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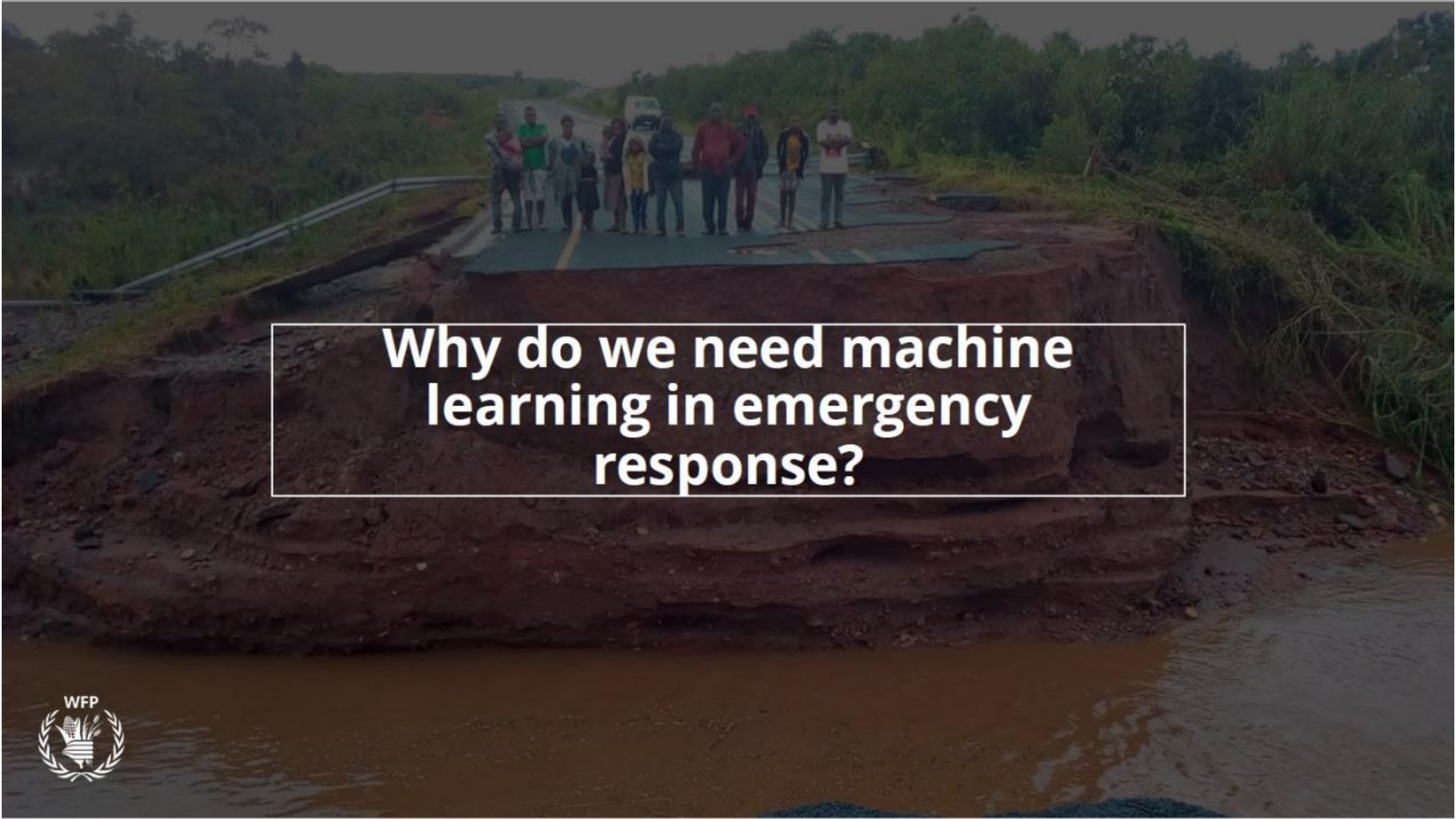
World Food Programme

SAVING LIVES
CHANGING LIVES

Machine Learning in Emergency Response

May 2021


Why do we need machine learning in emergency response?
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Transforming post disaster damage assessments

Impact

Data Collection

Data Processing & Analysis

Response

Within 72hrs of a disaster

The Challenge

- Super computers and data availability are key drivers behind Machine learning
- Access to both is the biggest challenge in emergencies

DEEP: Digital Engine for Emergency Photo-analysis

What is DEEP?

