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Flood Forecasting and Early Warning

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Outline

- **What is USAID/OFDA ?**
- **Why does USAID/OFDA support flood early warning systems?**
- **Our approach to flood early warning**
- **Examples of our activities related to floods**



USAID Office of U.S. Foreign Disaster Assistance (OFDA)



SAVE LIVES



ALLEVIATE SUFFERING

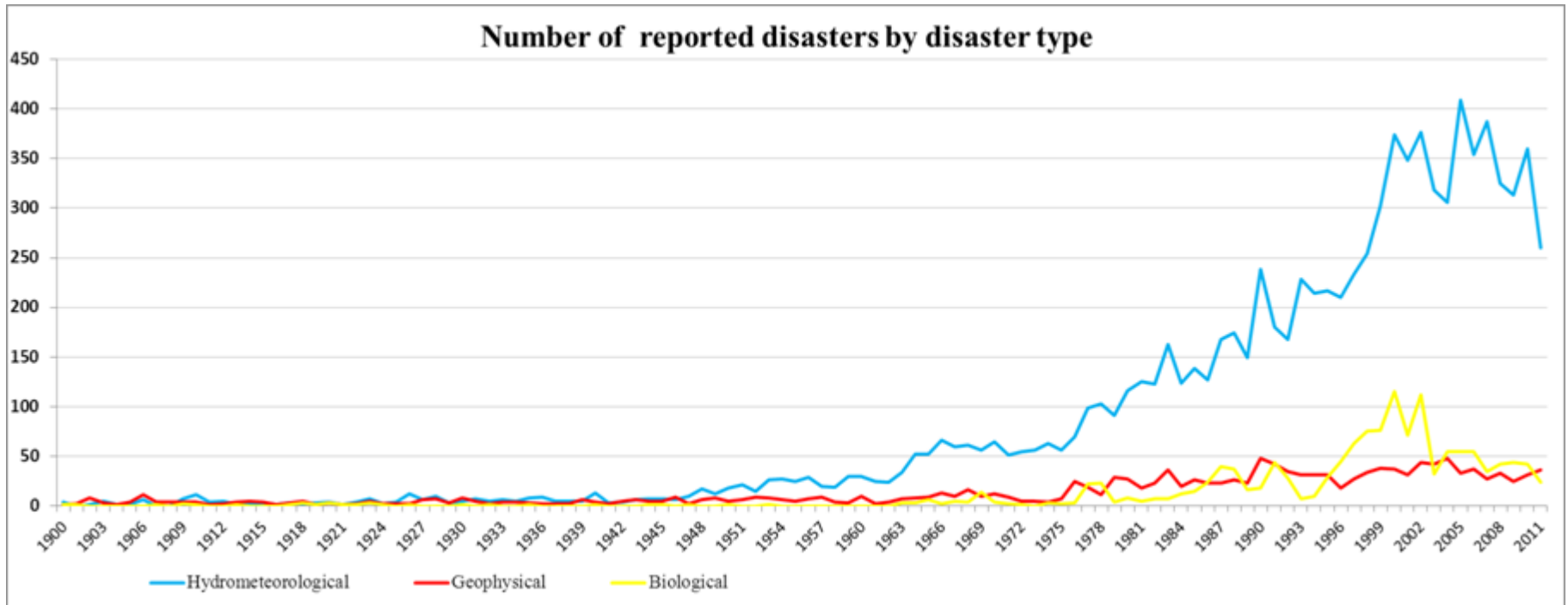


REDUCE THE SOCIAL AND ECONOMIC IMPACT OF DISASTERS



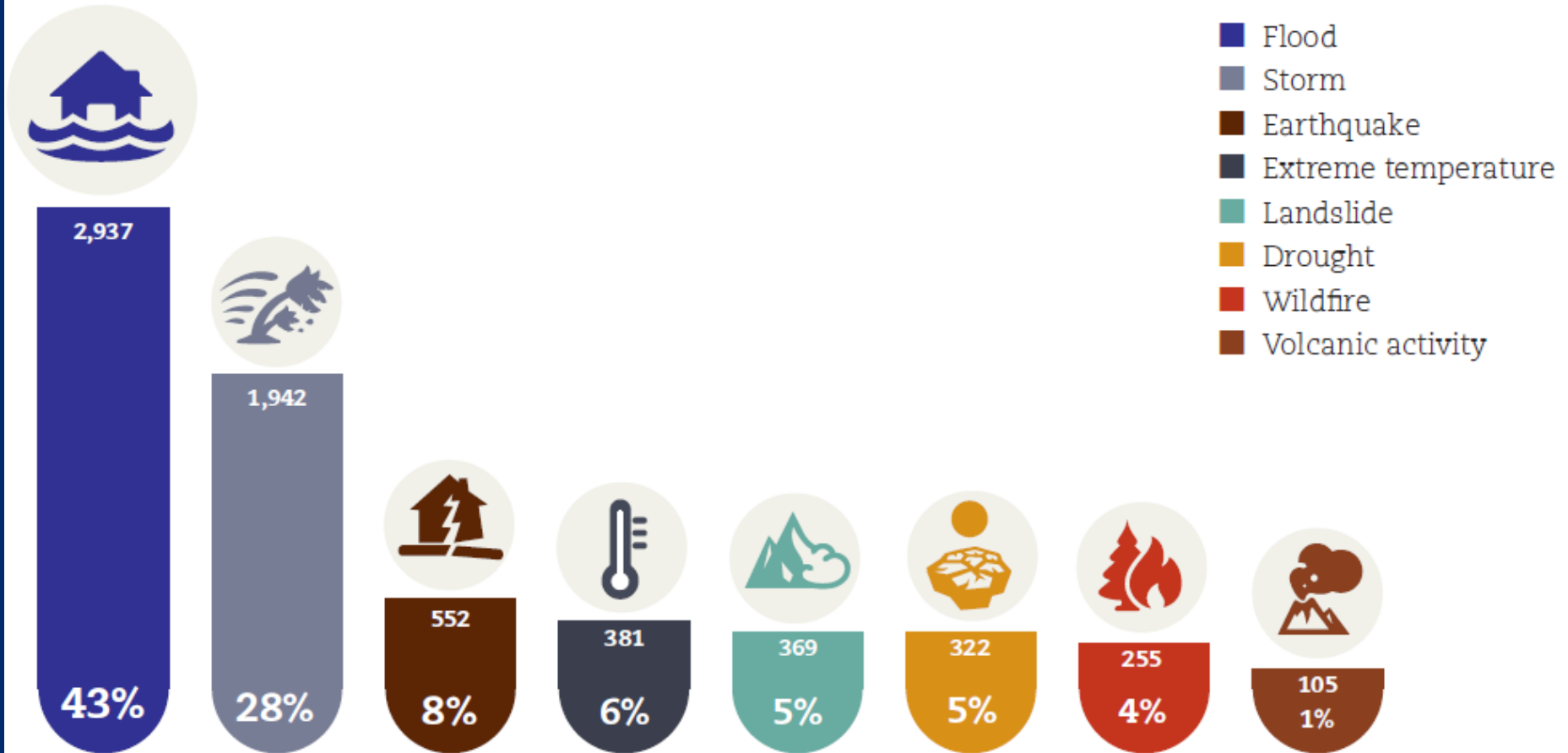
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Number of Natural Disasters



