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GIS for a Sustainable World:
Building a Resilient Future

May 10 - 11, 2022 | InterContinental, Geneva, Switzerland

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BIENVENUE

SELAMAT DATANG

Добро пожаловать

TERVETULOA

WELCOME

2022

VELKOMMEN

BIENVENIDO

WELKOM

VÄLKOMMEN

ようこそ

esri | THE SCIENCE OF WHERE

Applying GIS for Resilience

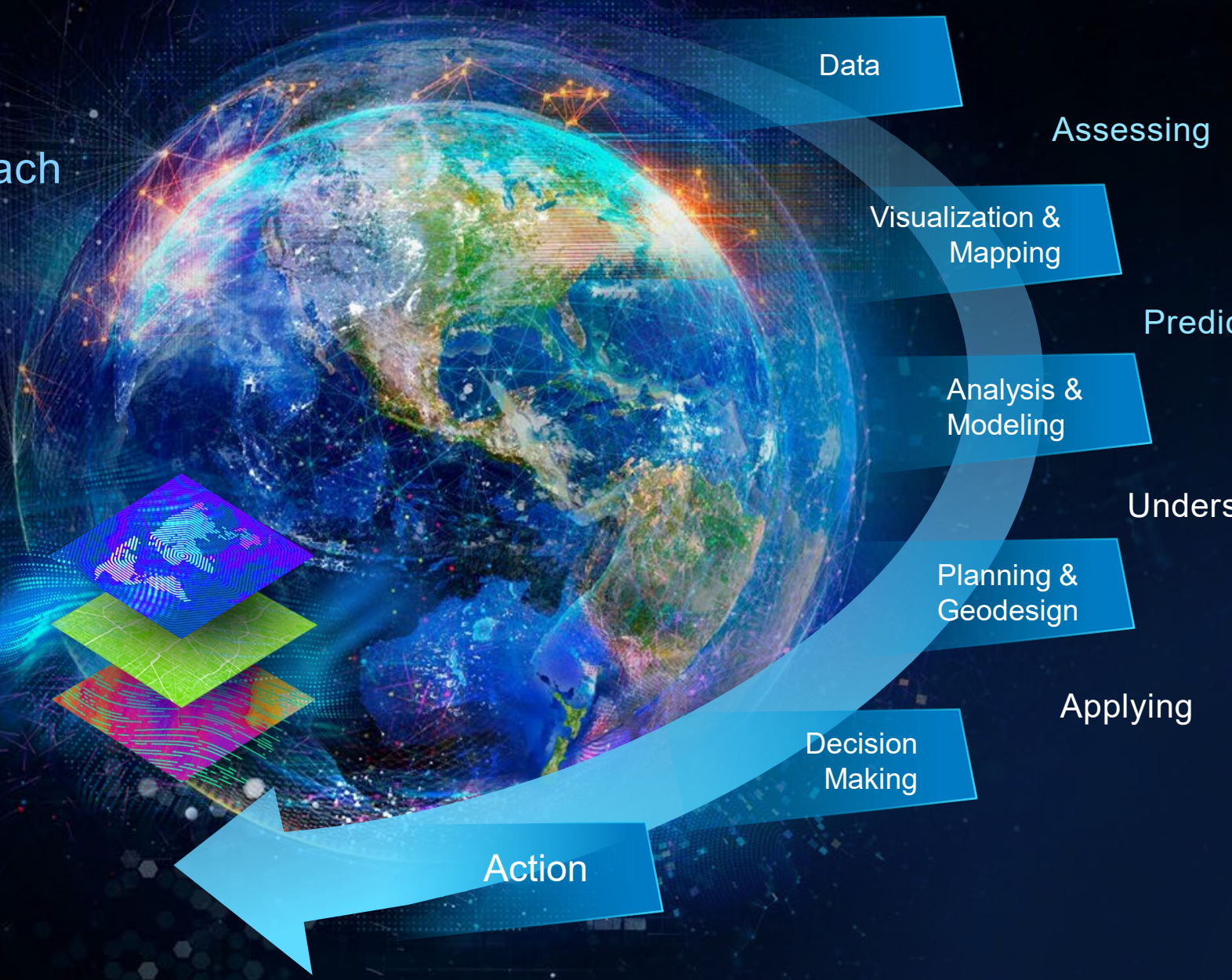
May 10 - 11, 2022 | InterContinental, Geneva, Switzerland

GIS

Enables The Geographic Approach

Providing a Process and Framework . . .

. . . For Applying Geographic Knowledge Widely



GIS Professionals . . .

Are Already Applying The Geographic Approach

Creating Many Focused Solutions

Lowering Greenhouse Gas Emissions

Improving Diversity, Equity & Inclusion

Managing Sustainable Agriculture & Forests

Preserving Natural Areas

Reducing Pollution

Creating Sustainable Cities

Responding to Epidemics

Predicting and monitoring shocks

Developing Renewable Energy

Restoring Nature

Protecting Biodiversity

Providing Social Infrastructure

Engaging Communities

Creating Efficiency

Developing Resilient Infrastructure

Automating Processes

Assessing Impact

Optimizing Logistics

Improving Decision Making

However,

We Need to Scale Up Our Collective Efforts . . . Exponentially

GIS Technology Is Advancing Rapidly

Integrating and Leveraging Many Innovations

Helping Us Scale Up Our Collective Efforts

Innovations and Trends in GIS

1. Increasingly Interconnected
2. Portals — Enabling Geospatial Infrastructure
3. Integrating of All Types of Data
4. Geospatial Apps Are Becoming Pervasive
5. Big Data Integration
6. Imagery and Remote Sensing Integration
7. Spatial Analytics Are Advancing
8. Immersive Experience
9. Geospatial Capabilities Are Becoming Embedded
10. Hubs Are Enabling Communities

TREND 1

GIS Is Increasingly Interconnected

Creating Geospatial Infrastructure

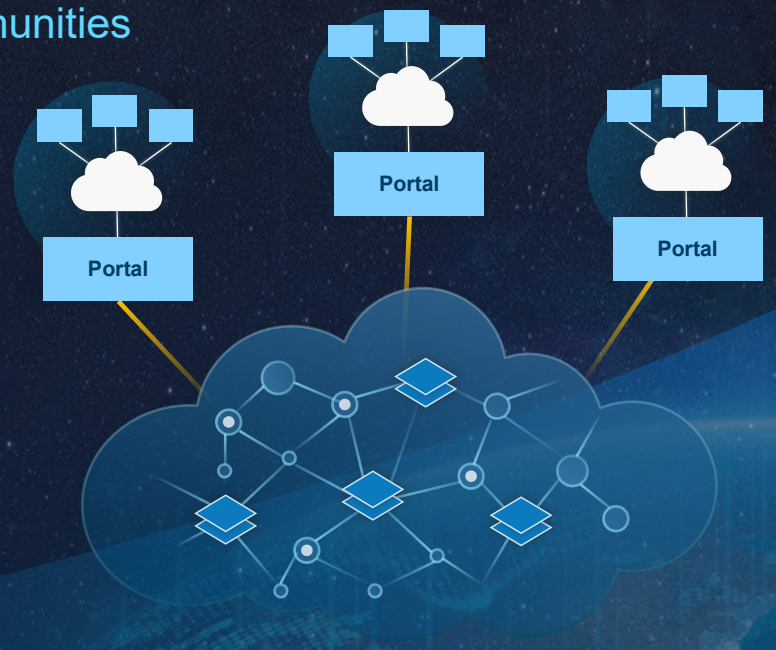
Connecting and Streamlining . . .
Collaboration, Workflows and Decision Making

TREND 2

Portals are Organizing Geospatial Infrastructure

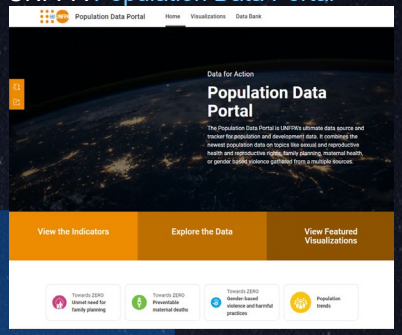
Integrating Geospatial Services . . .

Supporting All Types of Communities

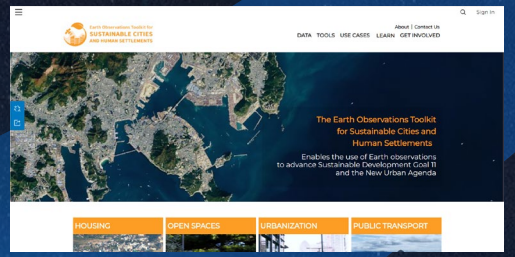


Shared Geospatial Services and Apps

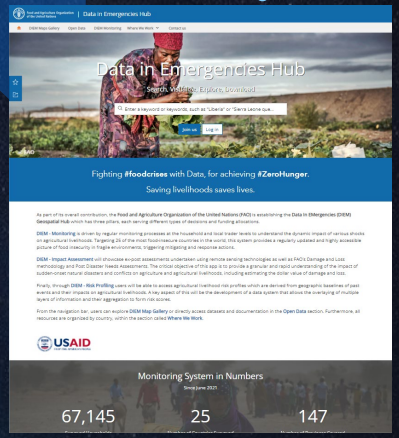
UNFPA Population Data Portal



UN Habitat EO Toolkit for Sustainable Cities



FAO Data in Emergencies Hub



. . . Transforming GIS

Geospatial Infrastructure Is Expanding Rapidly

Supporting Local to Global Applications

Millions of Users . . .

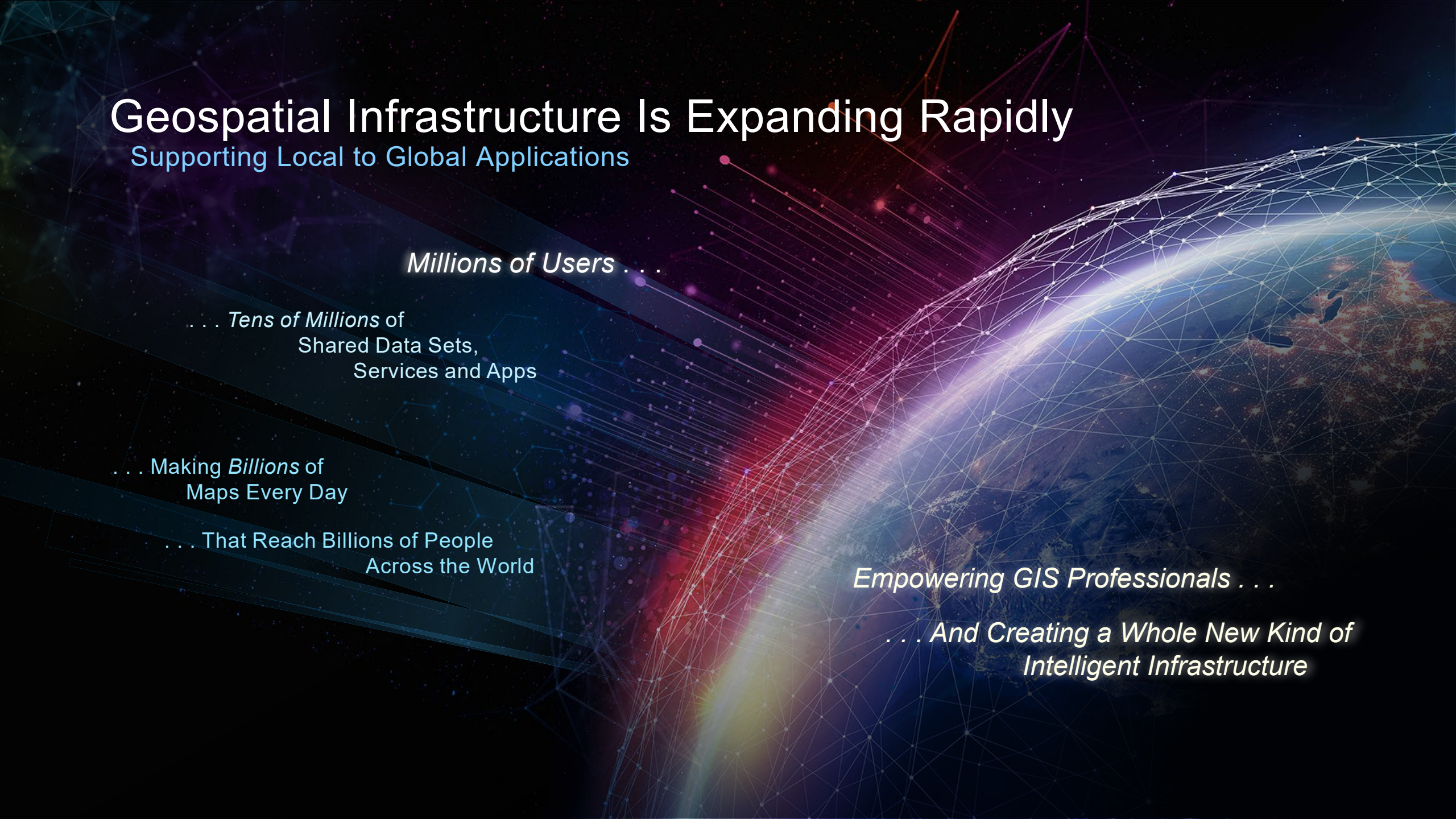
. . . *Tens of Millions* of
Shared Data Sets,
Services and Apps

. . . Making *Billions* of
Maps Every Day

. . . That Reach Billions of People
Across the World

Empowering GIS Professionals . . .

. . . And Creating a Whole New Kind of Intelligent Infrastructure



TREND 3

GIS Is Directly Integrating All Types of Data

Making Them Available and Immediately Usable

TREND 4

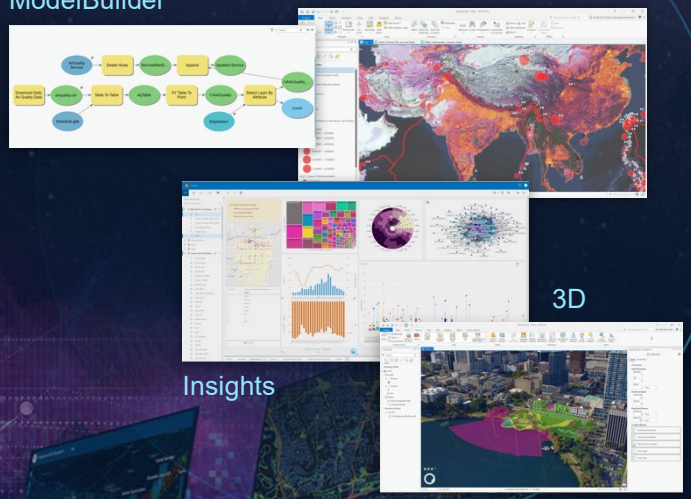
Geospatial Apps Are Becoming Pervasive

Supporting Many Types of Workflows and Engagements

Powerful Desktop Apps

ModelBuilder

Pro



Insights

3D

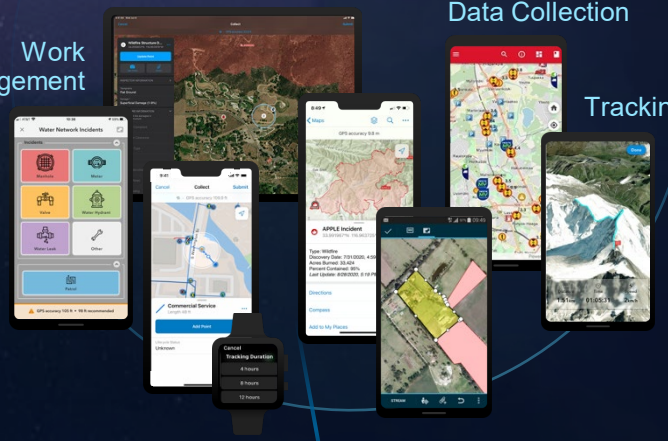
Massive Mobile Deployments

Awareness

Work Management

Data Collection

Tracking



Pervasive Web Apps

Dashboards

Mapping

Infographics

StoryMaps

Geospatial Infrastructure

Empowering Everyone . . .
. . . In the Organization and Beyond

John Morrison

International Search and Rescue Advisory Group (INSARAG)

Using Esri Technology for International Disaster Coordination

INSARAG INFORMATION MANAGEMENT WORKING GROUP

JOHN MORRISON - JOHN.MORRISON@FAIRFAXCOUNTY.GOV

INSARAG is a global network of more than 90 countries and organisations under the United Nations umbrella.