DEEP is an application designed to automate the learning analysis and processing of high resolution images and ultimately, help speed up our response time during emergencies.

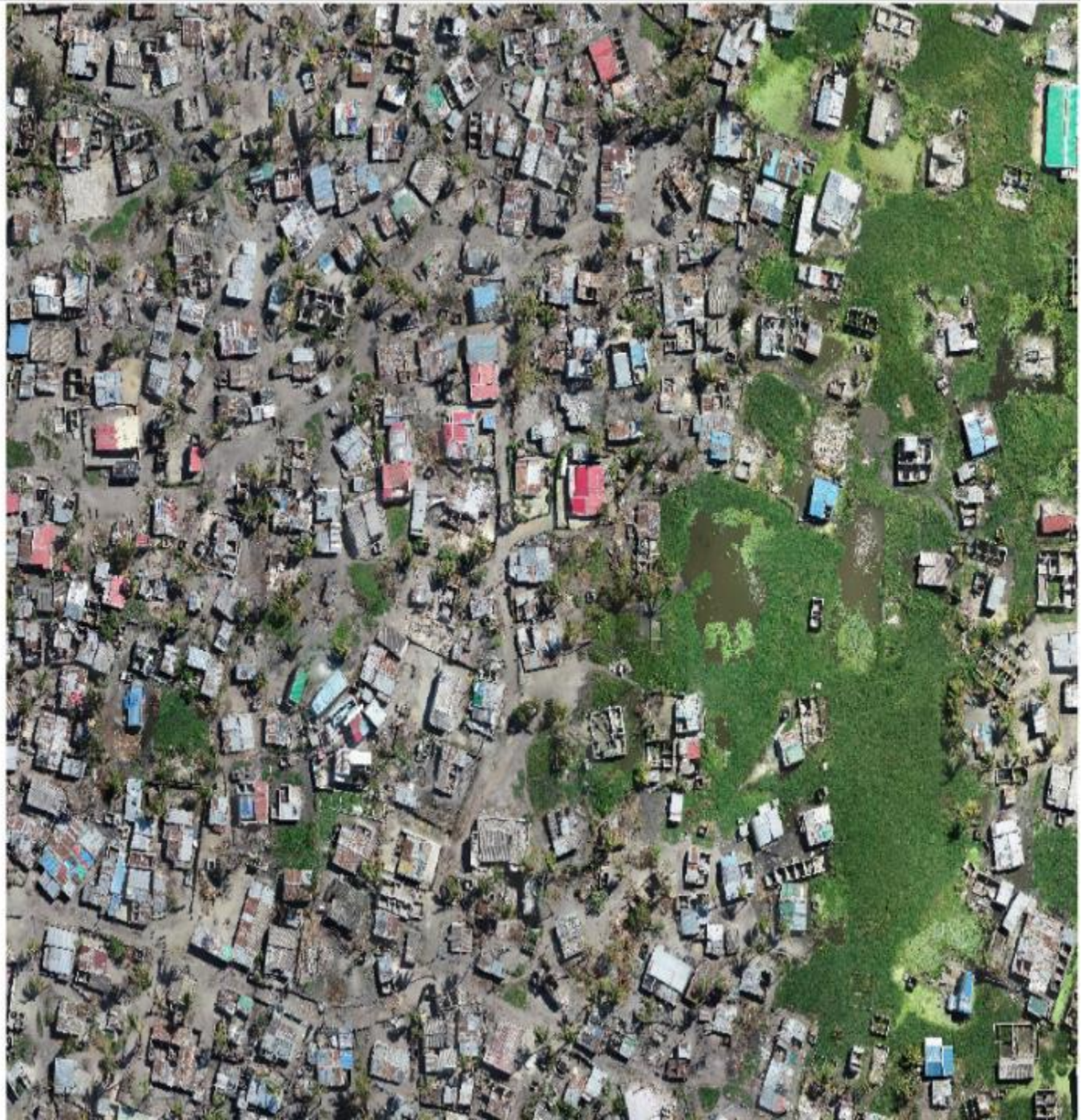
DEEP is built on these characteristics:

1. Ready for emergencies
2. Easy to use
3. Fully modular

Damage Assessment

Task: Detect every building in the map to understand people density distribution and estimate m2 of damaged buildings in the area.