Source: OFDA/CRED

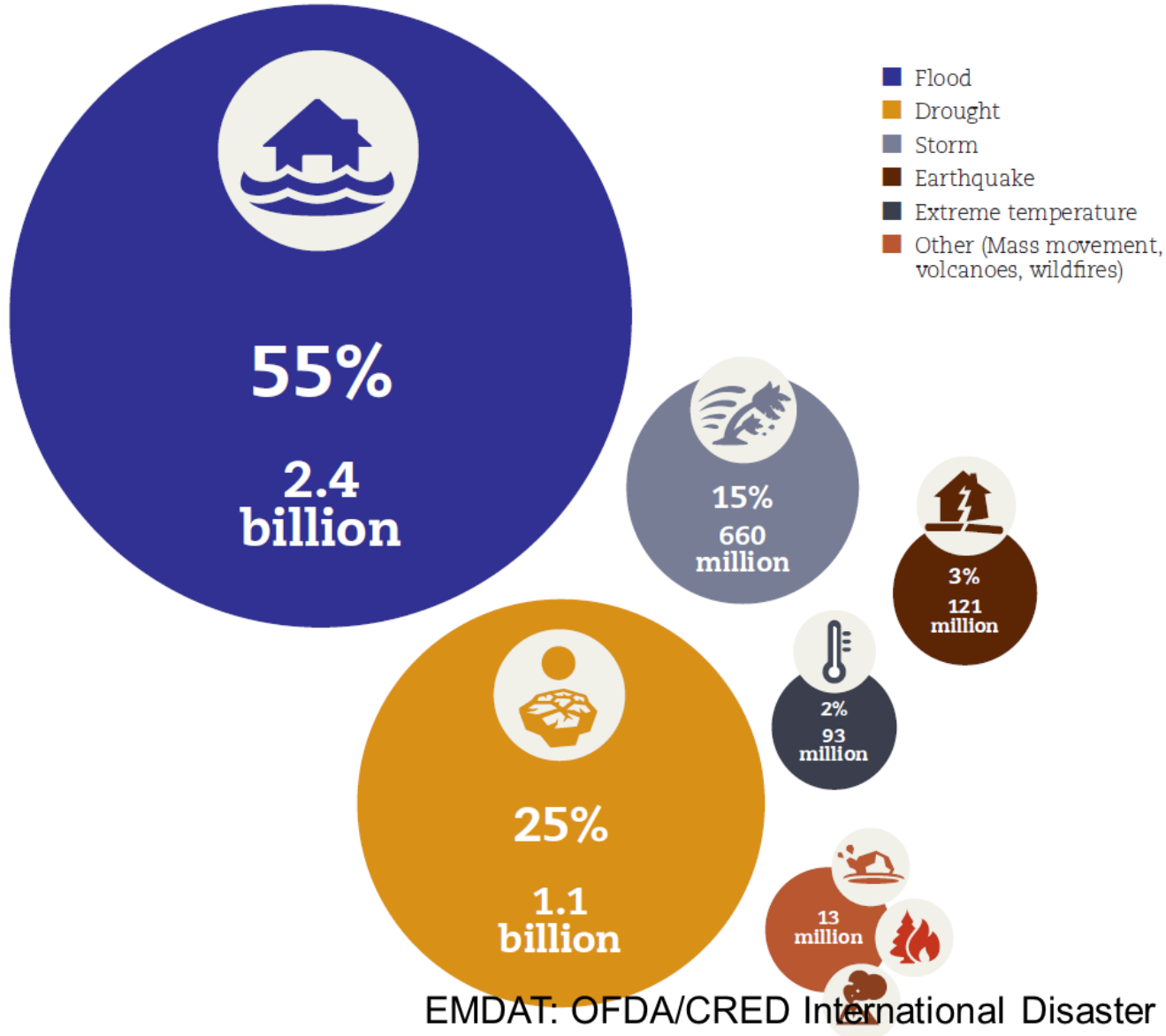
Natural Disasters Type 1994-2013





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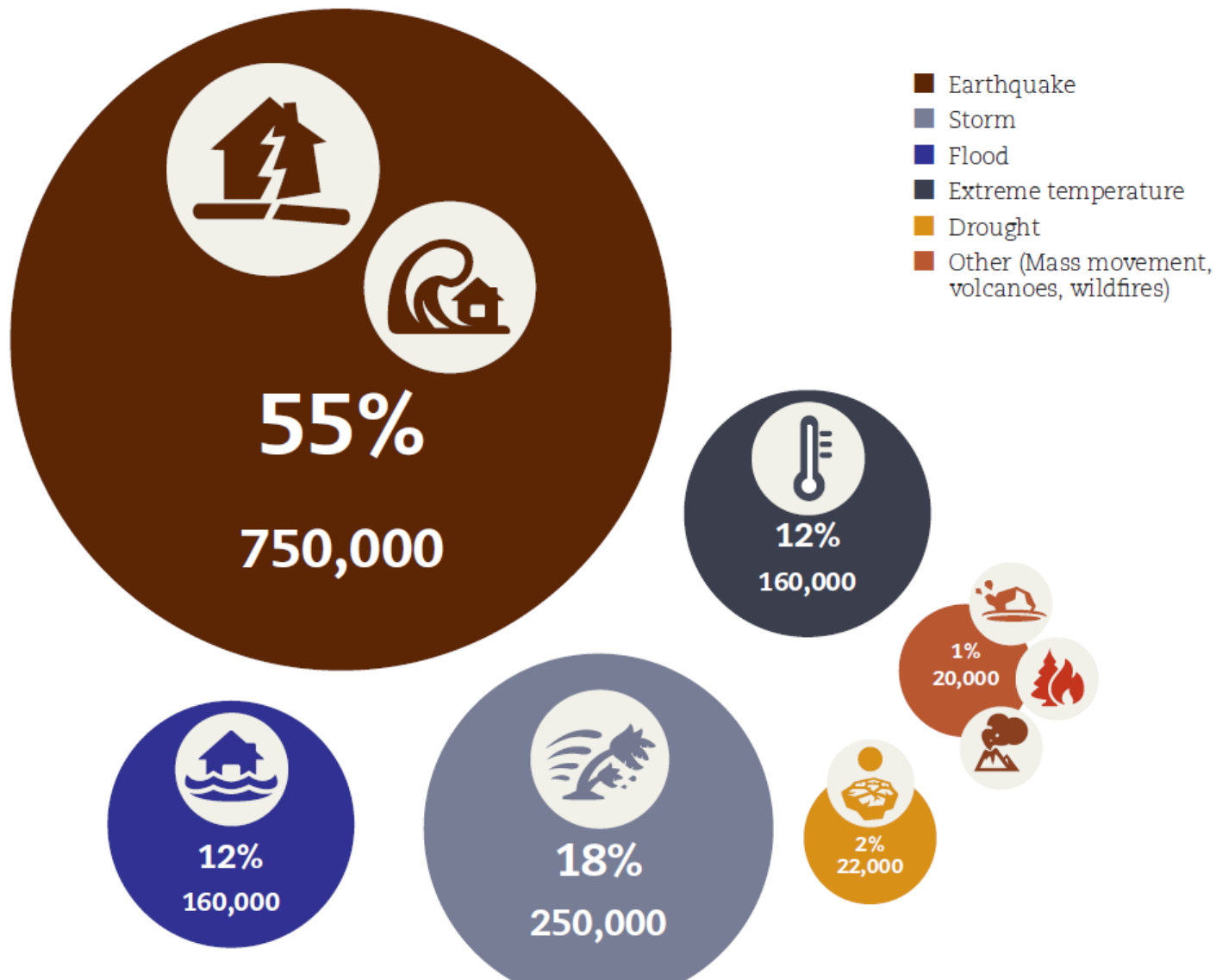
Natural Disasters Total Affected, 1994-2013





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Natural Disasters Total Deaths, 1994-2013



How does an End to End Hydro meteorological Early Warning System Work?

An end to end early warning system consists of a warning and response system made up of many interconnected components. When successful, an end to end hydrometeorological early warning system reduces the impact of hydrometeorological events by providing timely, accurate information that gives sufficient lead-time to prepare for and efficiently respond to extreme events. Investment in user knowledge, capacity of forecasters, and close coordination of all sectors and levels of government are essential to the success of early warning systems.



