EARLY WARNING SYSTEM

DISASTER MANAGEMENT

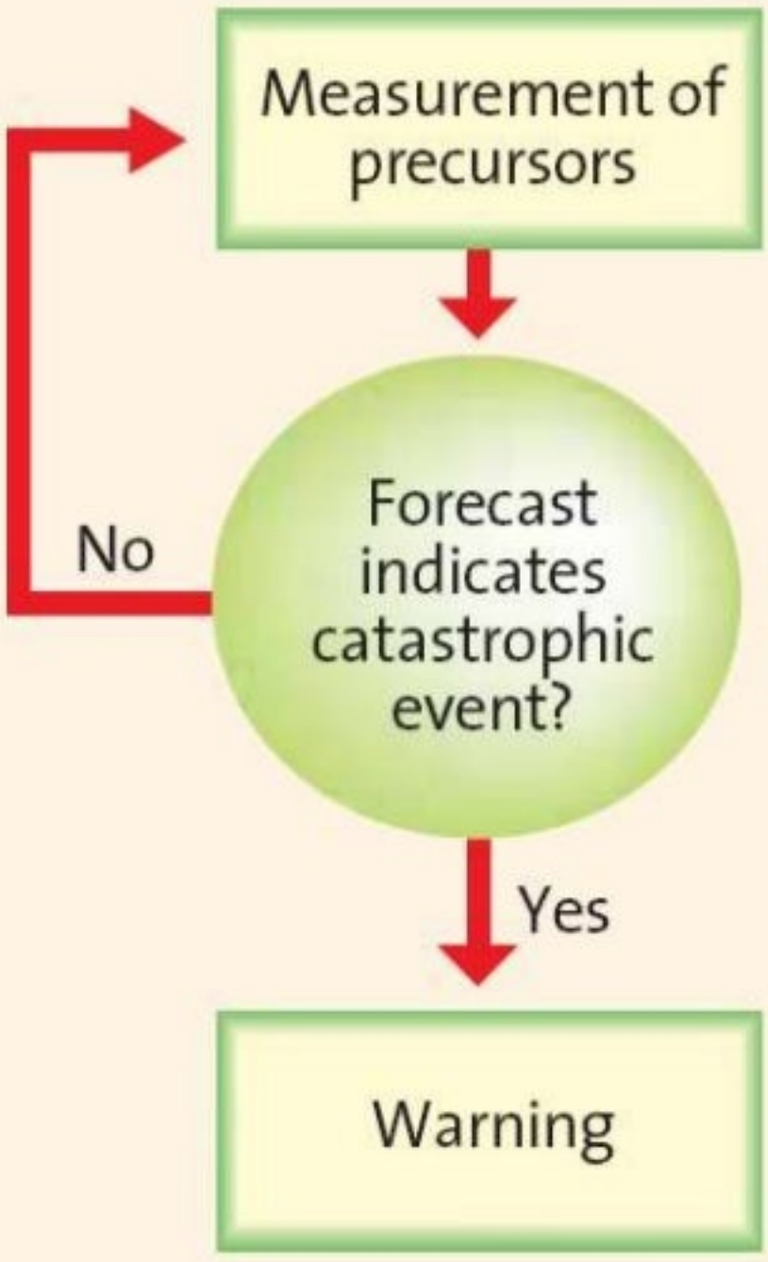
EARLY WARNING SYSTEM

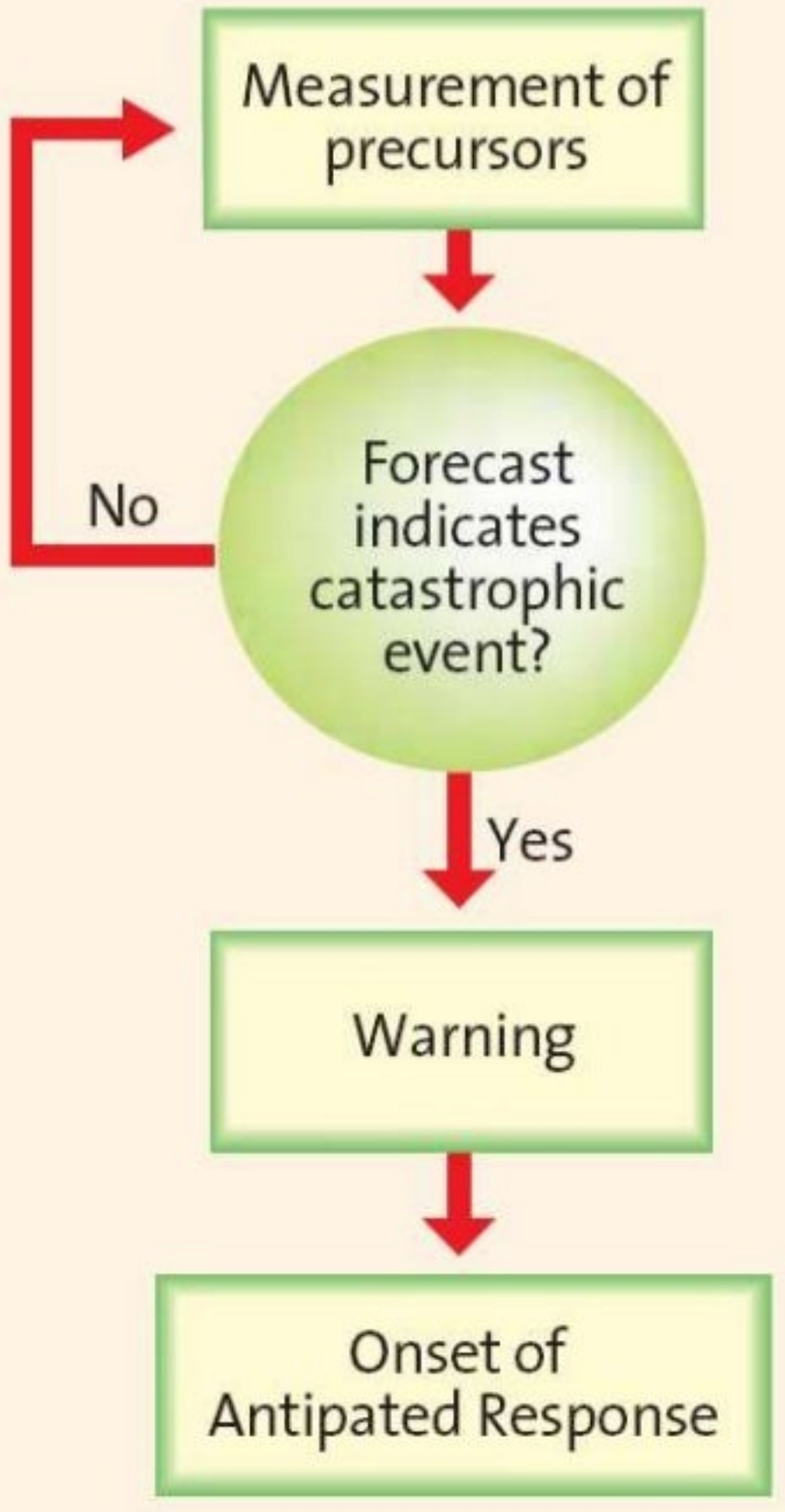
- An **Early Warning System** (EWS) can be defined as a set of capacities needed to generate and disseminate timely and meaningful warning information of the possible extreme events or disasters (e.g. floods, drought, fire, earthquake and tsunamis) that threatens people's lives.
- The purpose of this information is to enable individuals, communities and organizations threatened to prepare and act appropriately and in sufficient time to reduce the possibility of harm, loss or risk.

CHARACTERISTICS OF EWS

- Effective early warning systems require strong technical foundations and good knowledge of the risks.
- But they must be strongly people centered – with clear messages, dissemination systems.
- Public awareness and education are critical; in addition, many sectors must be involved.
- Effective early warning systems must be embedded in an understandable manner and relevant to the communities which they serve.