The damage assessment analysis is usually done at a later stage of the emergency response process and can take weeks.



With DEEP

we make the analysis in the first 72hrs of a disaster, providing key information to support decision-making and resource allocations.

10 minutes (per drone flight) to get a damage assessment (with 15% error)

Without DEEP

Days to weeks to manually conduct the image analysis and produce key information.

DEEP now works (almost) everywhere

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The Mozambique response

Capacity building June 2019

10 Participants from INGC and Universidade Eduardo Mondlane

10 Trainings days

1 TB drone images from Kenneth and Idai

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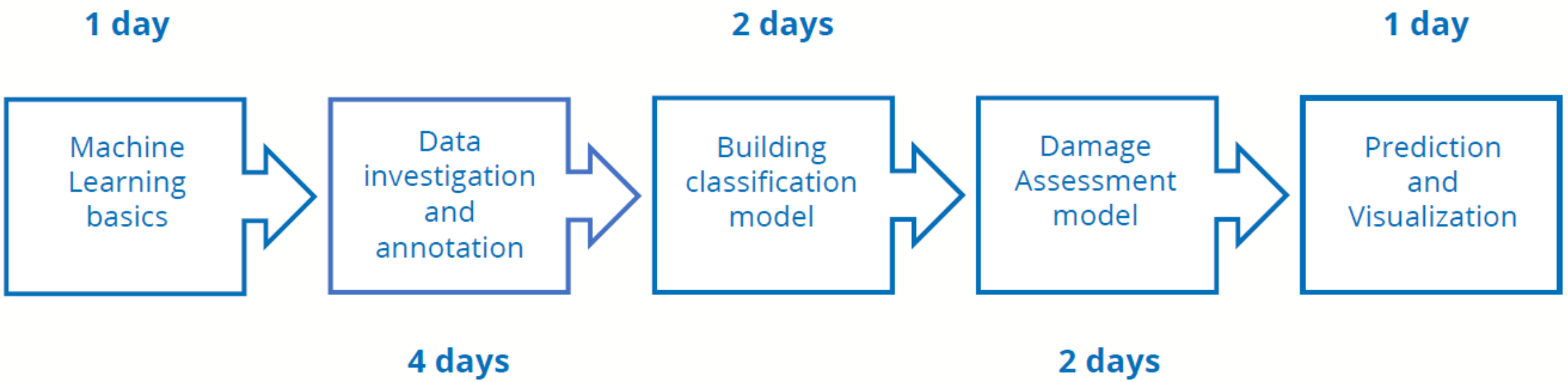
INGC

Instituto Nacional de Gestao de Calamidades

Workshop Workflow



Lessons learned

1. Machine learning applications need to be rooted in emergency response contexts, including challenges related to connectivity and computing power.

2. Complementing drone data gathering with machine learning analysis capacity, like DEEP, is essential to improve the information value chain and decision-making in disaster response

3. Preparedness is key: Without appropriate collaboration with the local government and institutions before an emergency, machine learning is of little concrete value.