1 Monitoring and Collection of Data

Satellite, radar, and ground observation networks are used to monitor and collect data on extreme hydrometeorological events.



2 Center

Collected data is then sent to a central location for quality control, archiving, and analysis.



3 Meteorological and Hydrological Forecast

From this data, forecasts are produced that detail rainfall, temperature, snowfall, and streamflow.



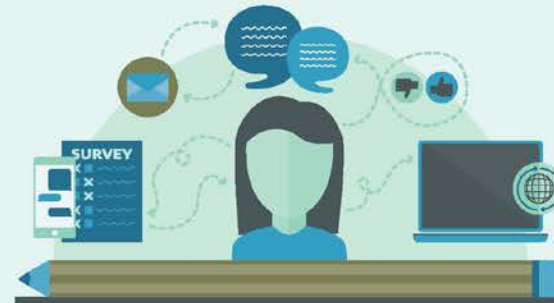
4 Warning Generation and Dissemination

Forecasts are then used to disseminate warnings to public and at-risk populations. Warnings must be provided in a format users can easily understand.



5 Action

Decision makers and the public must monitor hazards, develop protocols for warning, plan for extreme events, and develop policies for disaster management.



6 Feedback

User feedback is encouraged to periodically improve and address the needs of decision makers.



LEAD TIME:

An early warning system should provide timely, accurate information to give sufficient lead time to prepare for and respond to hydrometeorological events



INTERCONNECTIVITY IS KEY:

Each component in this process is essential and failure of any of these components will lead to failure of the entire system.



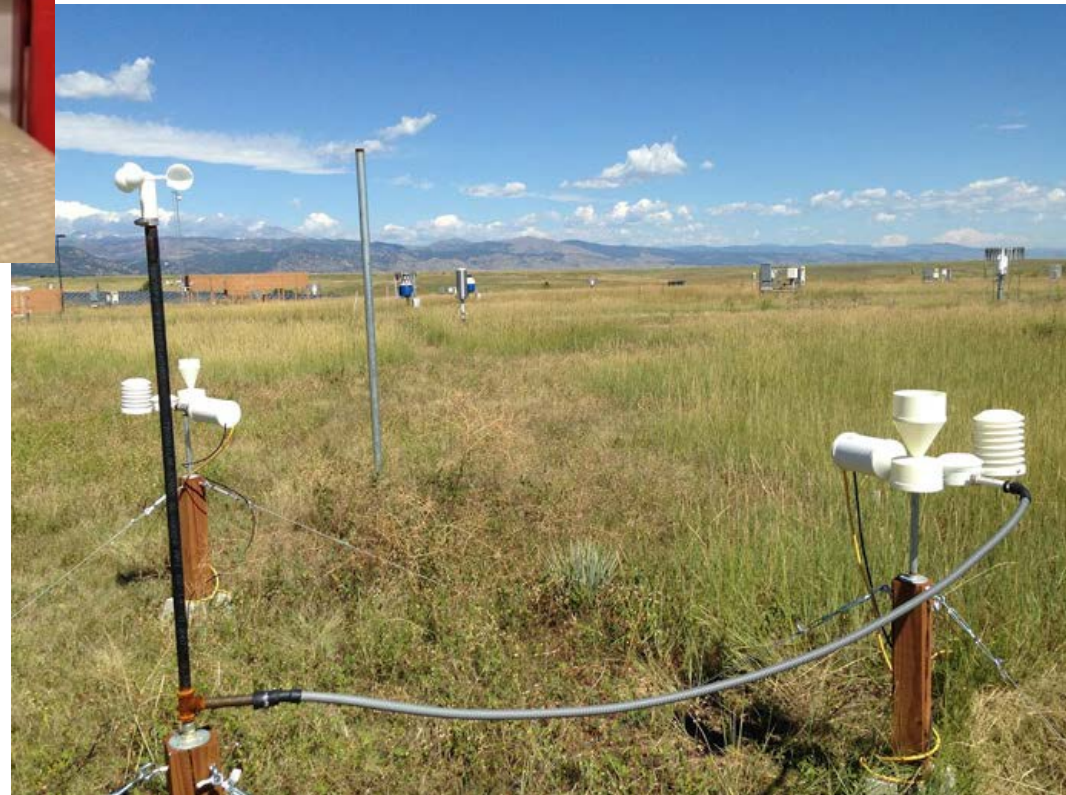
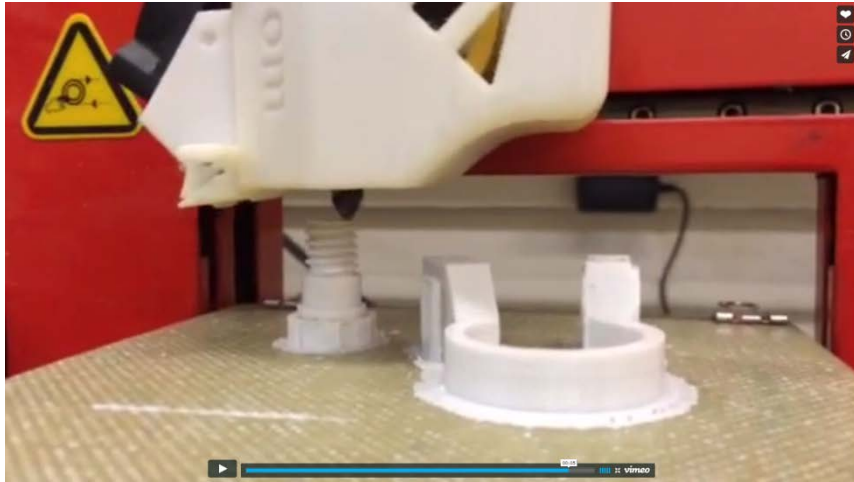
400%

increase in the number of weather, water and climate disasters over the past 25 years.