Three phases of early warning systems





AGENCIES FOR FORECASTING

Disasters	Agencies
Cyclone	Indian Meteorological Department
Tsunami	Indian national centre for oceanic information services
Floods	Central water commission
Earthquakes	Indian Meteorological Department

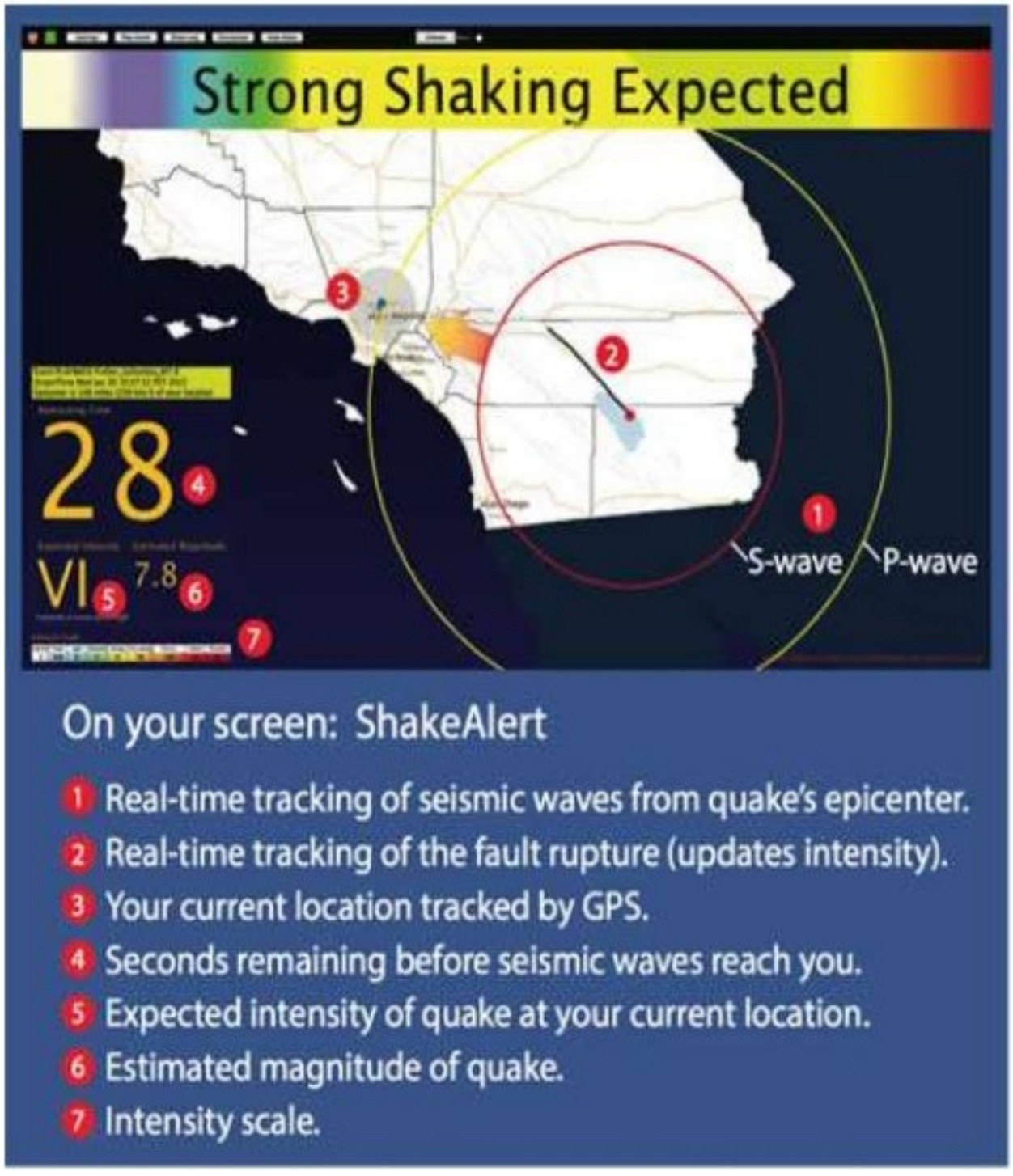
EARTHQUAKE

- Earthquake early warning systems use earthquake science and the technology of monitoring systems to alert devices and people when shaking waves generated by an earthquake are expected to arrive at their location.
- For this purpose USA California developed a machine called ‘ShakeAlert’ which gives the exact time of arrival of shaking to the stations.
- With the help of this technology we can save so many lives and also reduce damage to buildings to some extent.