4. Building local capacity has enormous value in terms of response speed and information sharing.

WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

Implementing emerging technologies for flood forecasting

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World Meteorological Organization
Organisation météorologique mondiale

Dr. Hwirin Kim

Head of Hydrological Forecasting and Water Resources Services (HWR) division

World Meteorological Organization

Introduction to WMO

- Set up on 23 March 1950
- Successor to International Meteorological Organization (IMO, created in 1873)
- Specialized agency of the United Nations for meteorology (weather and climate), **operational hydrology** and related geophysical sciences.
- UN system's authoritative voice on the state and behavior of the Earth's atmosphere, its interaction with the oceans, the climate it produces and the resulting distribution of water resources.
- **Technical Support and Services to 193 Member States**

Weather

Climate

Water

Environment

Research

Capacity development

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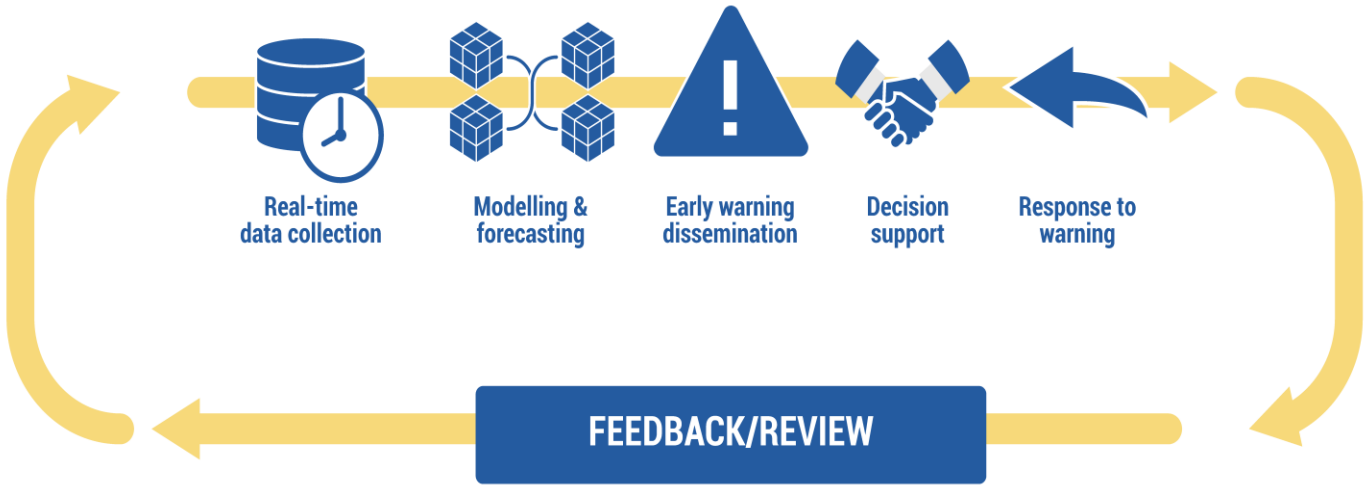
End-to-End Early Warning Systems for Flood Forecasting (E2E-EWS-FF)



- An E2E-EWS-FF designed to identify a flood hazard with sufficient lead time and enables mitigation of inherent flood risks
- Main purpose of EWS to issue warnings when a flood is imminent or already occurring

An E2E-EWS-FF should consider the following inter-related components:

(i) Disaster risk knowledge; (ii) Detection, monitoring, analysis and forecasting of hazards and possible consequences; (iii) Warning dissemination and communication and (iv) Preparedness and response capacities

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3D-Printed Automatic Weather Stations (3D-PAWS)

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Background

- High cost of technical equipment required for observations can impede the working of an early warning system, particularly in developing countries
- A standard weather station can cost several thousands of dollars
- To overcome these challenges and to better serve its Members, WMO is supporting an initiative that makes use of three-dimensional (3D) printing technology
- 3D-PAWS initiative was developed by University Corporation for Atmospheric Research (UCAR) and the US National Weather Service International Activities Office with support from the USAID Office of U.S. Foreign Disaster Assistance (OFDA)

Implementation in Afghanistan

- Afghanistan regularly affected by severe drought and floods leading to loss of lives and livelihood

- Through a CREWS (Climate Risk and Early Warning Systems) project, WMO is providing support to Afghanistan

- Use of locally produced components at fraction of the cost (of the order of a few hundred dollars)

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Implementation in Afghanistan

- 3D-PAWS sensors currently measure : pressure, temperature, relative humidity, wind speed, wind direction, precipitation, and visible, infrared and UV light

- System uses a Raspberry Pi single-board computer for data acquisition, data processing and communications.