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Observations 3D-Printed Meteorological Network





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Addressing Flash Floods Globally

Flash Floods have the highest mortality rate globally

- **Among the top weather-related hazards**

... **BUT there are no discernible trends for loss reduction**

- **No flash flood warnings for vast populated areas of the world**
- **Transboundary nature**
- **Lack of local capacity and of regional cooperation**
- **Limited in situ data in small regions**
- **Large-river flood-warning strategies ineffective for flash floods**





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South East Europe Flash Flood Guidance

SEFFG - Southeast Europe Flash Flood Guidance System

Current Date: **2017-06-14 17:36 UTC** Nav Date: **2017-06-14 16:00 UTC**
 Year: Month: Day: Hour: REGION:

DT	MWGHE Precipitation	GHE Precipitation	Gauge MAP	Merged MAP	ASM	FFG	IFFT	PFFT	ALADIN Forecast	FMAP	FFFT
01-hr	 2017-06-14 16:00 UTC Text view	 2017-06-14 16:00 UTC Text view		 2017-06-14 16:00 UTC Text view		 2017-06-14 12:00 UTC Text view	 2017-06-14 13:00 UTC Text view	 2017-06-14 12:00 UTC Text view	 2017-06-14 16:00 UTC	 2017-06-14 16:00 UTC Text view	 2017-06-14 12:00 UTC Text view
03-hr	 2017-06-14 16:00 UTC Text view	 2017-06-14 16:00 UTC Text view		 2017-06-14 16:00 UTC Text view		 2017-06-14 12:00 UTC Text view	 2017-06-14 15:00 UTC Text view	 2017-06-14 12:00 UTC Text view	 2017-06-14 16:00 UTC	 2017-06-14 16:00 UTC Text view	 2017-06-14 12:00 UTC Text view
06-hr	 2017-06-14 16:00 UTC Text view	 2017-06-14 16:00 UTC Text view	 2017-06-14 12:00 UTC Text view	 2017-06-14 16:00 UTC Text view	 2017-06-14 12:00 UTC Text view	 2017-06-14 12:00 UTC Text view	 2017-06-14 12:00 UTC Text view	 2017-06-14 12:00 UTC Text view	 2017-06-14 16:00 UTC	 2017-06-14 16:00 UTC Text view	 2017-06-14 12:00 UTC Text view
24-hr	 2017-06-14 16:00 UTC Text view	 2017-06-14 16:00 UTC Text view	 2017-06-14 12:00 UTC Text view	 2017-06-14 16:00 UTC Text view					 2017-06-14 16:00 UTC	 2017-06-14 16:00 UTC Text view	

Composite Product: [text](#), [CSV](#), [CSV1](#)

SFTP data transfer (requires SFTP Client): [EXPORTS_REGIONAL_2017-06-14](#)

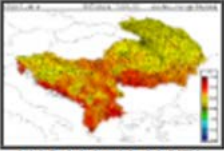
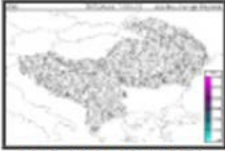

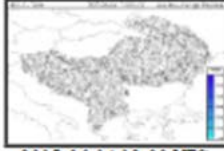
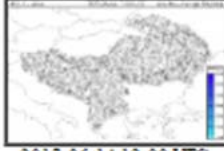
Surfmet Gauge Observations at 2017-06-14 12:00 UTC

Station Identifier	Station Name	Accumulated Precipitation (mm 06hr)	Average Temperature (C)	Snow Depth (cm)	Snow Cover (Index)	Region	Latitude	Longitude	Elevation	Enable Precipitation Flag	Enable Temperature Flag
11001	Wblfegg	0.00	16.90	No Report	No Report	Southeast Europe Regional	48.1	13.603333333	634	Enabled	Enabled
11008	Rohrbach	0.00	21.10	No Report	No Report	Southeast Europe Regional	48.566666666	14	602	Enabled	Enabled
11010	Linz/ Hoersching-Flughafen	0.00	21.85	No Report	No Report	Southeast Europe Regional	48.233333333	14.183333333	298	Enabled	Enabled
11012	Kremsmuenster	0.00	21.20	No Report	No Report	Southeast Europe Regional	48.05	14.133333333	383	Enabled	Enabled
11016	Amsterten	Reported Missing	23.10	No Report	No Report	Southeast Europe Regional	48.116666666	14.866666666	274	Enabled	Enabled
11018	Allentsteg	0.00	19.50	No Report	No Report	Southeast Europe Regional	48.603333333	15.366666666	598	Enabled	Enabled
11020	Zweistl	0.00	20.15	No Report	No Report	Southeast Europe Regional	48.816666666	15.2	506	Enabled	Enabled
11021	Litschan	0.00	19.55	No Report	No Report	Southeast Europe Regional	48.946666666	15.033333333	564	Enabled	Enabled
11022	Retz	0.00	21.45	No Report	No Report	Southeast Europe Regional	48.766666666	15.95	256	Enabled	Enabled