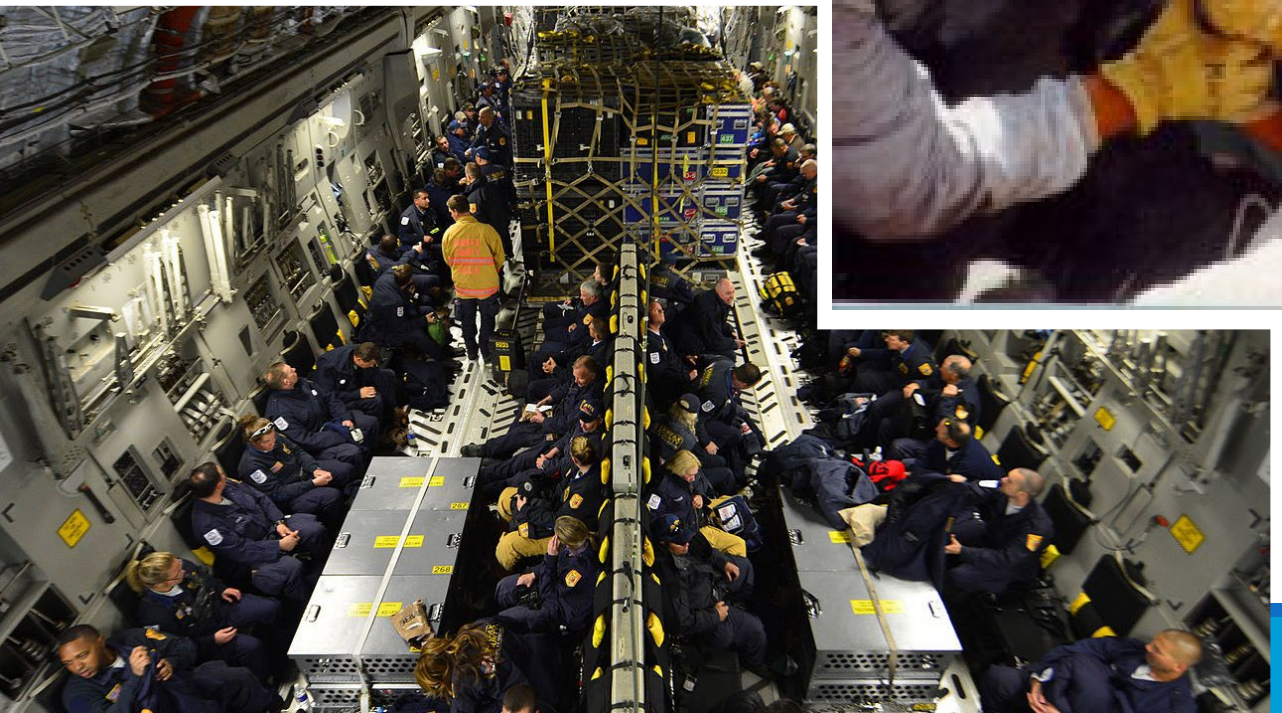
INSARAG deals with urban search and rescue (USAR) related issues, aiming to establish minimum international standards for USAR teams and methodology for international coordination in earthquake response based on the INSARAG Guidelines endorsed by the United Nations General.

Why? Because coordination saves lives.

INSARAG
Preparedness Response


USAID


PRYSE
USAID
FROM THE AMERICAN PEOPLE
FAIRFAX COUNTY
FIRE AND RESCUE DEPARTMENT
Fairfax County
Urban Search
and Rescue



History

Pre-2010 – Information kept by each team

2010 – Standardized paper forms

2015 – Data collection using open-source products

2017 – INSARAG Information Management Working Group established

2020 – ArcGIS for collection, analysis and reporting

KoBo Project

Introduced mobility solutions

Limited capability

Not able to extend to meet needs

Potential for adverse reaction from users as it didn’t meet needs

Did enhance the acceptance of ICMS in its AGOL format

Where does Esri come in?

Through the INSARAG Information Management Working Group, we sourced the best solution available

Started from an implementation by Fire and Emergency New Zealand

The result is the INSARAG Coordination and Management System (ICMS)

ICMS is set up as a unique instance for each USAR team throughout the world (60+) for training purposes and for each disaster

Information Management Working Group - 2017

Formed to develop and deploy the IM concept.

International group of USAR people

Move from Open Source (KoBo) to Esri based system

Finalised ICMS development

Developed process to test and QA system for operational use

Deployed to INSARAG environment

What is ICMS built with?

5 Dashboards

35 Feature Layers

14 Forms (Survey 123)

2 Hub pages

12 Microsoft Word Templates

10 Web Maps

5 Web Mapping Applications

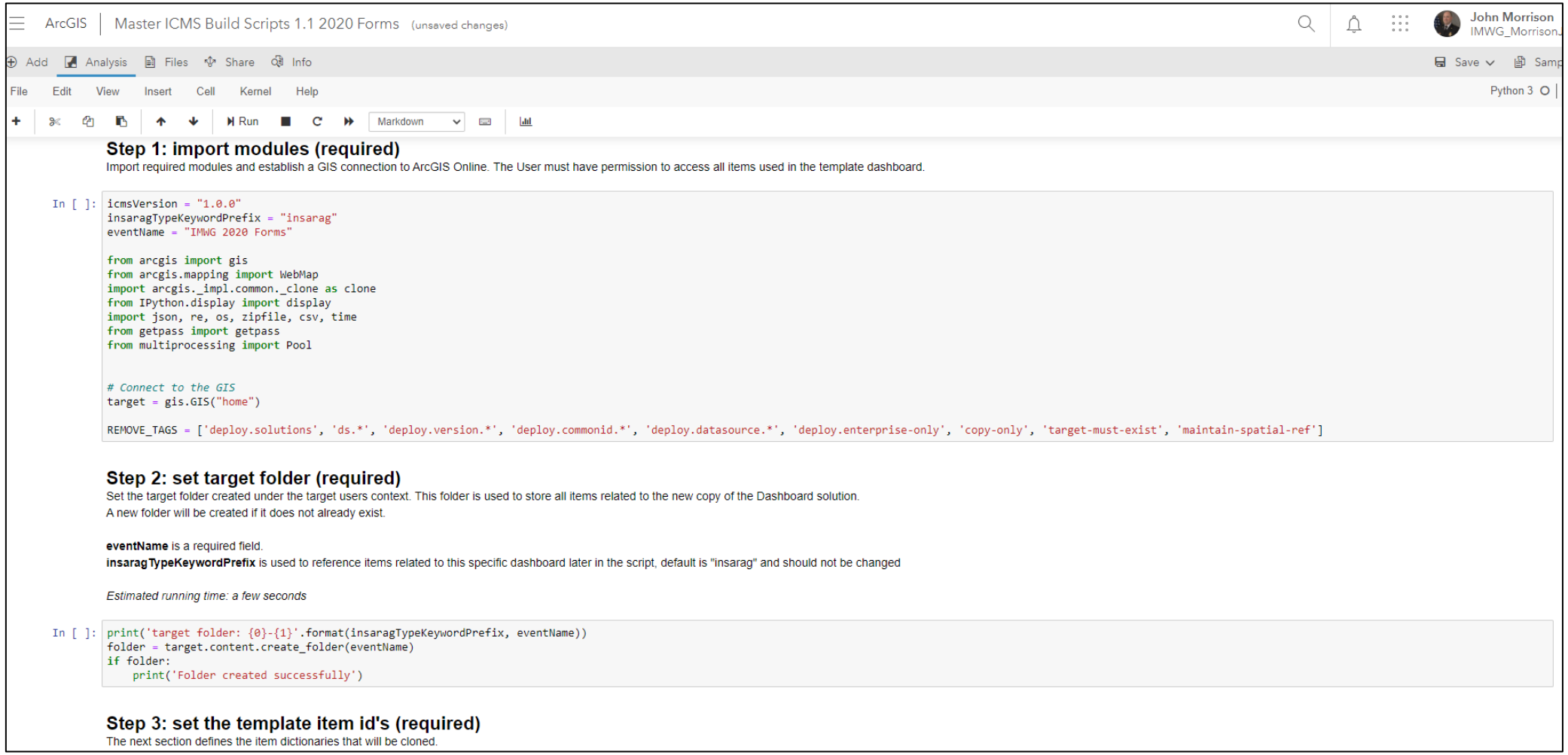
All created by 1 Jupyter notebook

ArcGIS Survey 123

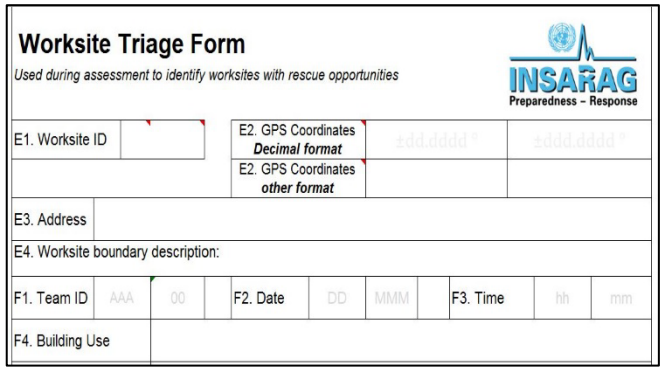
ArcGIS FieldMaps

ArcGIS QuickCapture

Jupyter Notebook



Digitising a Paper-Based Process

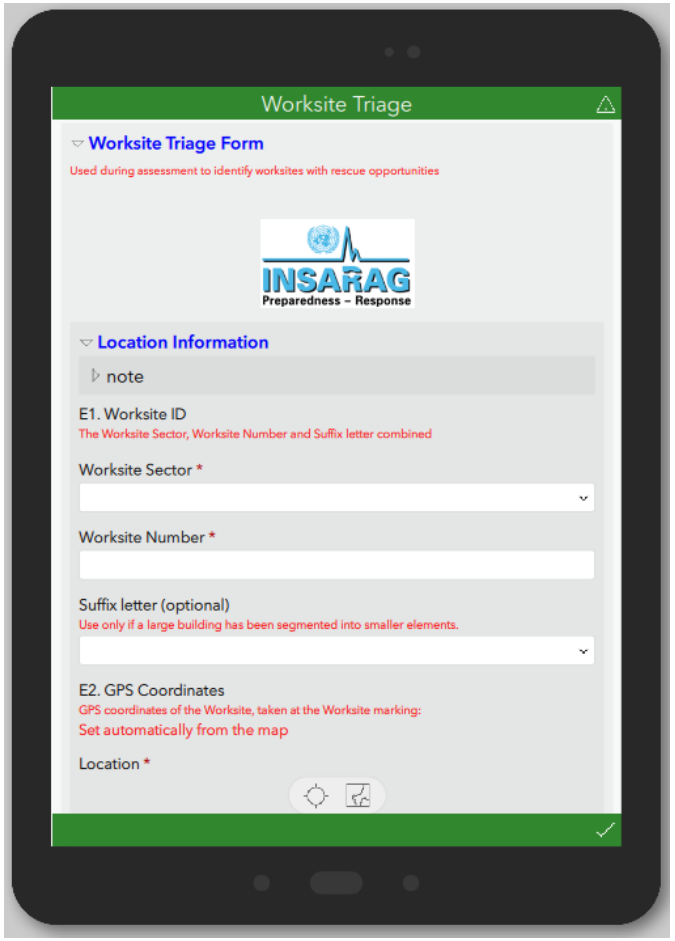


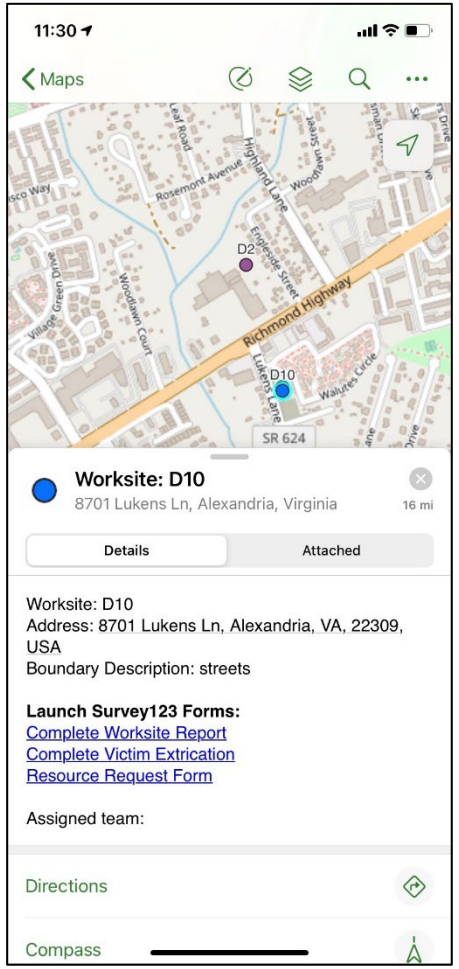
Worksite Triage Form

Used during assessment to identify worksites with rescue opportunities

INSARAG Preparedness – Response

E1. Worksite ID		E2. GPS Coordinates *Decimal format*	±dd.dddd ° ±ddd.dddd °
		E2. GPS Coordinates *other format*	
E3. Address			
E4. Worksite boundary description:			
F1. Team ID	AAA 00	F2. Date DD MMM	F3. Time hh mm
F4. Building Use			