EARTHQUAKE

- This can be done by detecting the first energy to radiate from an earthquake, the P-wave energy, which rarely causes damage.
- Using P-wave information, we first estimate the location and the magnitude of the earthquake.
- Then, the anticipated ground shaking across the region to be affected is estimated and a warning is provided to local populations.
- The method can provide warning before the S-wave arrives, bringing the strong shaking that usually causes most of the damage.

EARTHQUAKE



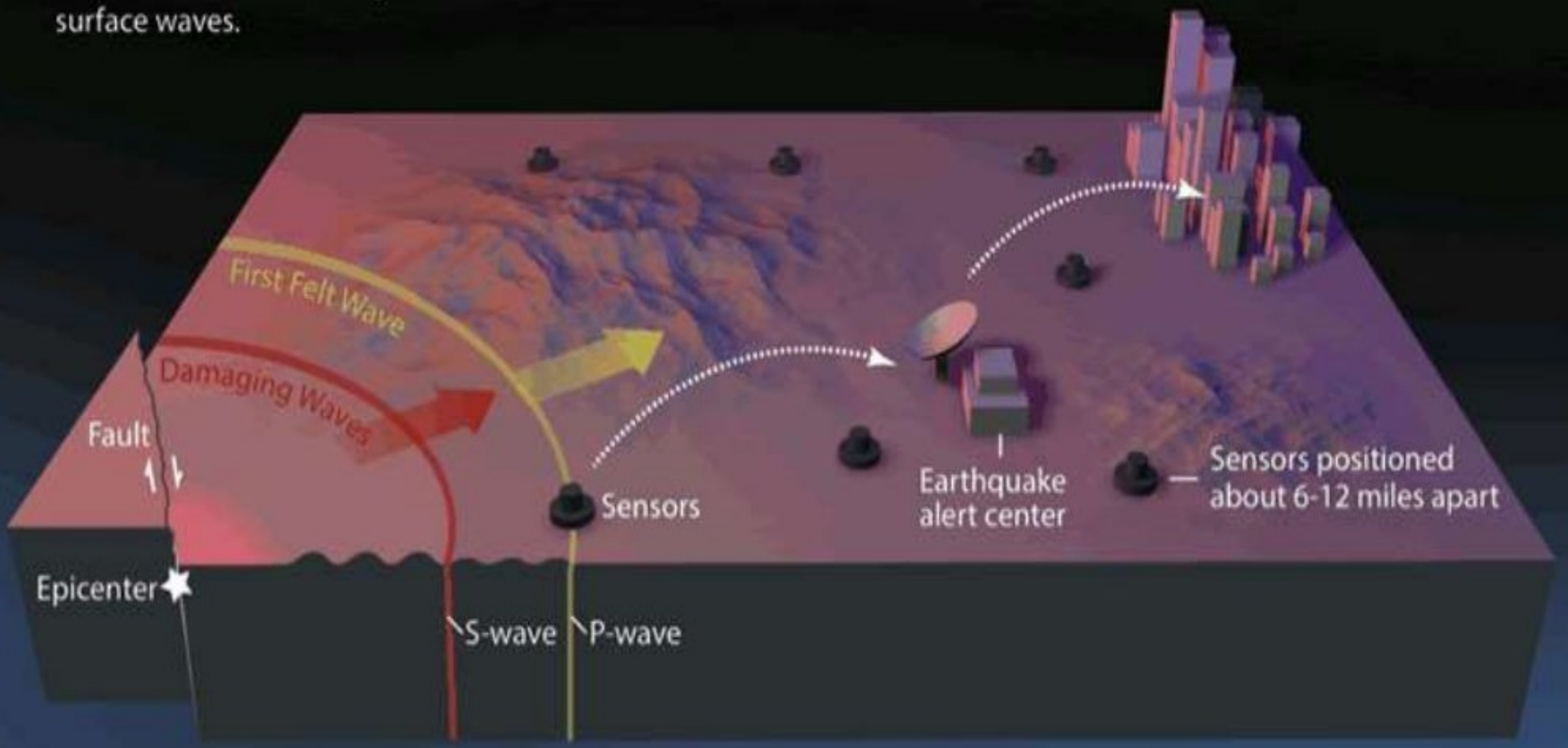
- A user receives a message like this on the screen of his computer.
- The message alerts the user to how many seconds before the shaking waves arrive at their location and the expected intensity of shaking at that site.
- The warning message also displays a map with the location of the epicenter, the magnitude of the quake, and the current position of the P and S waves.