Variety of hydro-met applications

- Improve mesoscale weather forecasts
- Strengthen early alert and regional decision support systems particularly for flash floods
- Agricultural monitoring and water resources management
- Health monitoring

Use of telecommunication for effective flood forecasting and management : An example

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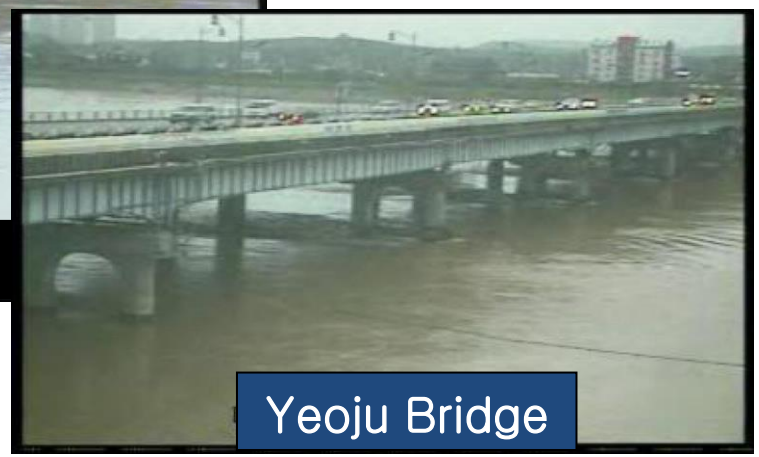

- National Hydrological Service using image stage gauge to record water level at multiple locations
- Real time data transmitted through various medium such as VHF, M2M, CDMA, VSAT
- Real time monitoring of floods being carried out through CCTV and shared with all relevant agencies