Timeline of an Incident

Incident occurs

Team Fact Sheet

Recon Phase

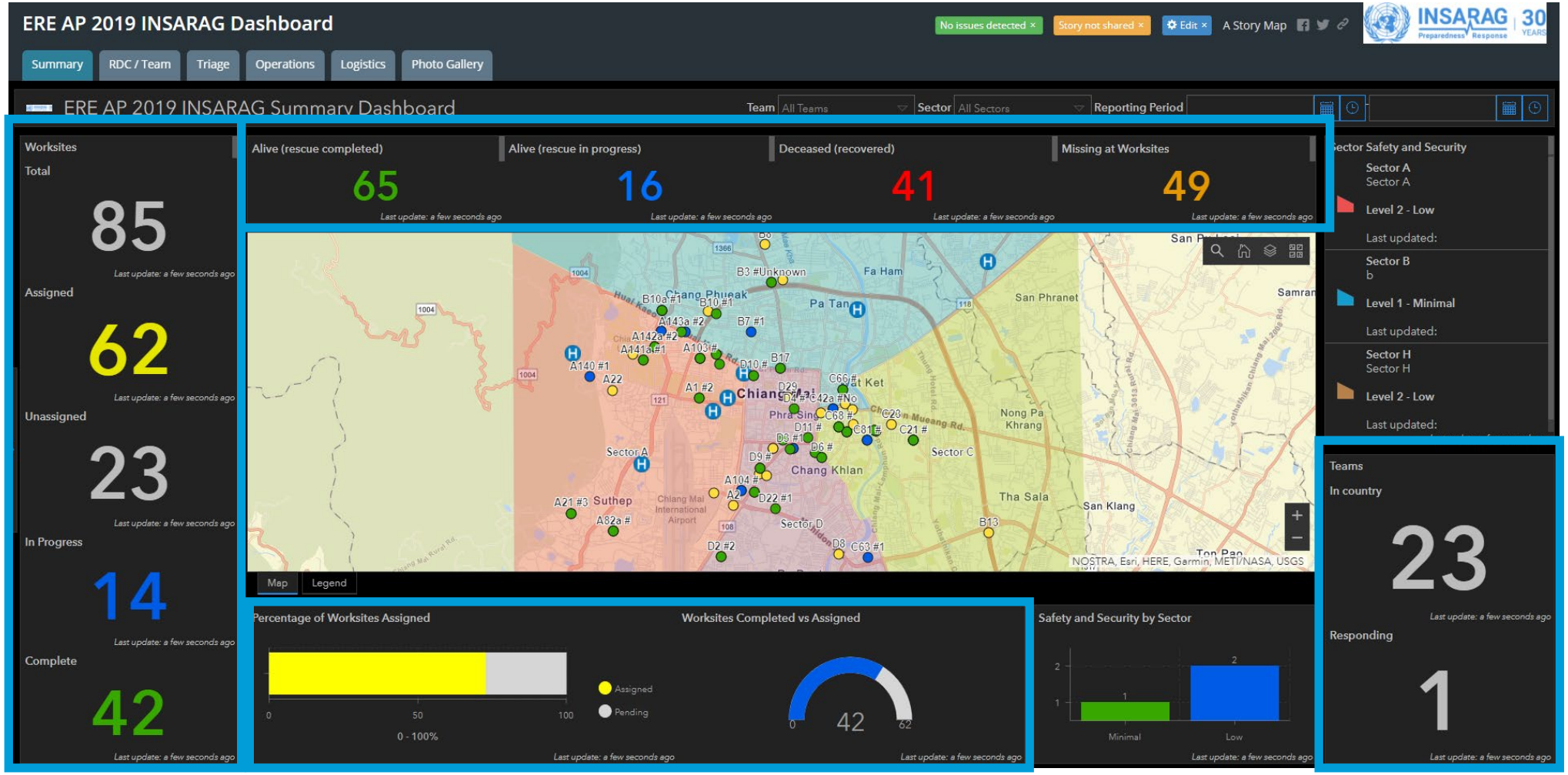
Worksite Triage Form

Operations Phase

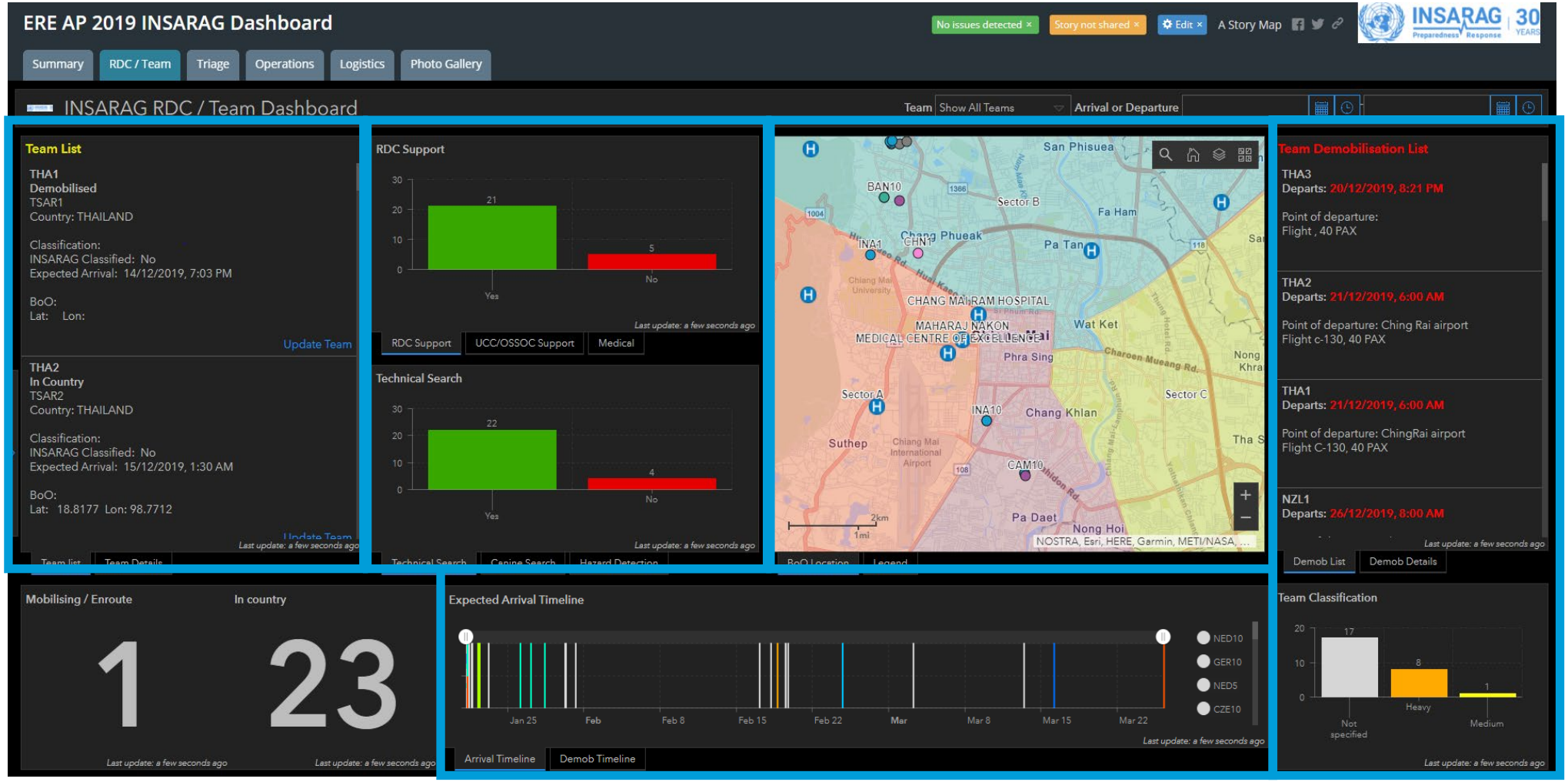
Worksite Report Form

Victim Extrication Form

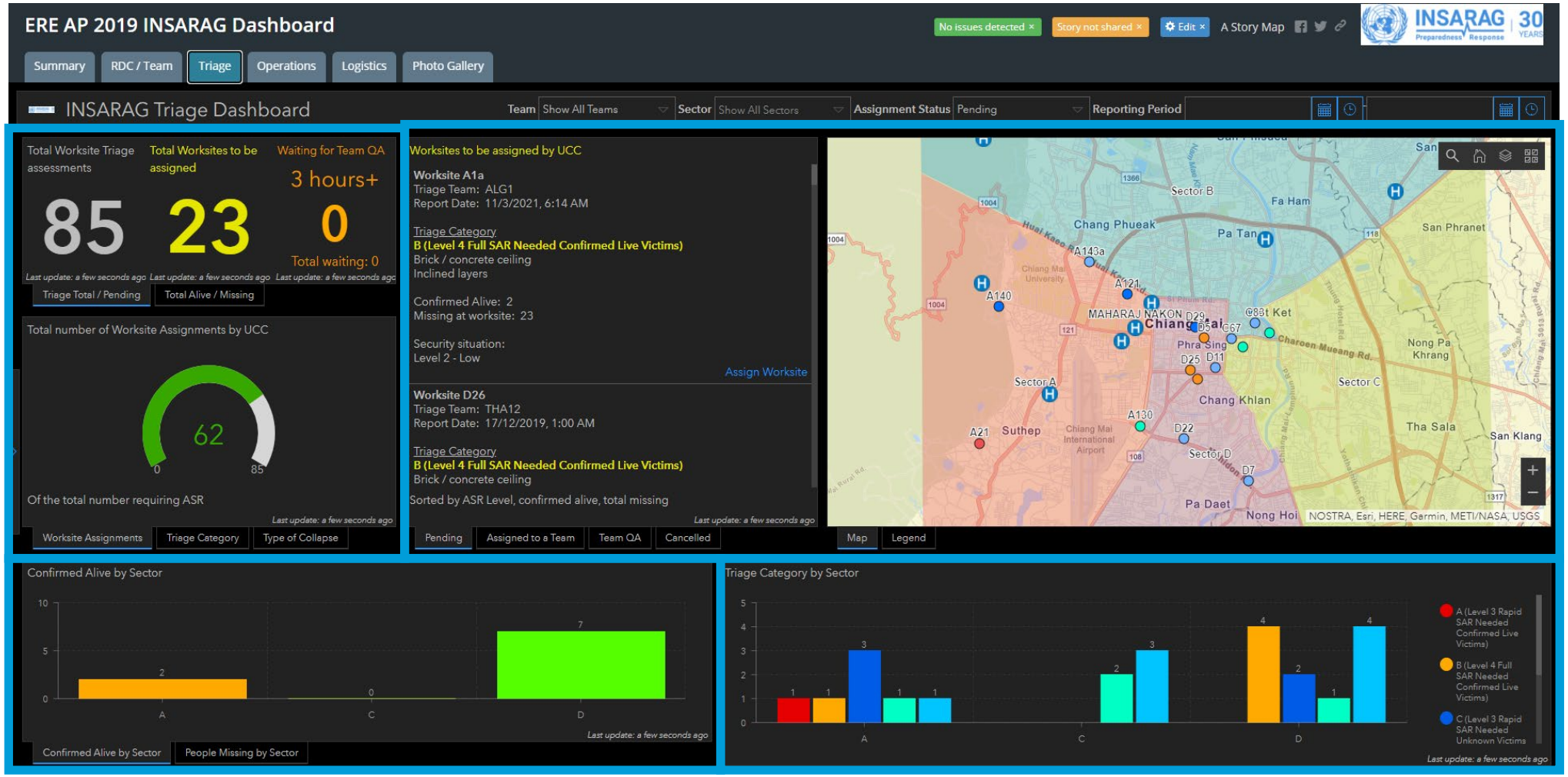
Dashboard – Overview



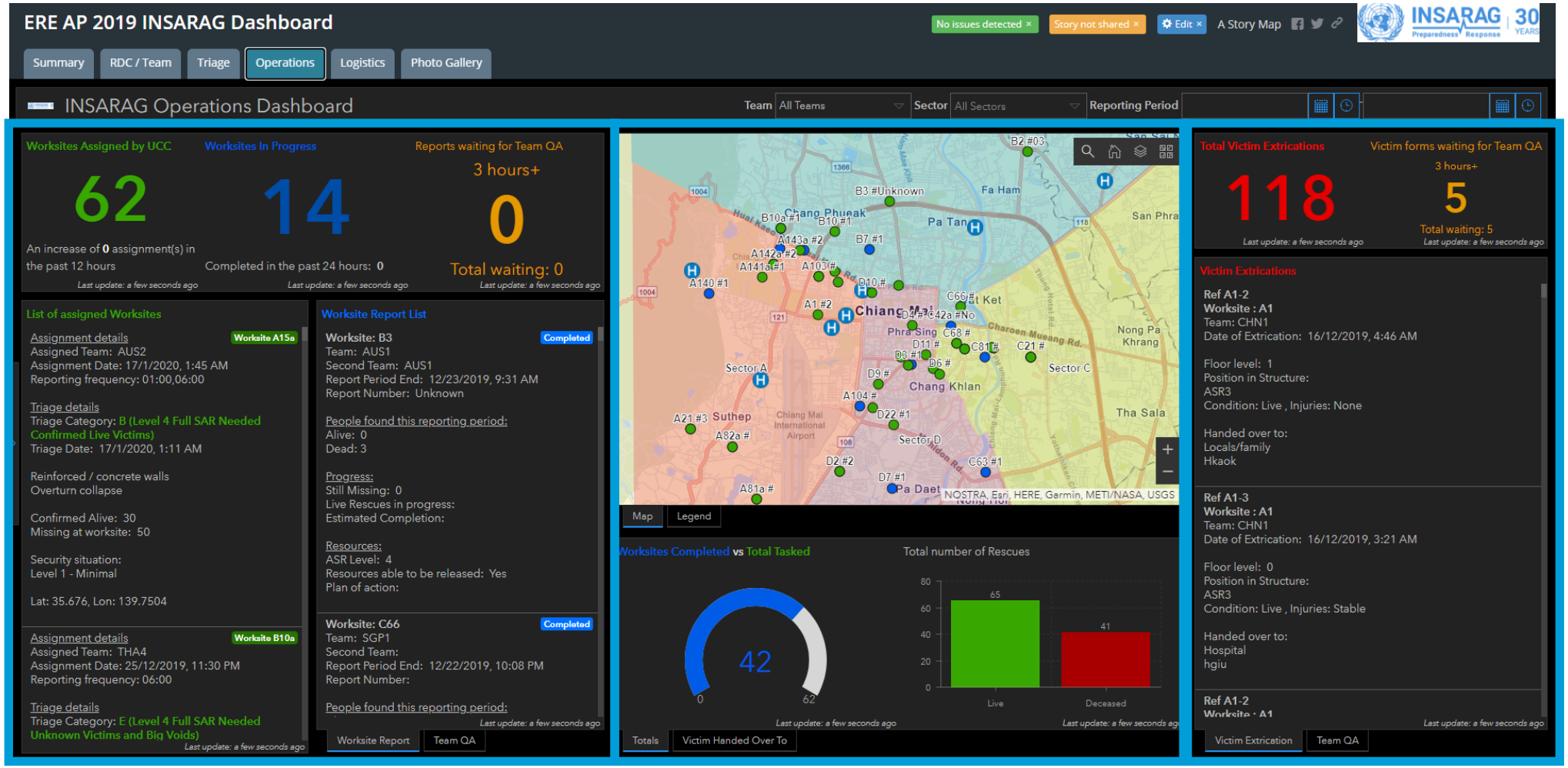
Dashboard – Team Management



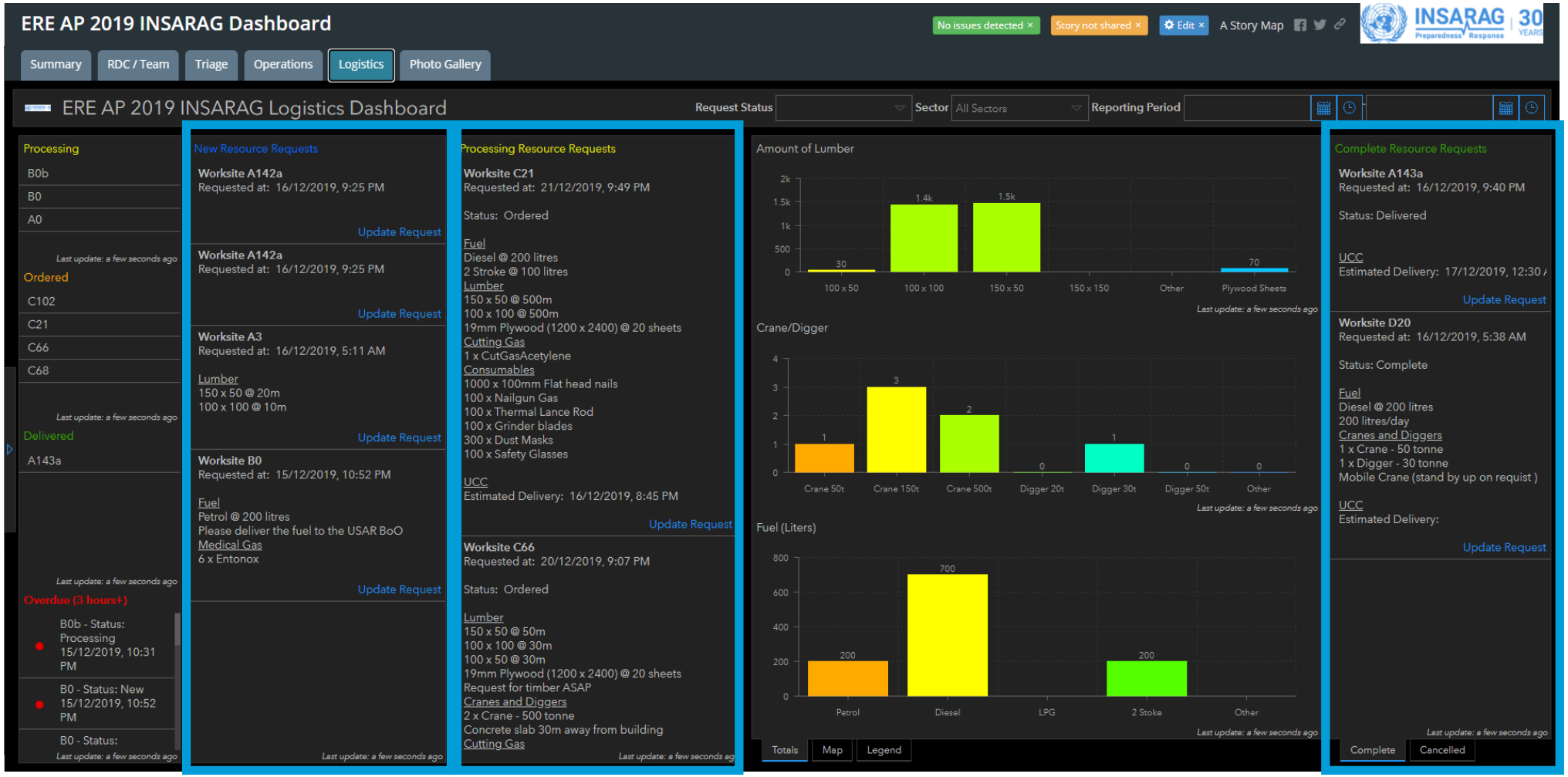
Dashboard – Triage



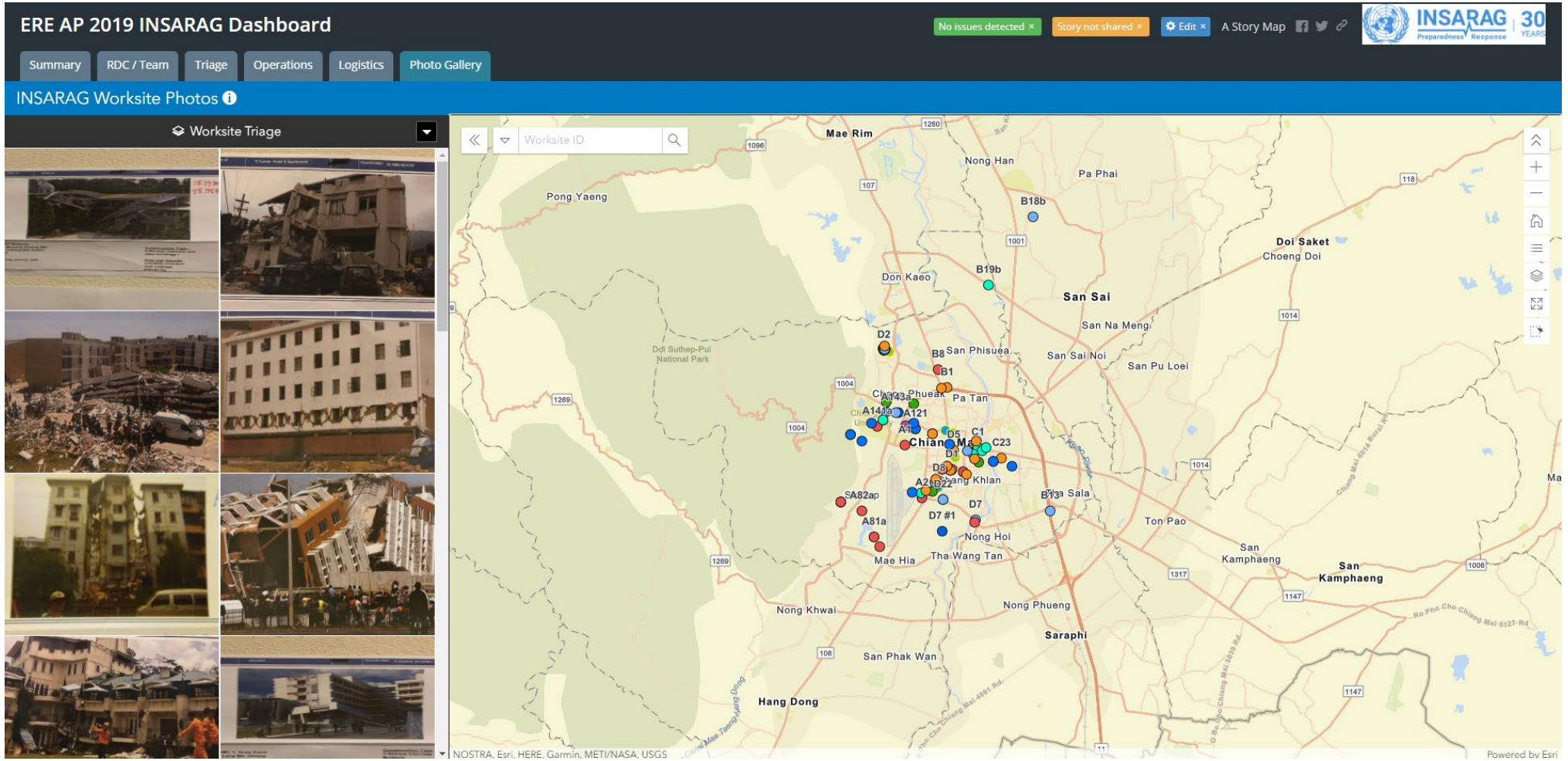
Dashboard – Operations