Earthquake Early Warning Basics

1 In an earthquake, a rupturing fault sends out different types of waves. The fast-moving P-wave is first to arrive, but damage is caused by the slower S-waves and later-arriving surface waves.

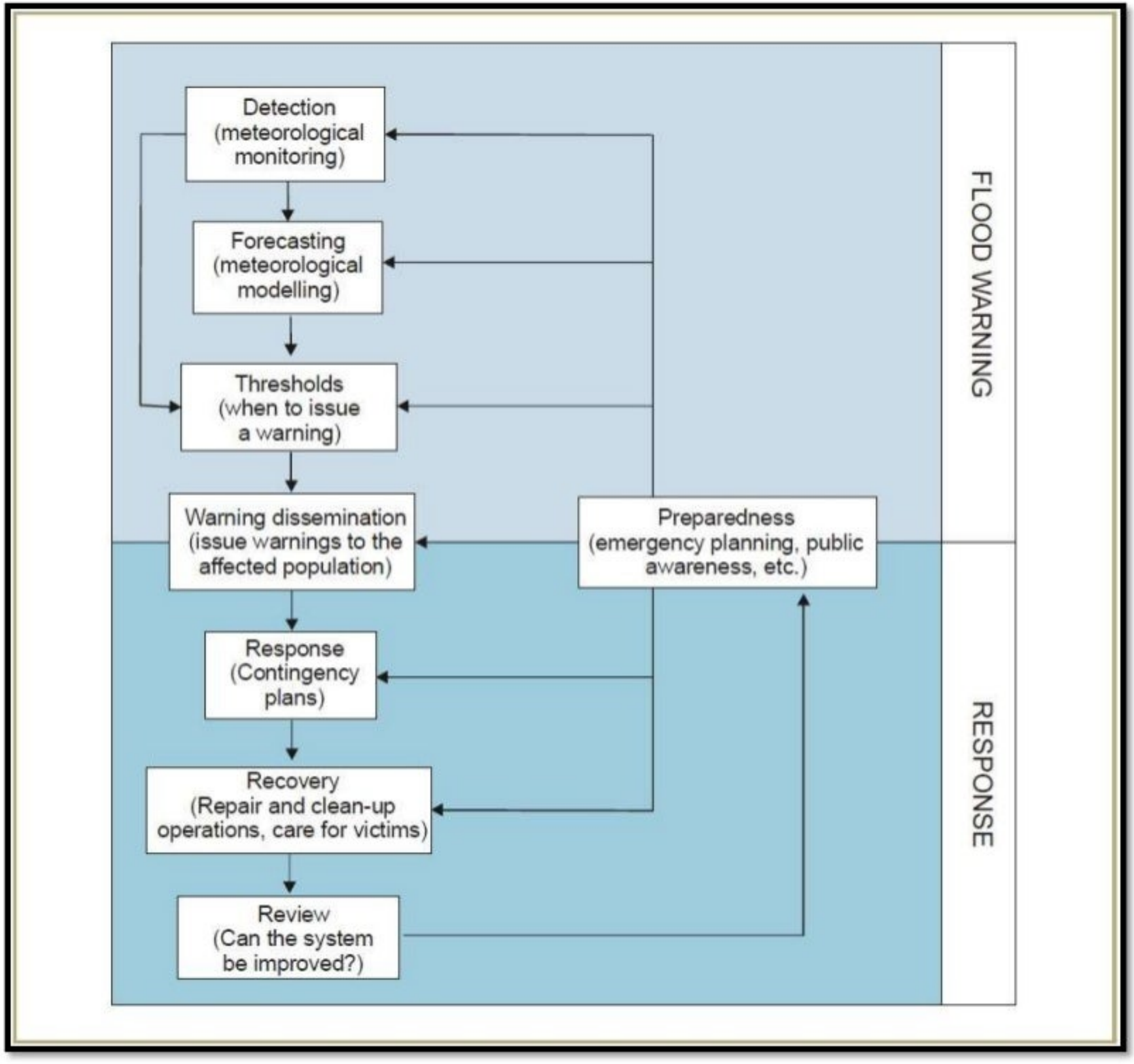
2 Sensors detect the P-wave and immediately transmit data to an earthquake alert center where the location and size of the quake are determined and updated as more data become available.