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SEE FFGS Snowpack

Snowpack Products				
DT	Gauge MAT	Latest IMS SCA	SWE	Melt
06-hr	 2017-06-14 12:00 UTC Text: view		 2017-06-14 12:00 UTC Text: view	
24-hr		 2017-06-14 00:00 UTC Text: view		 2017-06-14 12:00 UTC Text: view
4-day				 2017-06-14 12:00 UTC Text: view



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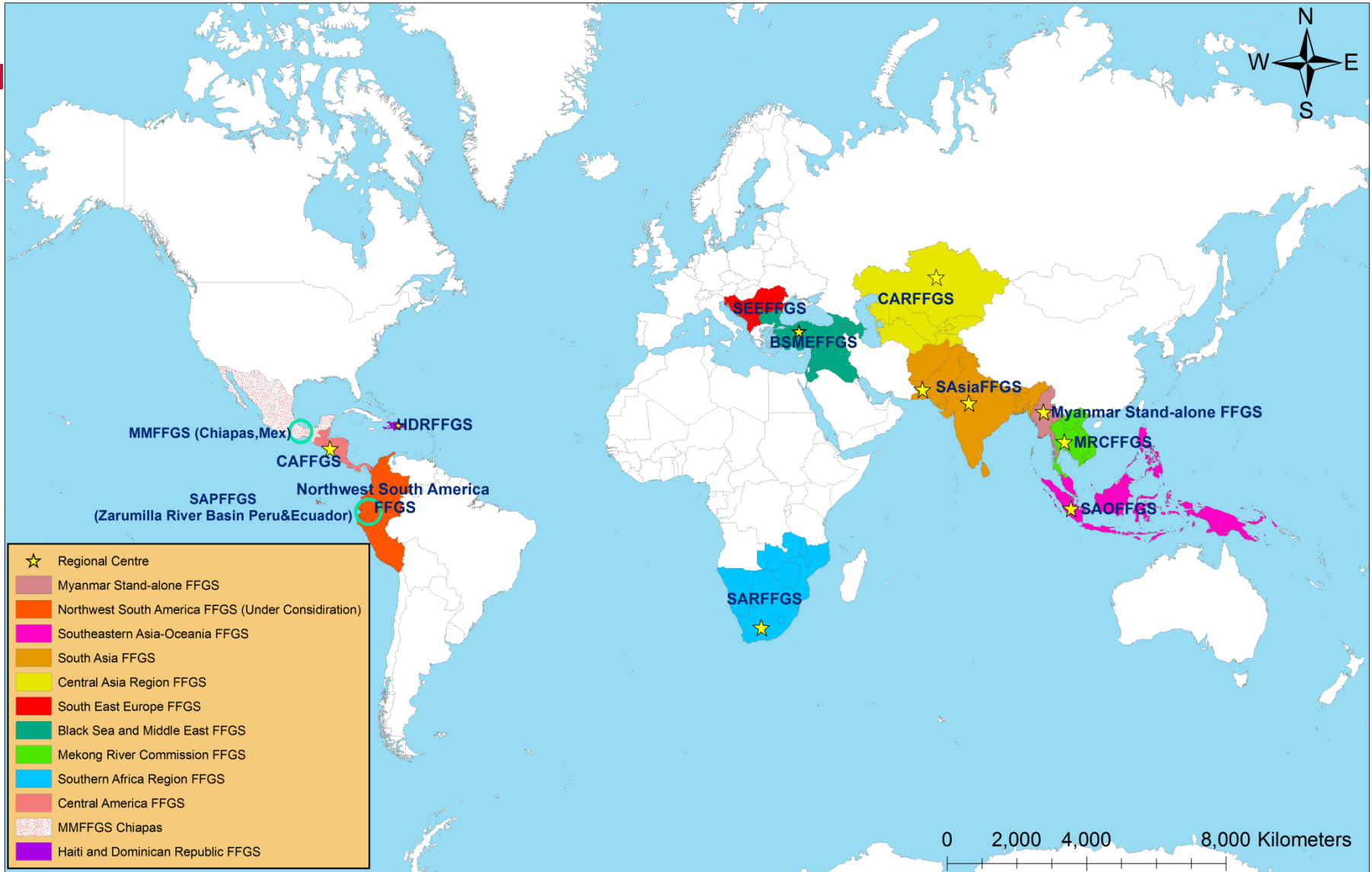
FFGS Additional Functionalities

- **Snowmelt outlook**
- **Urban Flash Flood Warning**
- **Rain-induced Landslide Hazard Threat Assessment**
- **Stream Routing Component**
- **Multi-model Capability**
- **FFGS User Interface**
- **Other applications**
 - **Linking with Community based EWS**
 - **Evaluate Effectiveness of watershed management interventions**