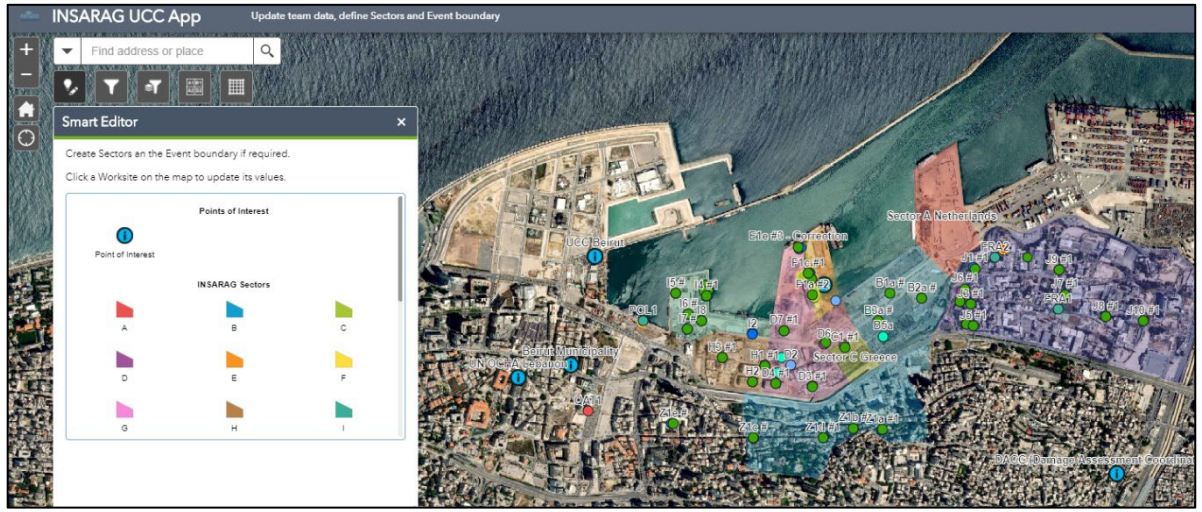
Dashboard – Logistics

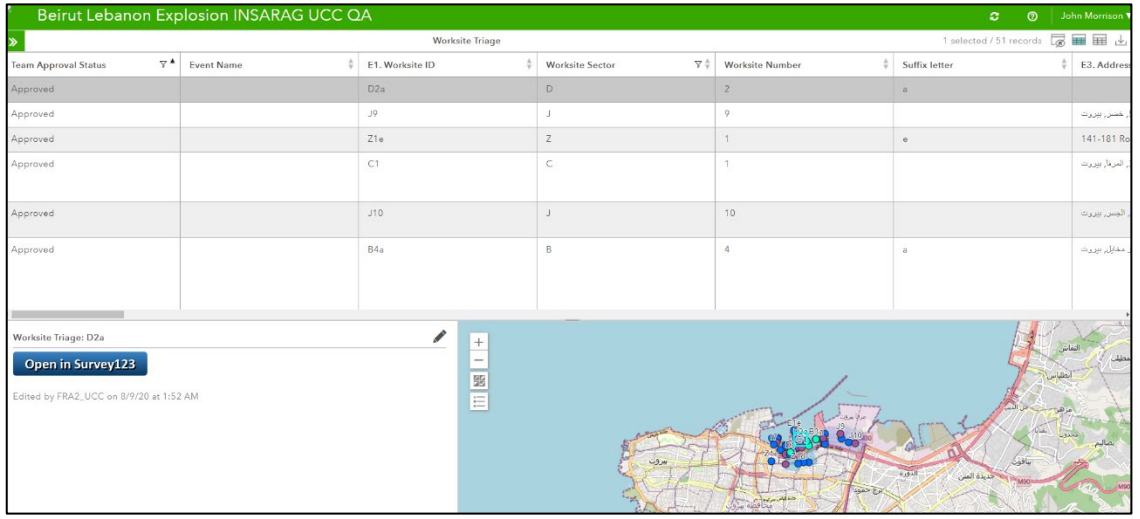


Dashboard – Photo Gallery



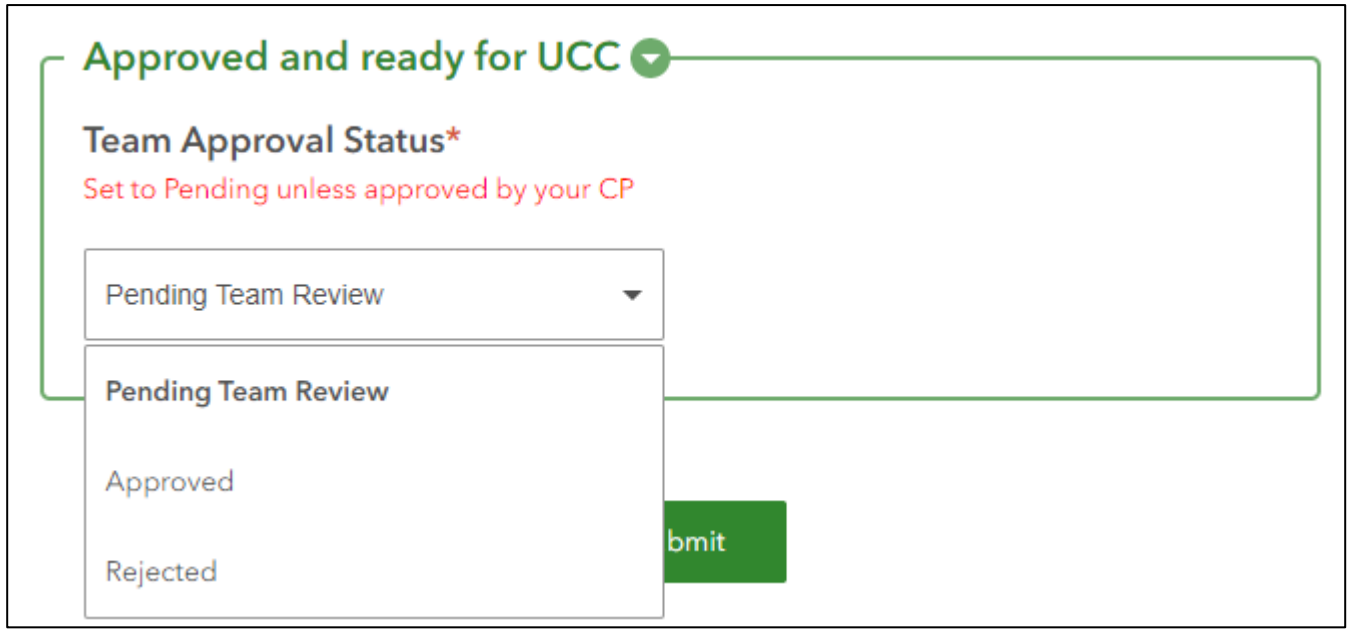
Tools and Quality Assurance

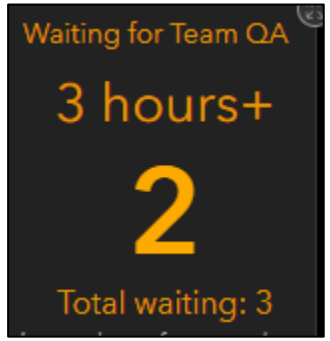




Quality Assurance

"Don't make bad decisions faster"





Iterative Design

Operationalised

Tested within IMWG group teams

Tested at full scale exercise (Tinglev, Denmark – NED1 IER)

Presented to Team Leaders meeting Santiago 2019.