3 A message from the alert center is immediately transmitted to your computer or mobile phone, which calculates the expected intensity and arrival time of shaking at your location.



FLOOD

- A typical flood warning system includes a number of items, including automated sensors which are placed in or beside rivers and reservoirs throughout a designated area.
- Data is then collected and sent immediately to a base station or personal computer.
- In this way, appropriate forecasts are sent to authorities or communities of those potentially affected by the developing flood, as soon as possible.


Detection (meteorological monitoring)
Forecasting (meteorological modelling)
Thresholds (when to issue a warning)
Warning dissemination (issue warnings to the affected population)
Preparedness (emergency planning, public awareness, etc.)
Response (Contingency plans)
Recovery (Repair and clean-up operations, care for victims)
Review (Can the system be improved?)
FLOOD WARNING
RESPONSE

FLOOD DUE TO MELTING OF ICE

- The Community-based Flood Early-warning System is used in Hindu Kush Himalayan region which is one of the most dynamic and complex mountain systems in the world.
- It is also extremely fragile and sensitive to the effects of climate change.
- One of the effects of climate change is the formation of meltwater lakes on the lower sections of glaciers in the Himalaya region.
- Because such lakes are inherently unstable and subject to catastrophic flood surges they are potential sources of danger to people and property in the valleys below them.

SOLUTION

- The wireless system manages flood or flash flood risk by providing early warnings to downstream communities and enhances cooperation between upstream and downstream communities in the sharing of flood information.
- This solution consists of two units
  - Transmitter
  - Receiver
- The transmitter is installed along the riverbank, and the receiver is installed at a house near the river.

SOLUTION

- A flood sensor attached to the transmitter detects rising water levels.
- When the water reaches a critical level, a signal is wirelessly transmitted to the receiver.
- The flood warning is then disseminated via mobile phone to concerned agencies and vulnerable communities downstream.
- Critical flood levels are set with the help of the local community.

Community-Based Flood Early-Warning System

To enhance the resilience of 45 vulnerable communities to flood hazards, ICIMOD, together with its partners Aaranyak (India) and SEE (Nepal), established the Community-Based Flood Early-Warning System project. The ICT-enabled system uses a flood sensor attached to a transmitter to detect rising water levels. When the water reaches a critical level, a signal is wirelessly transmitted to the receiver. The flood warning is then disseminated via mobile phone to concerned agencies and vulnerable communities downstream. Critical flood levels are set with the help of the local community.