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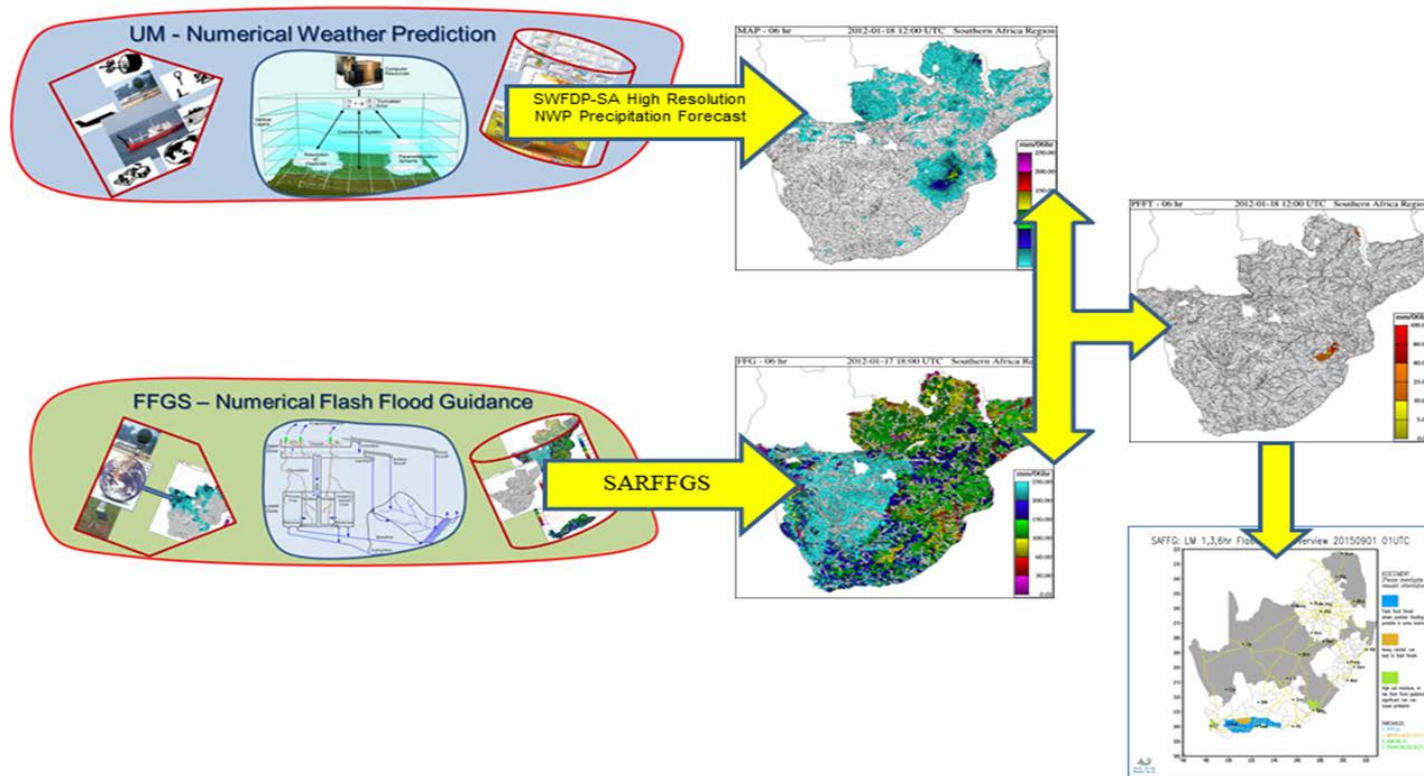
Global Flash Flood Guidance





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Leveraging Partnership SWFDP and FFGS