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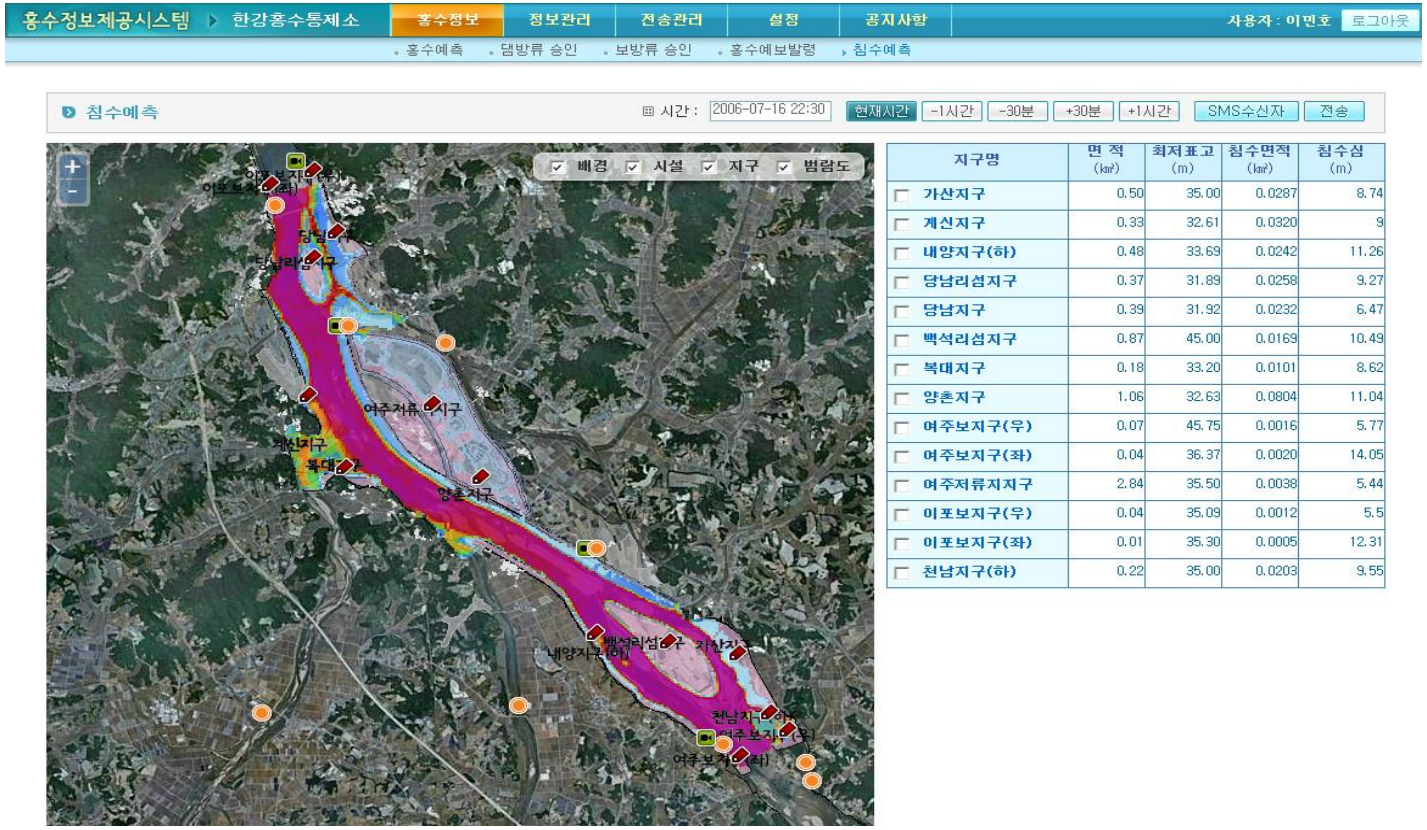
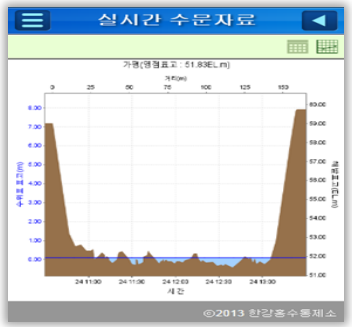
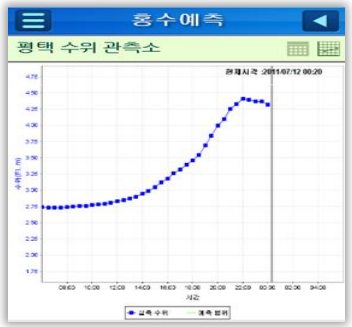


지구명	면 적 (㎢)	최저표고 (m)	침수면적 (㎢)	침수심 (m)
가산지구	0.50	35.00	0.0287	8.74
계신지구	0.33	32.61	0.0320	9
내양지구(하)	0.48	33.69	0.0242	11.26
당남리섬지구	0.37	31.89	0.0258	9.27
당남지구	0.39	31.92	0.0232	6.47
백석리섬지구	0.87	45.00	0.0169	10.49
북대지구	0.18	33.20	0.0101	8.62
양촌지구	1.06	32.63	0.0804	11.04
여주보지구(우)	0.07	45.75	0.0016	5.77
여주보지구(좌)	0.04	36.37	0.0020	14.05
여주저류지지구	2.84	35.50	0.0038	5.44
이포보지구(우)	0.04	35.09	0.0012	5.5
이포보지구(좌)	0.01	35.30	0.0005	12.31
천남지구(하)	0.22	35.00	0.0203	9.55





- Freely available smartphone app for public to see the current situation
- Inundation information that is made available through smartphone

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WMO – Flood Forecasting Initiative

