of the prototype Global Flood Dashboard and its linkage to the three regional systems (Component 1)
- NOAA: provide real-time rainfall rate estimates to support the HRC flash flood system, hydro-estimator, S-NPP VIIRS flood maps, and any other pilot efforts as needed
- JAXA: up to 100 images per year from ALOS-2 for demonstration purposes.
- CSA: RSAT-2 data over some regional pilot areas (exact areas TBC, data already being provided over

Caribbean/Central America and Southern Africa).

- ESA: The TIGER initiative will provide capacity building/training in Namibia, Zambia and South Africa; Sentinel-1 and 2 data will be available over regional pilot areas, and ESA will work internally to facilitate early access to Sentinel data during the early mission's lifetime in the three regions of interest.
- CNES: KAL Haiti data base can receive data over Haiti and be linked to regional pilot in Caribbean; SPOT and Pleiades data over regional pilot areas.
- ASI: COSMO-SkyMed data over some regional pilot areas (exact areas TBC).
- SANSA: data over Southern African test area; training.
- CIMA and SERTIT: RASOR platform for test sites in Haiti and Java by mid 2015; integration of data from several satellite sensors including TanDEM-X, COSMO-SkyMed, ALOS-2, Radarsat (through this pilot) and Pleiades, and flood modeling.
- CIMA: algorithms to support EO-based flash flood monitoring and forecast over RASOR test sites; expertise on practices for operational flash flood forecast.
- CIMH: capacity building tied to EO data exploitation in Caribbean.
- Deltares: development of Envisat ASAR radar archive over three test areas – linkages to global activities – through Global Flood Monitoring program (10-year Global Flood Archive based on Envisat ASAR imagery and a global flood detection algorithm) – regional case studies over Southern Africa, Java and Haiti.
- HRC: Flash flood guidance system running operationally from HRC in Dominican Republic and Haiti (build bridges to KAL Haiti and CSDP). Flash flood systems provided by HRC in Southern Africa and Mekong. HRC will incorporate selected EOS products into the operational flash flood warning systems and evaluate effectiveness.
- Dartmouth Flood Observatory/University of Colorado: Completion of global coverage for "Surface Water Record" displays and supporting GIS data and associated public data distribution portals. Includes previous maximum flood extent data and current surface water from NASA NRT Global MODIS Flood Mapping
- University of Maryland: Global Flood Monitoring System (GFMS) continued development, improvement and testing using TRMM/GPM rainfall into hydrological model with routing at 12 km and 1 km resolutions. Continued routine real-time product generation (www.flood.umd.edu). U of Maryland will work with pilot to provide through the global model regional cut-outs tailored by users, so that a user can define a specific polygon of interest and receive flood bulletins and products only for their area.
- Lippmann Institute (with TU Wien and JPL): test water-related EO products (Envisat based flood map) for data-assimilation in hydraulic models with a number of case study flood events, generate flood hazard maps of the Lower Zambezi area using the archive of ENVISAT ASAR WSM imagery.
- ACRI: MERIS archive for historical flood events; development of Sentinel 2/3 use in regional pilots.
- MRC, ADPC, and RCWC: in-situ data for product calibration and validation.

Capacity building:

- U. of Maryland: capacity building with global users and in regional pilot regions using global real-time results.
- ESA: TIGER activities in Namibia and Zambia will link with the CEOS Flood Pilot in Southern Africa. The activities include the development and installation of a Water Observation Information System (open source software) and—most important—intensive training of the local stakeholders. Interfaces will be established to the existing global systems (Component 1 above) to improve local capacity. Finally, the WOIS as open source software can be disseminated further in the Southern African region, possibly in South Africa (already included in TIGER).
- RASOR project (CIMA, AG, SERTIT and Deltares): the FP7 RASOR project will work closely with local users in the Caribbean, especially with CIMH, to develop capacity working with satellite EO data on flood management; RASOR will also work in Indonesia (Java) with local users to develop uptake of EO-based products.
- Lower Mekong Basin and Indonesia: The Project Mekong activities will link existing flood monitoring and management activities to the CEOS Flood Pilot. Partners will develop a methodology and application strategy for efficiently integrating EO data products with the Flood Management and Mitigation Programme (FMMP) flood monitoring network and forecasting system. The utility of these activities for improving flood management capacity will be demonstrated and improved through the

engagement of the stakeholders and linking the EO data products, global systems and local gauge data. In Indonesia, capacity building activities will be centered on training end users in RASOR platform use as a tool to integrate EO data into prototype risk assessment systems. Involvement with the Global Earth Observation System of Systems Architecture Implementation Pilot: The NASA-led initiatives through the GEOSS AIP continue development of Sensor Web tools/techniques that are demonstrated and adopted by regional flood component practitioners for improved uptake of CEOS provided EO data including the open source release of the Open GeoSocial Application Programmer Interface (API) software September 2014.

Outreach activities:

- The pilot will use a registered user system where anyone can register as an organization or individual and offer constructive feedback to validate and improve the system (allows metrics); users will be encouraged to evaluate pros and cons of various global systems and linkages to regional products, to allow feedback and improvement of existing systems.
- The flood pilot activity will provide (through its website) an “index” of who is doing what, where and how they are linked with regard to global and regional flood management efforts in the areas covered by the pilot (to be maintained by the flood team leads and automated when possible).
- CEOS Flood Pilot will design specific products that will be made publicly available through social media, including work using Open Street Map as a tool to validate satellite EO flood extent data and products in several of the test areas. These links to social media will also provide tools for metrics gathering through inherent tracking mechanisms to assess uptake.
- The pilot will use structured multi-channel communication to ensure broad public outreach while respecting confidentiality and targeted communication where appropriate.

Suggested evaluation criteria:

1. Increased use of global flood monitoring and modeling tools/sites (pilot will track metrics from 2014 to 2016, and categorize the user communities)
2. Successful integration of archived and near-real time satellite EO into operational flood monitoring systems in the three pilot areas
3. Quantitative evaluation of the effectiveness of modeling and observational products for warning and response for the three pilot areas.

Pilot Contributors:

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