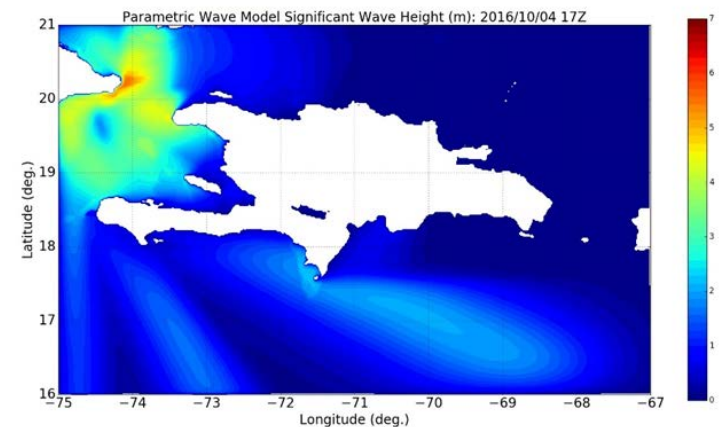
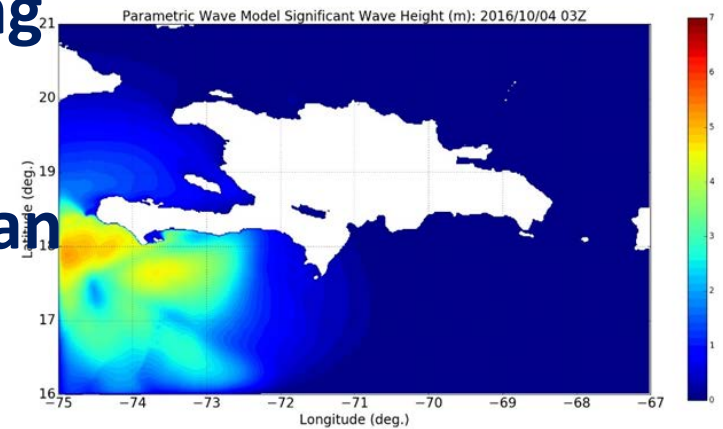
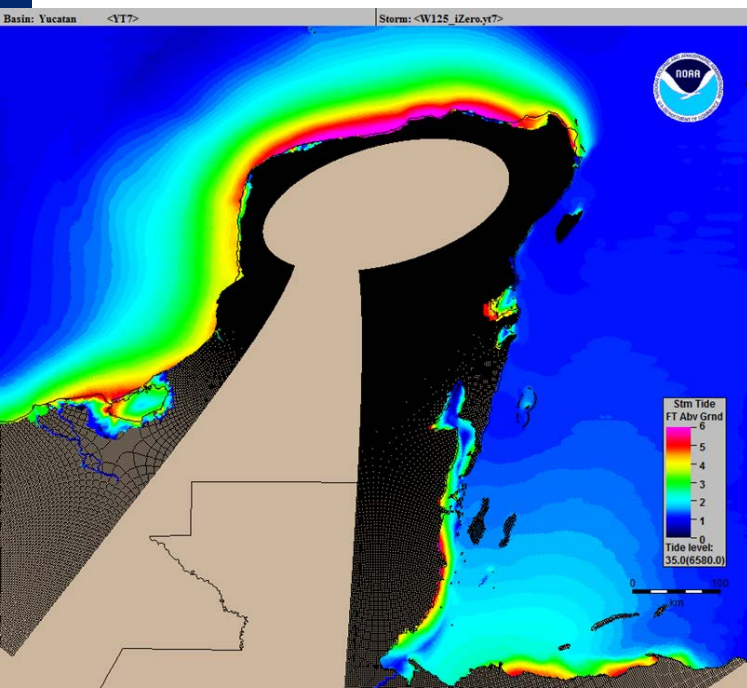




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Coastal Inundation Forecast Demonstration Project

- Hispaniola Storm Surge Warning
- Belize, Mexico
- Potential expansion in Caribbean





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Weather-Ready Nation

- **Becoming a Weather-Ready Nation is about building community resiliency in the face of increasing vulnerability to extreme weather:**

- **“Ready, Responsive, Resilient”**

- **REQUIRES...**

- **Accurate, Consistent Forecasts and Warnings**
- **Impact-based Decision Support Services (IDSS)**
- **Linking Physical and Social Sciences**
- **Multiple Dissemination Pathways**
- **Working with Partners to Gain Response; includes embedding personnel in Emergency Operations Centers**



***Involves entire Weather Enterprise WORKING TOGETHER
to achieve far-reaching national preparedness for weather events***



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Weather-Ready Nation *Impact-based Decision Support Services*

- Improve understanding of societal impacts
- Make our information more relevant to decision makers.
- Participate directly in decision making for those decisions fundamental to the role of government, especially the protection of life and property.
- Improve communication with users and participate actively in the decision making process



"The information you and the weather service provided us ultimately saved more lives than we could ever count."

--Shane Cohea, Moore Medical Center
Moore, Oklahoma
May, 2013



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Need to Move...

From
*What the weather will
be*

To
*What the weather
will do*

Weather Thresholds

- 50mm in 24 hours
- 35 knot winds

Social Impacts

- Roads flooded
- Communities cut off
- Power lines down



David Johnson





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WRNs El Salvador

Forecast for El Salvador that take the impacts

F06/F12

Moderate rain and thurmsstorm probabilities 60%





Moderate rain 60
Oprobabilidades medianas a inundaciones

Temporaly close the Los Chorros way. 70 % probabilities landslides

Temporaly Málaga Street close for floods

Apply the matrices, Severe Thunderstorms

Severe Thunderstorms

	Minimal	Minor	Significant	Severe
				
	Business as usual	Localised Business as usual	Localised Short term strain on emergency personnel	Widespread Prolonged strain on emergency personnel
Flooding:	<ul style="list-style-type: none"> Some Pooling of water on roads- resulting in minimal traffic route disruption 	<ul style="list-style-type: none"> Localised flooding of susceptible roads, low-lying areas and bridges Localised and short term disruption to 	<ul style="list-style-type: none"> Flooding of roads, settlements and low-lying areas, resulting in closure of some bridges and roads 	<ul style="list-style-type: none"> Widespread flooding of low-lying areas, resulting in closure of some bridges and major roads Widespread, prolonged

Emission date octubre 15, 2017.



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Working together beyond national borders

- **Flash Flood Guidance System**
- **Zambezi River Basin Flood Early Warning Strategy**
- **Coastal Inundation Forecast Demonstration**
- **South East Europe Multi-Hazard Early Warning Hazard Advisory System**
- **Natural and Nature based Flood Management: Green Guide**
- **Community based activities**
- **Others**





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Building Capacity

- Strengthen local capacity
- Provide tools
- Regional and Global Trainings
- Operational training in the US
- Mentoring
- Networking





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Questions