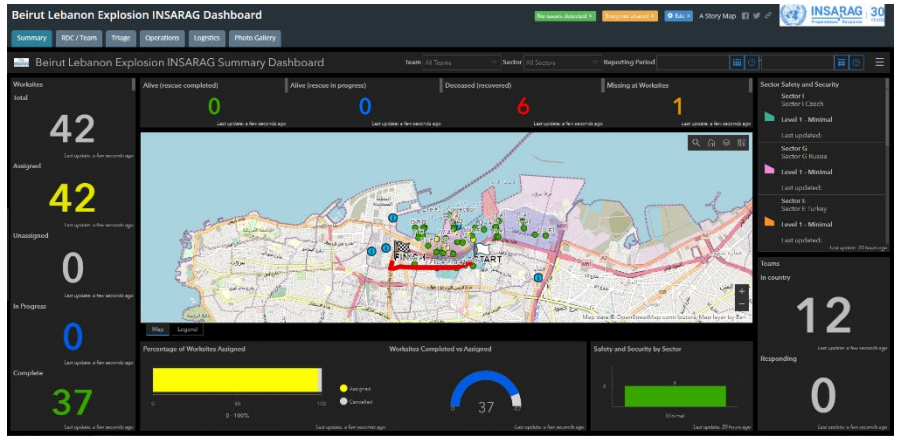
Deployed March 2020

Training (Virtual) 2020-2021

Operational deployments

- Beirut Port Explosion Aug 2020
- Haiti Earthquake 2021

Change management and future enhancements



Where do we go next?

INSARAG
Preparedness Response

UAS Integration

Team-based squad management

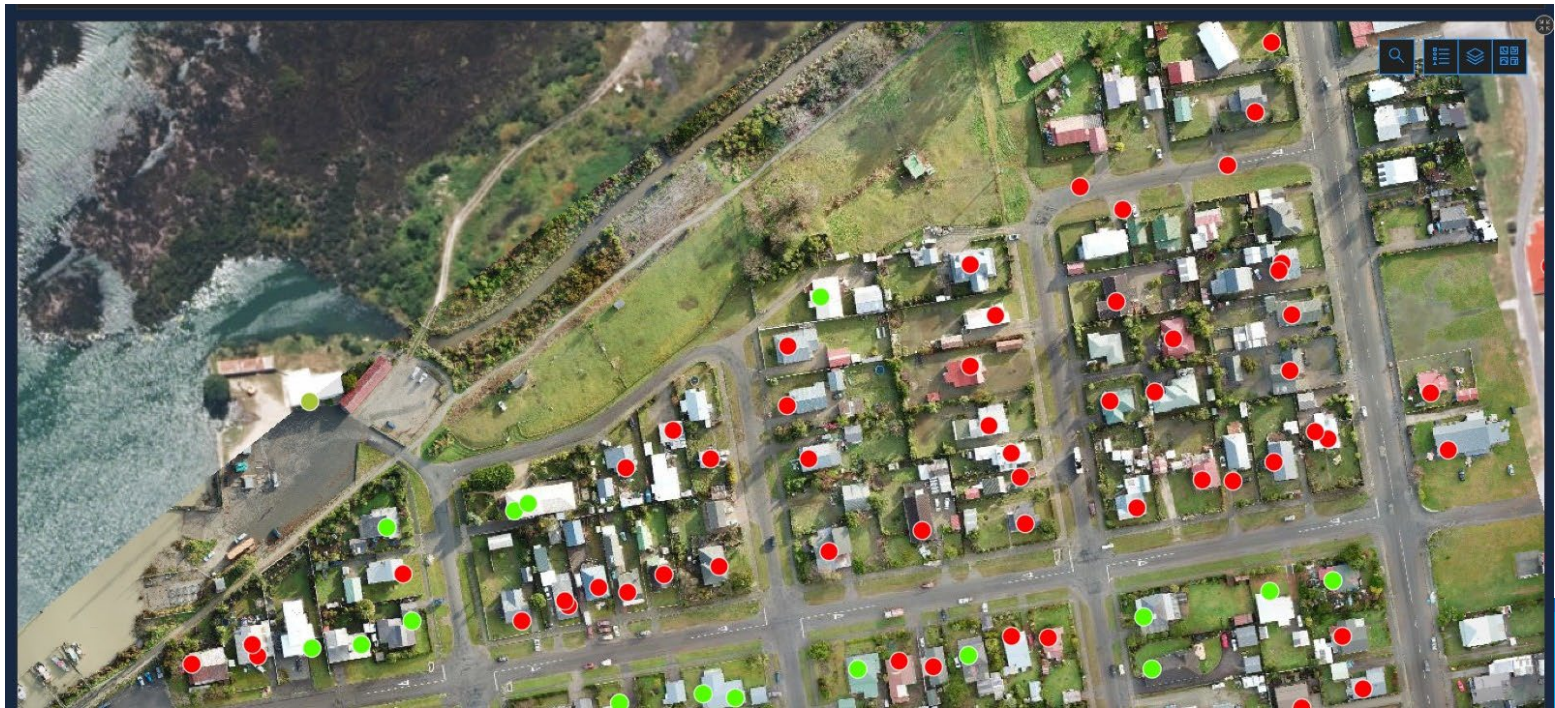
Data sharing across platforms

Flexible response

Flexible Response

Hurricane Dorian

Pacific Cyclones



Contact Information

John Morrison

Fairfax County Fire and Rescue Department

John.Morrison@fairfaxcounty.gov

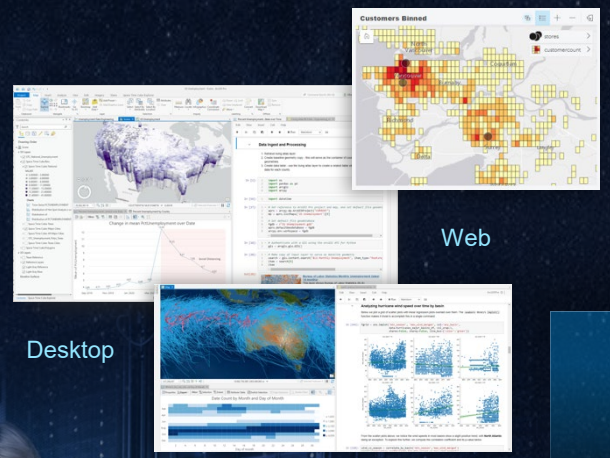
@John_C_Morrison

+1-703-447-9013

TREND 5

Big Data Integration

Offering New Opportunities for GIS Analysis & Insight



Desktop

Web

Web

Desktop

Opening Access
to Massive Data

- Imagery
- Real-Time / IoT
- Unstructured
- Transactional

Advancing
Spatial Data Science

- Query
- GeoVisualization
- Analytics
- Modeling
- GeoAI & ML

Big Data

Data Lakes &
Data Warehouses

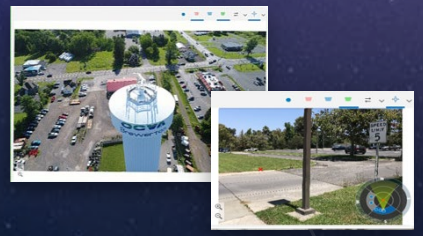
Creating New Forms of Understanding

TREND 6

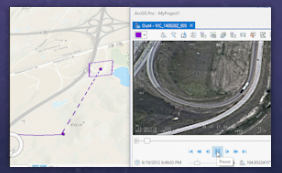
Advances in Imagery and Remote Sensing

Transforming All Aspects of Geospatial Work

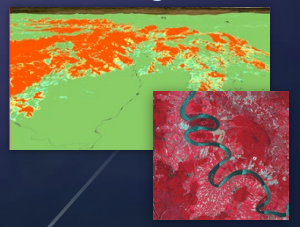
Oriented Imagery



Motion Imagery



Dynamic Image Processing



Point Cloud Visualization

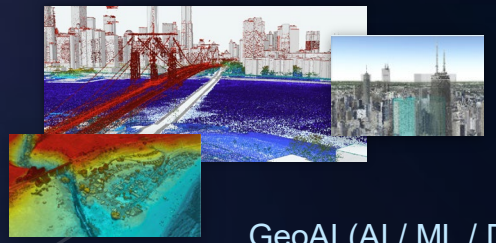
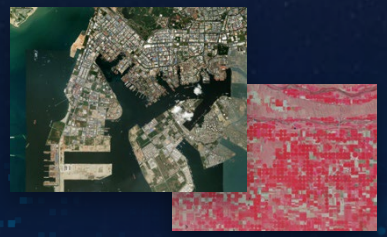
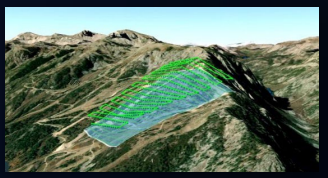


Image Basemaps



GeoAI (AI / ML / DL)

Drone Data Capture



Reality Capture & Digital Photogrammetry

Advancing Geospatial Science

Integrating Massive & Timely Content

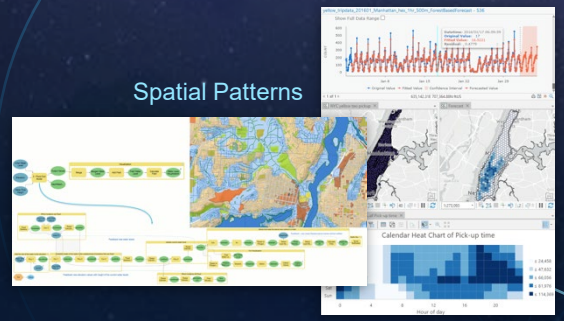
TREND 7

Spatial Analytics Are Advancing

Creating New Insights and Understanding

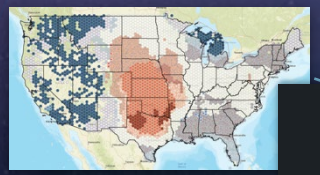
Predictive Modeling

Spatial Patterns



Trends

Spatiotemporal

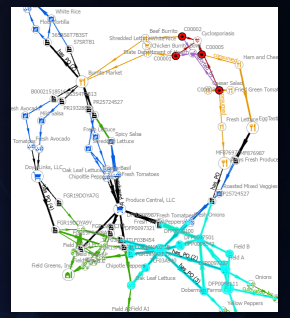


Hot Spot / Cold Spot

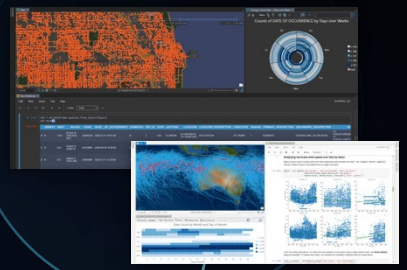
Data Cube

Interactive Visual Analytics

Graph Analytics



Big Data

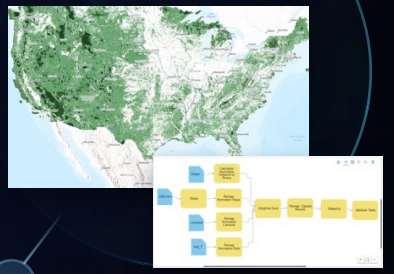


Real-Time

GeoAI & ML

Raster Analytics & Modeling

(In the Cloud)



. . . Bring It Together

Leveraging Many Technical and Scientific Innovations

Rami Alouta

Esri, Nonprofits and Global Organizations

TREND 8

3D Digital Twins and Immersive Experiences

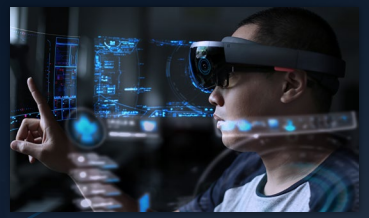
Integrating All Types of Information

Reality Capture

3D System of Record

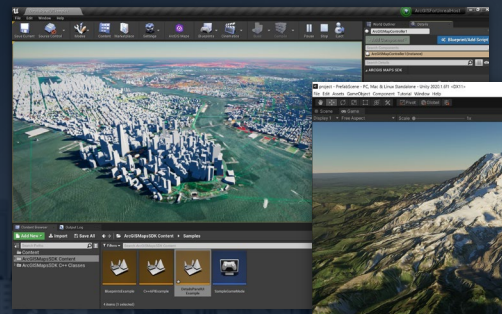
Real-Time Sensors

Digital Twin



Headsets

Game Engine Integration



Mixed Reality

Tabletop AR

Real-Time and Interactive . . .
. . . Transforming How We See, Understand and Act

TREND 9

Geospatial Capabilities Are Becoming Embedded

Geo-Enabling Enterprise Workflows of All Types

Data

Maps

Analytics

Adobe

Salesforce

Amazon

SAS

IBM

MicroStrategy

Microsoft

Autodesk

SAP

Engineering

ERP

Graphic Design

Work Management

Analytics

CRM

Facility Management

Knowledge Workers

Power BI

Office

SAS Viya

Civil 3D

Integrating Geographic Thinking . . .

. . . Empowering Non-GIS Professionals from Across the Organization

TREND 10

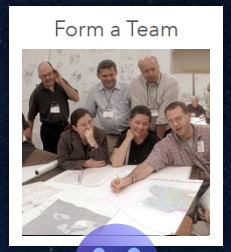
GIS Hubs Are Bringing Communities Together

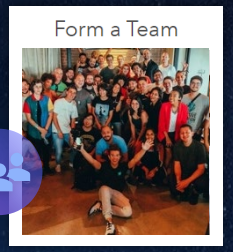
Organizing Information, Initiatives, Teams & Activities

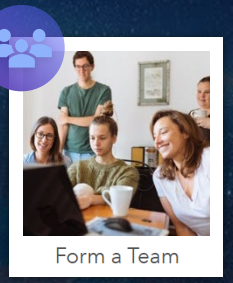
Organizers

Initiative Websites

Communities







Volunteers
(Individuals)

Cleanup
Neighborhood Watch
Emergency Response
Tree Planting
Crowdsourcing
Surveys
"Adopt - A"

Professionals
(Organizations)

Planning
Emergency Response
Data Collection
Agency Collaboration
Census
Regional Initiatives

Fostering Many Forms of GeoCollaboration . . .