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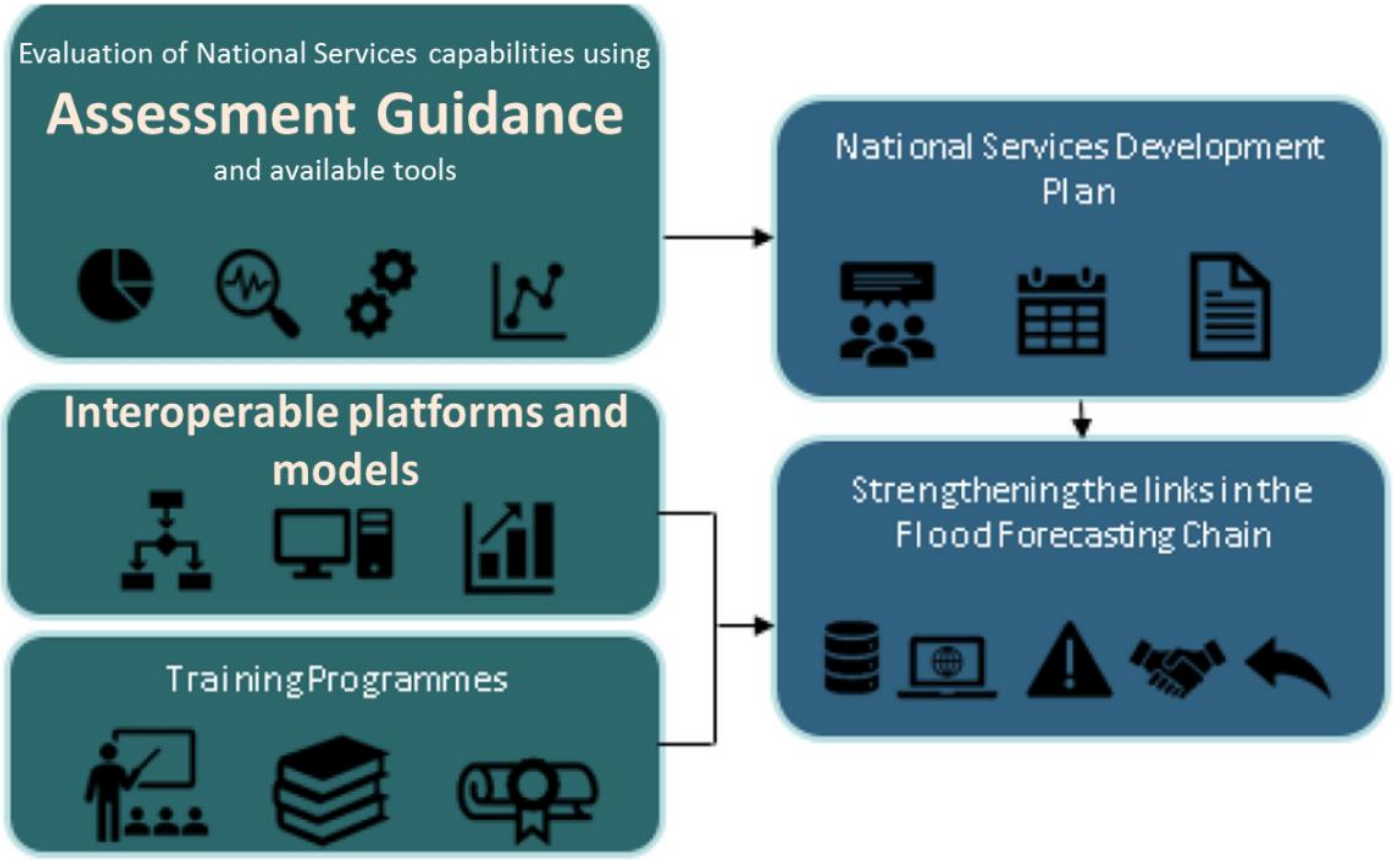
HWR Activity Brief:
WMO Flood Forecasting Initiative



Two major activities as part of the Flood Forecasting Initiative:

- Assessment guidelines on national needs and capabilities on E2E EWS for floods
- Inventory of interoperable models and platforms for flood forecasting

Working with Associated Programme on Flood Management for development of Community of Practice

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Associated Programme on Flood Management (APFM)

- APFM is a joint initiative of WMO and the Global Water Partnership (GWP)

- Supports countries in the implementation of Integrated Flood Management (IFM) within the overall framework of Integrated Water Resources Management (IWRM)

- Supported by a network of professional institutions that form the Support Base and provide technical backup

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https://www.floodmanagement.info/

THANK YOU