Rui Kotani

Group on Earth Observations (GEO)

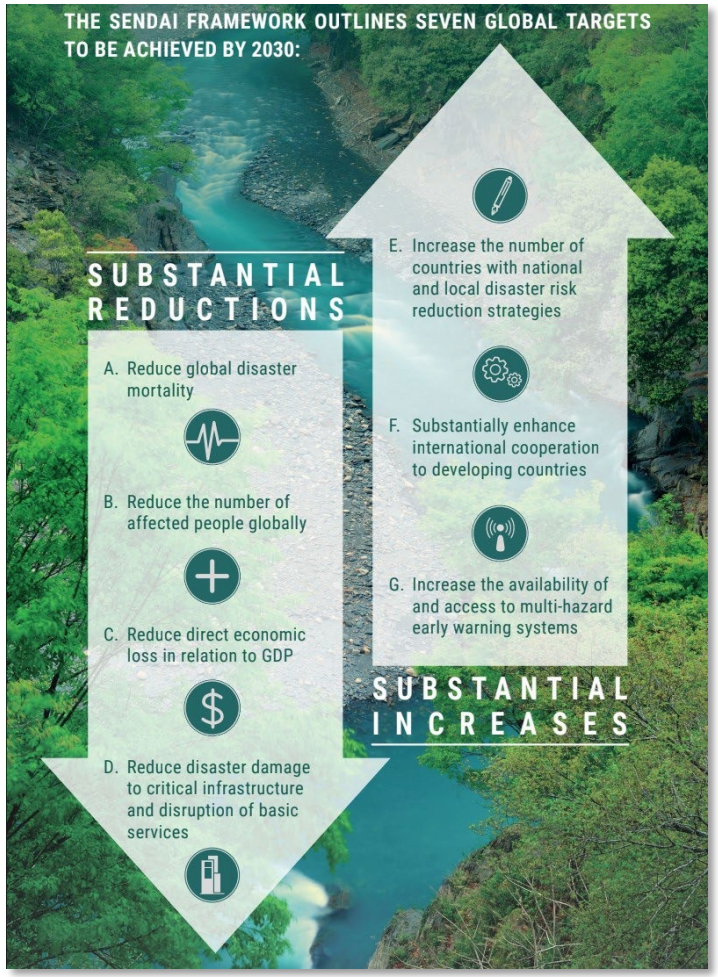
GROUP ON EARTH OBSERVATIONS

Development of the Earth Observations Risk Toolkit

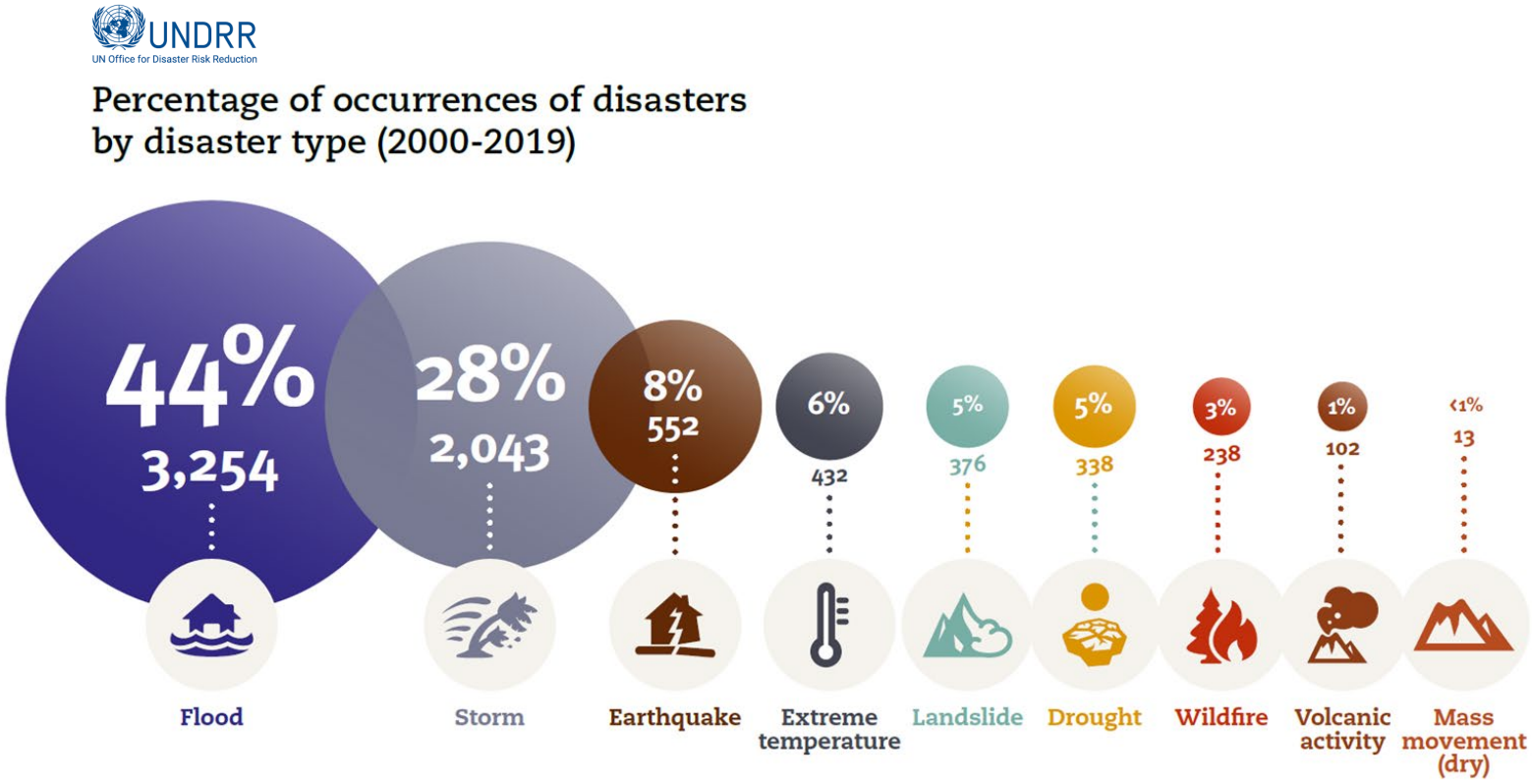
GIS for Sustainable World Conference
11 May 2022

Rui Kotani,
Disaster Risk Reduction Coordinator
GEO Secretariat

Sendai Framework for Disaster Risk Reduction 2015-2030



Promote and increase use of Earth observations to address disaster risk reduction efforts and achieve Global Targets.



Credit: Human Cost of Disasters, UNDRR

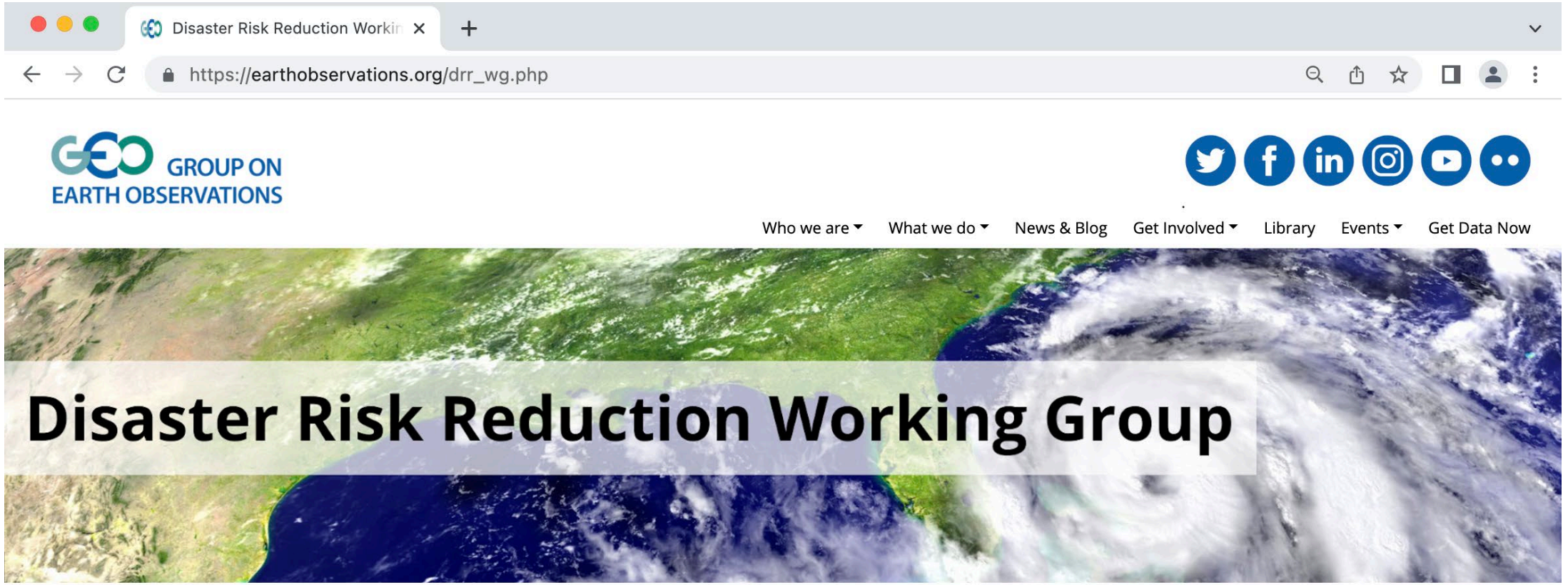
Group on Earth Observations (GEO)

Participating Organization

UNDRR
UN Office for Disaster Risk Reduction

Associate

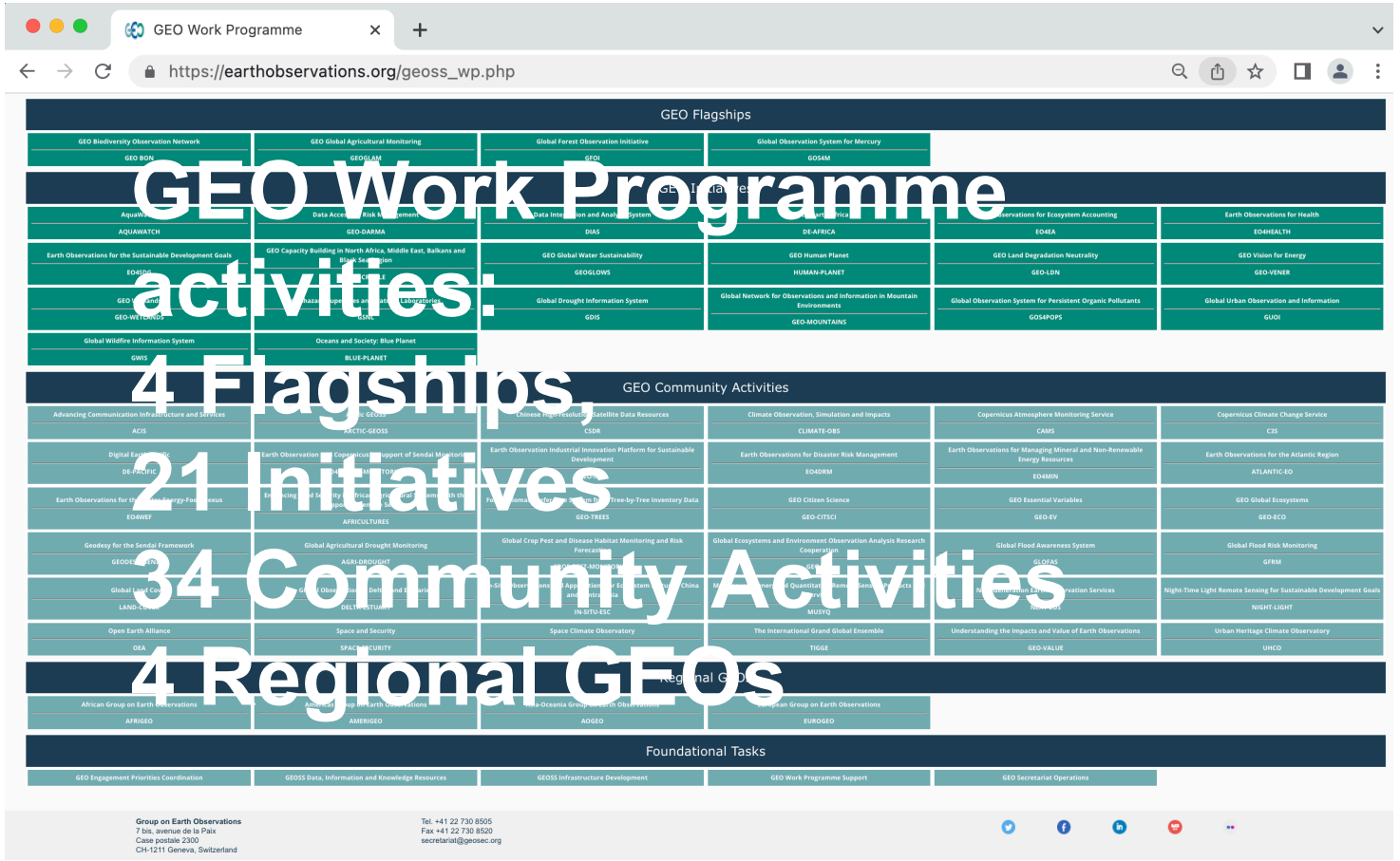
esri



- Serves as primary GEO liaison to **UNDRR**
- Approximately **100 members**, nominated by the Principal of their relevant GEO Member or Participating Organization

GEO Disaster Risk Reduction Working Group

Established to develop and implement a **coherent and cross-cutting approach within GEO** to advance the use of EO in support of national DRR and resilience strategies, policies, and programmes



GEO Work Programme activities:

4 Flagships

21 Initiatives

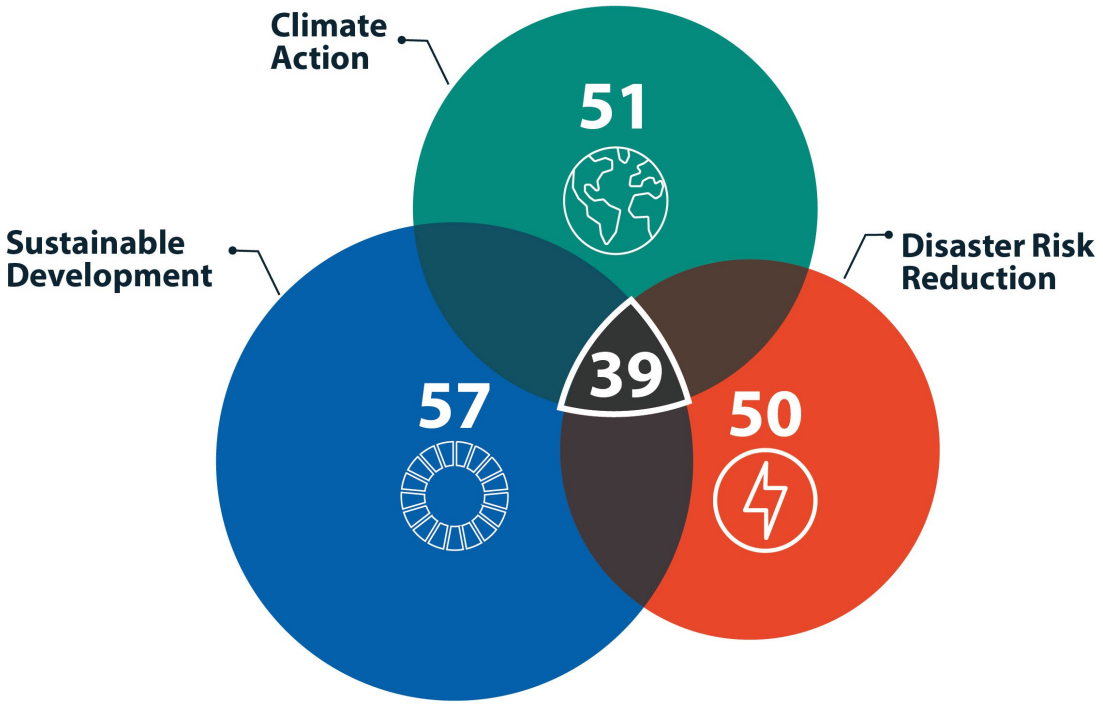
34 Community Activities

4 Regional GEOs

GEO Disaster Risk Reduction Working Group

Coordinates DRR-related activities across the GEO Work Programme in coordination with the GEO Secretariat and works to improve the GEO community's ability to reduce existing risk and avoid the creation of new risk, ultimately supporting countries to embark on risk and climate resilient development pathways

GWP activities supporting global policy drivers



Source: GEO Virtual Symposium: Session on Improving Policy Relevance and Delivery of the Next GWP (May 5, 2022)

GEO Disaster Risk Reduction Working Group

Sub-group 1
Led by **David Borges**
NASA

Overall coordination of EO Risk Toolkit

Sub-group 2
led by **Nathaniel Newlands**
Agriculture and Agri-Food Canada and Statistics Canada

Sub-group 3
Led by **Kene Onukwube**
DEAR Africa

Content development

SG1: GEO Work Programme Coordination

SG1 aims to develop and implement a coherent and crosscutting approach within GEO to advance the use of EO to support countries' disaster risk reduction and resilience efforts. SG1 works closely with SG2 and SG3 to understand real requirements at the national level and communicate these requirements to relevant activities within the GWP while:

- Highlighting aspects of the GWP related to DRR , and describe key elements and locations of each activity *(Task 1.1: Development of Joint Engagement Mapping Exercise and dashboard);*
- Promoting sharing of data and knowledge to improve DRR, including through good practices and impact *(Task 1.2: Development of EO Risk Toolkit and GAR Contributing Papers); and*
- Promoting awareness of relevant global policy frameworks across the GWP, such as UN-GGIM WG-Disasters Strategic Framework on Geospatial Information and Services *(Task 1.3: Outreach and engagement events/meetings).*

SG2: UNDRR Coordination for Sendai Framework Priorities

SG2 leverages the efforts of SG1 and uses the combined resources of SG2 to promote the dissemination and use of EO to strengthen disaster risk reduction capabilities according to country needs as identified by UNDRR. Serving as primary GEO liaison to UNDRR, SG2 works towards:

- Increasing the use of EO data for local and national DRR strategies (*Task 2.1: Assessment of EO descriptions in DRR strategies of GEO member countries*); *(Task 2.2: Policy briefs and use cases on the use EO to create disaster loss data for DRR strategies and for reporting on the Sendai Monitor Global Indicators [via EO4Sendai-Monitoring]); (Task 2.3: Development and implementation of EO-leveraged data collection tools to visualize vulnerability and exposure to be used in DRR strategies);*
- Increasing the use of GNSS-enhanced EO data through consortia *(Task 2.4: GAR Contribution Paper, policy briefs and new partnerships with ITU [via GEODESY4Sendai])*; and
- Increasing the use of EO data to show trends over time and hot spots while predicting and analyzing future risks *(Task 2.5: Use cases and workshops [via GSNL])).*

SG3: Climate Change and SDG Coordination

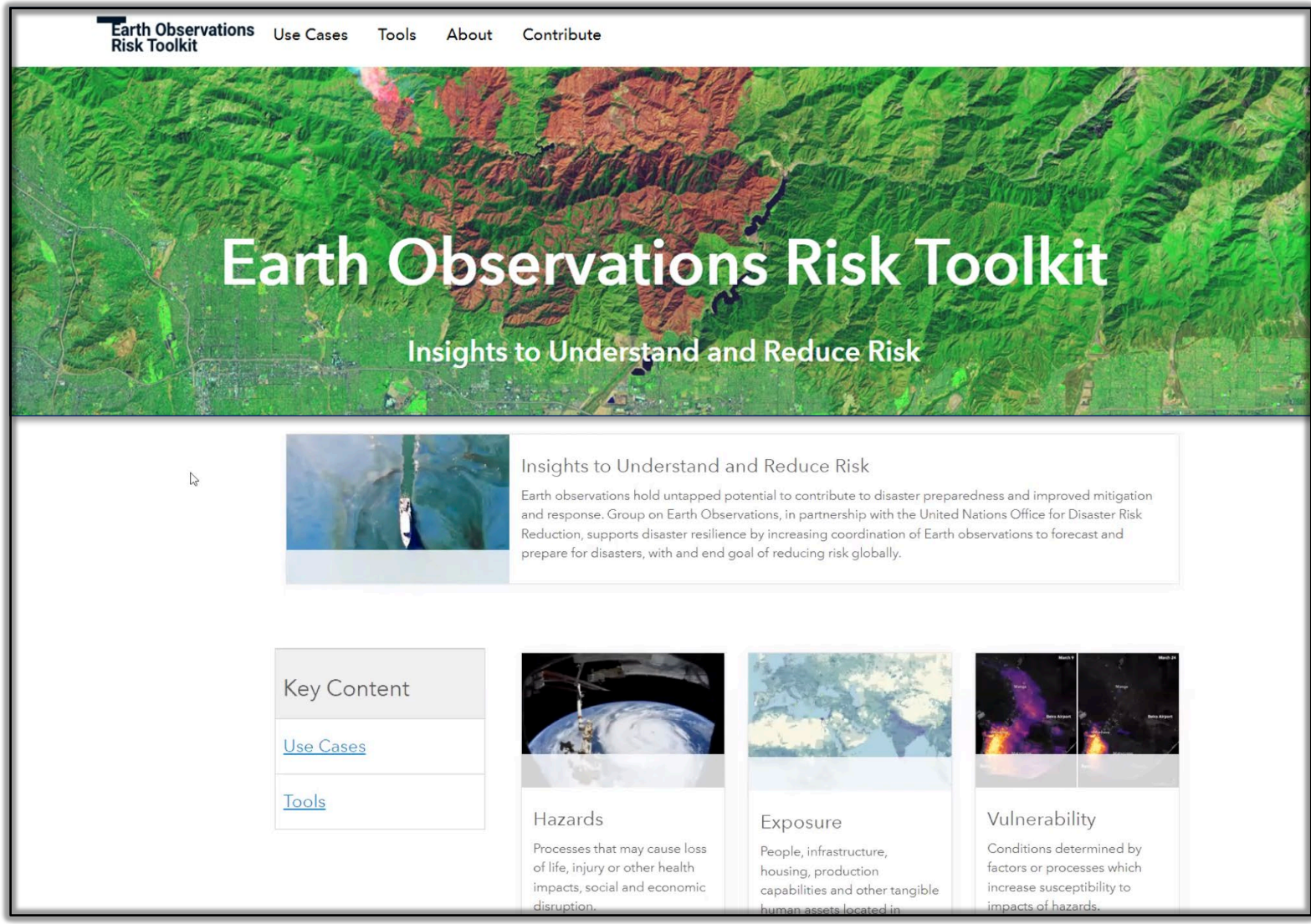
SG3 leverages SG1 efforts to provide an overview of links, and actionable opportunities, between disaster risk reduction, climate change, SDGs, and urban activities. Serve as primary link to CC-WG, SDG and Urban related activities, SG3 is working on:

- Developing EO-links between DRR, Climate Change and SDGs, notably for adaptation, early warning and resilience (*Task 3.1: Policy briefs on EO use in handling various types of natural hazards, such as landslides, wildfire and snow melt*) (*Task 3.2: Compendium with collection of texts and references on EO's role in SDG targets and indicators in relation to the SFDRR and the Paris Agreement [in collaboration with HPI, EO4SDG etc.]*).

Source: GEO Week Side Event: Sneak Preview of EO Risk Toolkit (Nov 25 & 26, 2021)

Earth Observations Risk Toolkit (beta)

- By GEO DRR-WG in collaboration with UNDRR and Esri
- Will provide DRR users with access to open source **EO tools** and **services** to fill knowledge gaps on hazards, vulnerabilities and exposure at country level
- Will be launched on **May 25** at the 7th Session of the Global Platform for DRR 2022

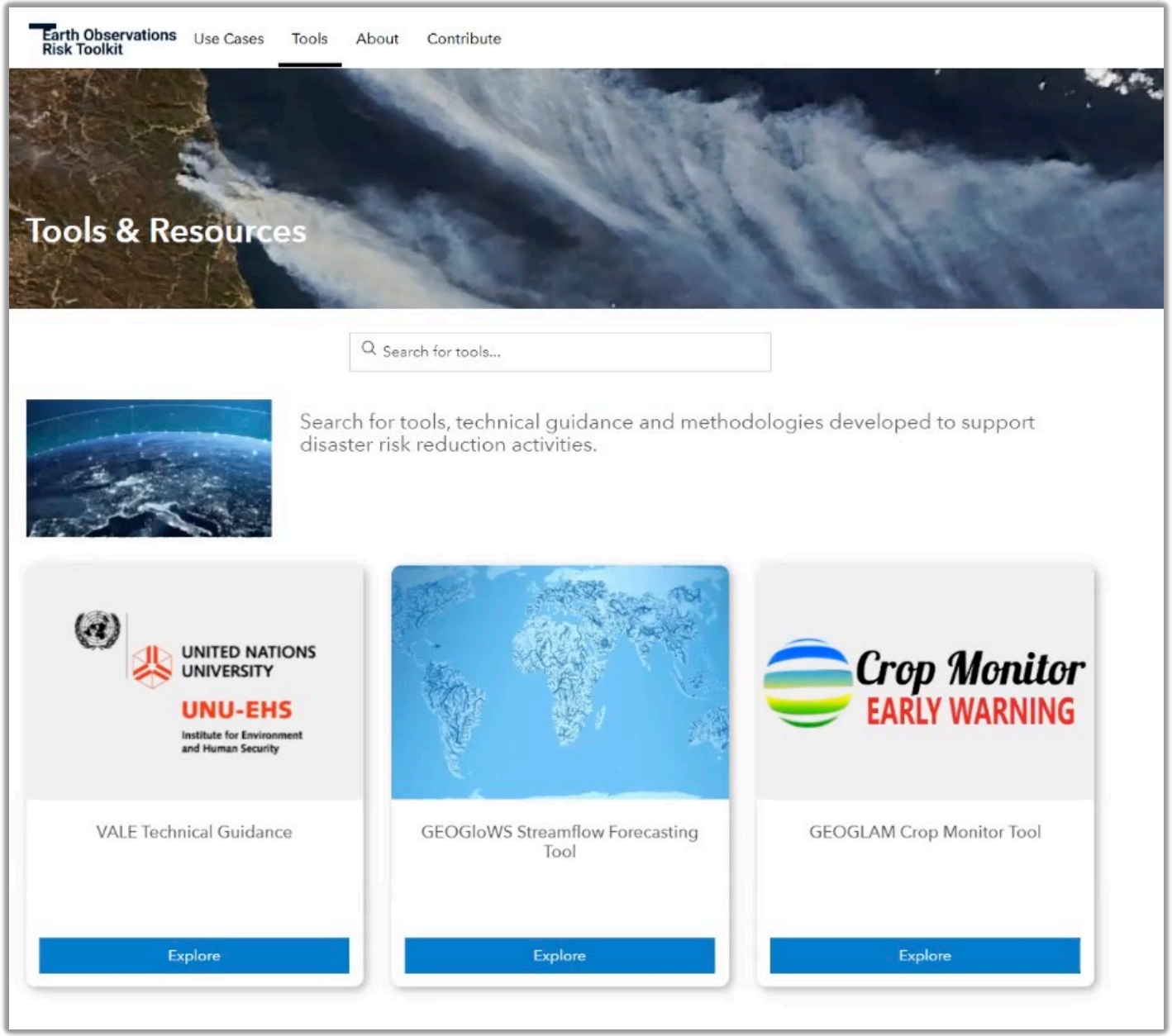


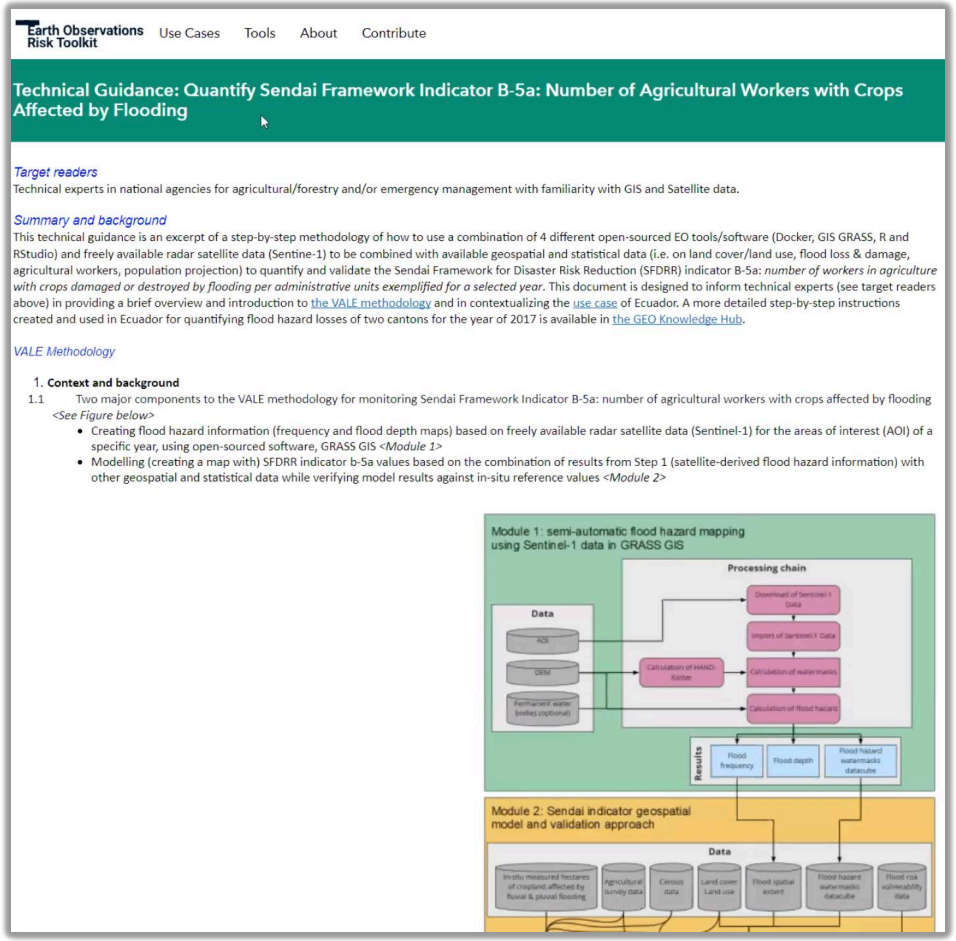
Note: these images are drafts and the webpages may look difference after launching of the batá version

Alignment with UNDRR GRAF team

- UNDRR flagship initiative Global Risk Assessment Framework (GRAF) and its Risk Information Exchange (RiX)
- GRAF pays attention to interconnected and systemic risk
- GRAF aims to help **UN partners** and pilot **countries** (Least Developed Countries and Small Island Developing States that are prone to repeated loss and damage from disasters) better collect, access and apply multidimensional risk **data** and **analysis**

Risk Information Exchange





Contents of the toolkit will provide government decision makers with a concise summary of **EO tools and services** in addressing natural hazards that could cause disasters and **options** to deal with it.

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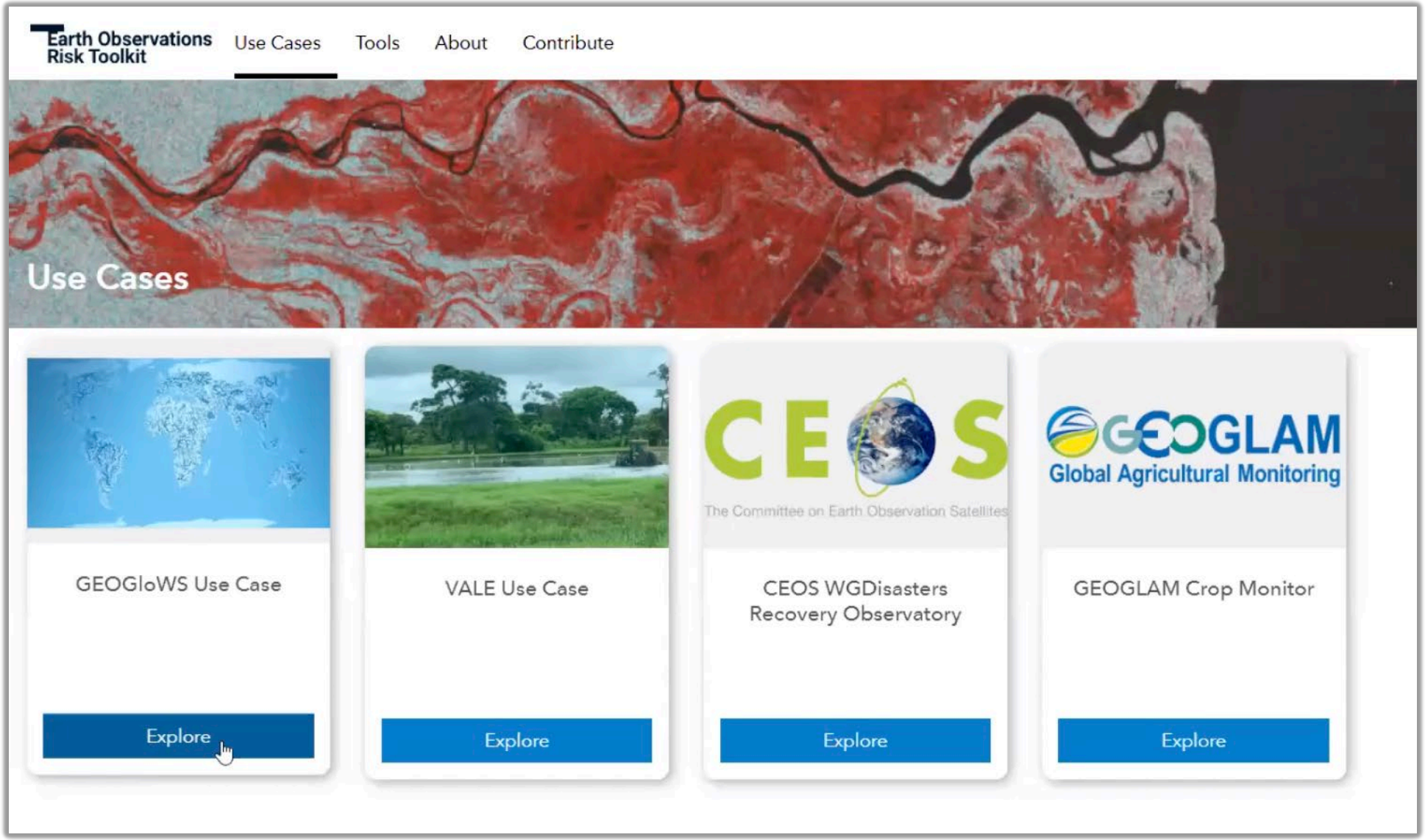

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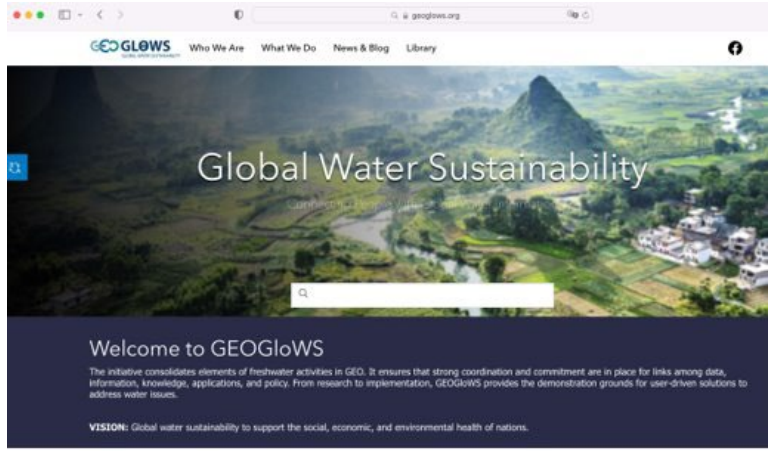
Toolkit Use Case Example:

GEO GLOWS
GLOBAL WATER SUSTAINABILITY

- An activity of the GEO Work Programme
- International voluntary mechanism
- Providing coordination, data, knowledge and services across diverse freshwater activities in GEO



Source: GEO Virtual Symposium: Session on Addressing Systemic Risk in Jamaica (May 4, 2022)

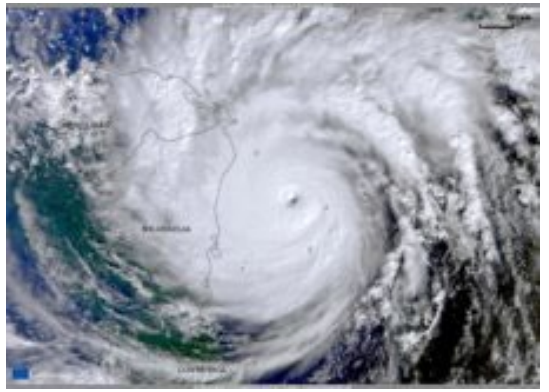
Toolkit Use Case Example:

GEO GLOWS
GLOBAL WATER SUSTAINABILITY

- Tool: a precipitation/flood forecasting EO tool called GEOGloWS-ECMWF Streamflow Forecast service
- User: Honduras' state-owned power company (ENEE)

GOBIERNO DE LA REPÚBLICA DE HONDURAS
EMPRESA NACIONAL DE ENERGÍA ELÉCTRICA ENEE

- Location: Sula Valley
- Hazards: Hurricane Iota (Category 5) after Hurricane Eta (November 16, 2020)
- Use: for controlled water discharges from a reservoir between two major hurricanes



Source: Copernicus (Nov 17, 2020)

Source: Dinero HN (Nov 5, 2020)

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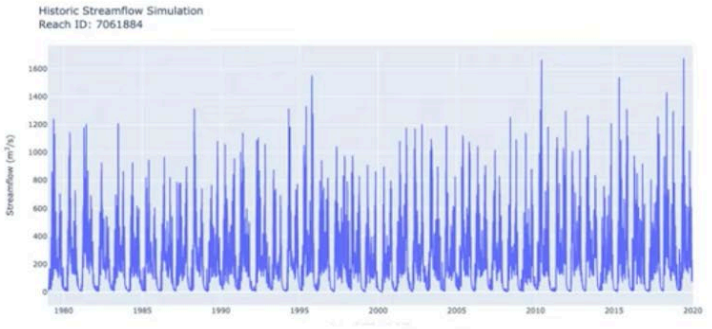
Source: GEO Virtual Symposium: Session on Addressing Systemic Risk in Jamaica (May 4, 2022)

Toolkit Use Case Example:

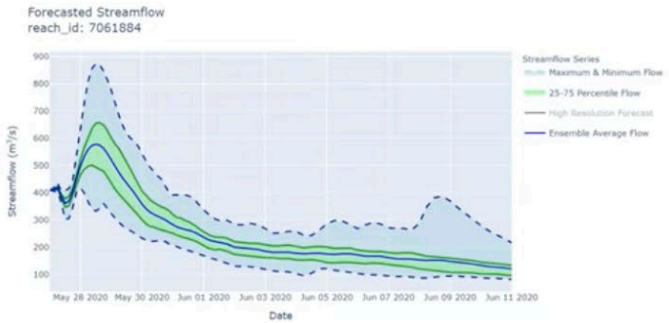
Tool: GEOGloWS Hydroviewer

- Part of the GEOGloWS ECMWF Streamflow Forecast service
- Web app can create:

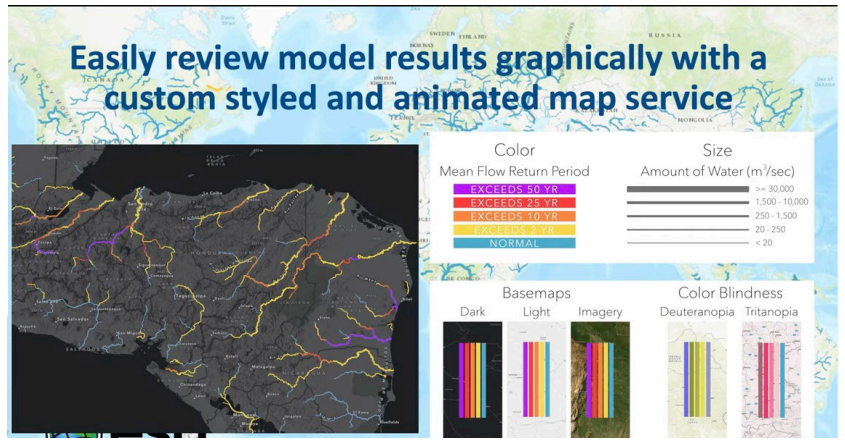
✓ subsets of river flow data for download (out of every river in the world)
✓ daily 15-day ensemble forecasts
✓ 40+ year historical simulation
✓ custom styled and animated mapping of river flows



Hindcast (1980-Present)



Forecast (Ensemble, 15 days)



https://apps.geoglows.org/apps/geoglows-hydroviewer/

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Source: GEO Virtual Symposium: Session on Addressing Systemic Risk in Jamaica (May 4, 2022)

Toolkit Use Case Example:

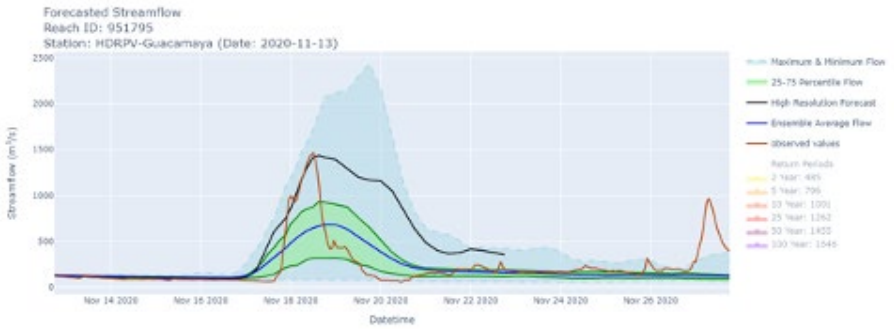
GEO GLOWS
GLOBAL WATER SUSTAINABILITY

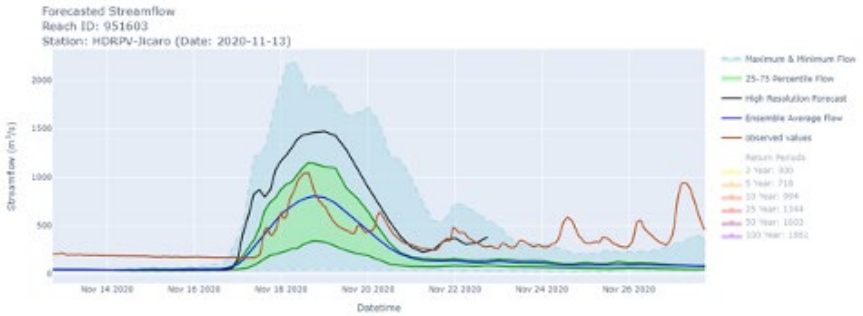
How ENEE used the tool:

- Projected the potential water levels of the reservoir to assess the necessity for controlled discharges
- Made a series of low water releases of reservoir water in the El Cajón Dam towards the Sula Valley
- Continuously monitored and validated the forecast in real-time as the hurricane hit the land
- Provided information to disaster organizations

COPECO HONDURAS

CENEPRED





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Toolkit Use Case Example:

GEO GLOWS
GLOBAL WATER SUSTAINABILITY

Damage to Sula Valley significantly reduced:

$3,794 m

Hurricane Mitch (Category 5) in 1998

economic loss

>

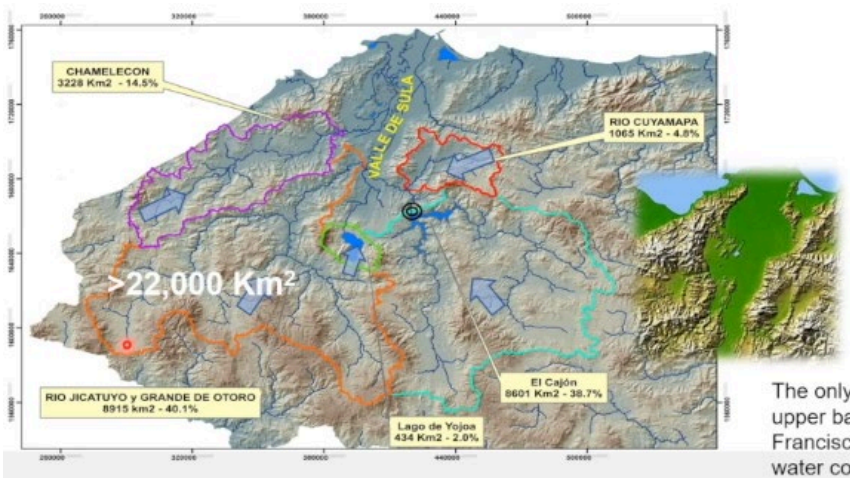
- 40%

$2,171 m

Hurricanes Eta & Iota

Note:

- ✓ Sula Valley: Honduras most vulnerable area
- ✓ El Cajón Dam: the only structure in place capable of controlling the massive volume of runoff (39% of total water discharge) to the Sula Valley



The valley receives water discharges from 4 rivers

The only major river control structure in the upper basin is the Central Hidroeléctrica Francisco Morazán, with about 39% of the water contribution to the valley.

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Source: GEO Virtual Symposium: Session on Addressing Systemic Risk in Jamaica (May 4, 2022)

Thank You

Communicate and Collaborate with GEO:

Rui Kotani
@GEOSEC2025 / rkotani@geosec.org

#EO4Impact

Our Agenda Today

Wednesday, May 11th

- 11:00am – 11:15am: Networking Break in Expo
- 11:15am – 12:30pm: Training Sessions
- 12:30pm – 1:30pm: Hosted Lunch in Expo
- 1:30pm – 2:30pm: Anticipatory Action Lightning Talks & Panel
- 2:30pm – 3:00pm: Networking Break in Expo
- 3:00pm – 4:15pm: Localization Lightning Talks & Panel
- 4:15pm – 5:15pm: Closing Social in Expo

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