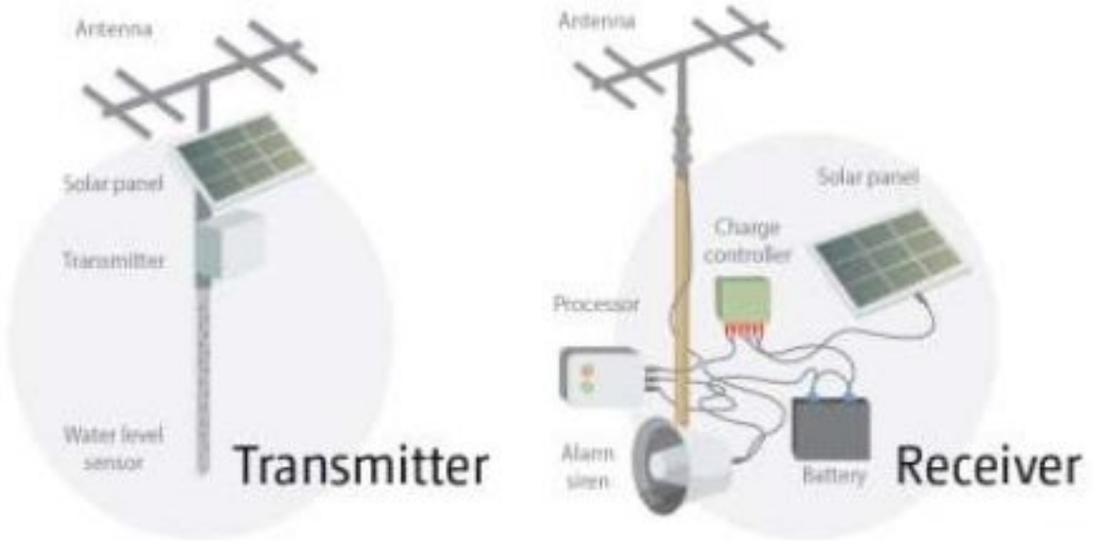
How it Works

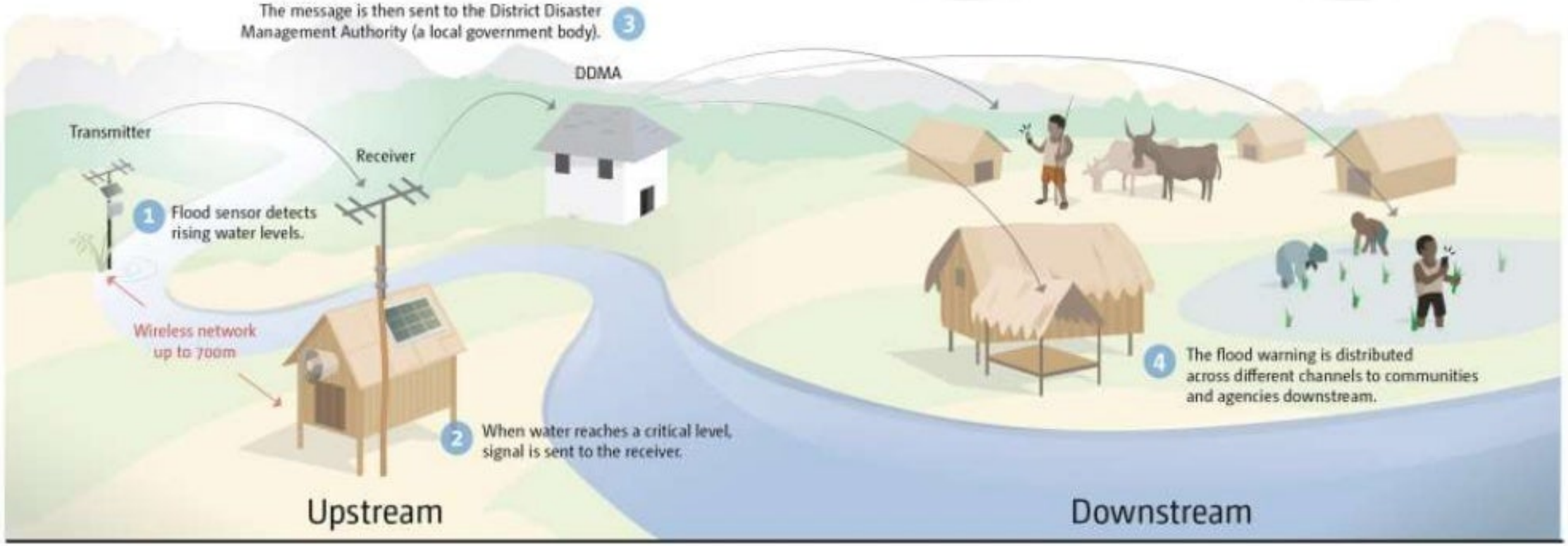
The ICT-enabled system installed upstream sends warning signals to flood-vulnerable villages downstream when water reaches a critical level. This gives people time to move out of harm's way, saving lives and property.

Early-Warning System

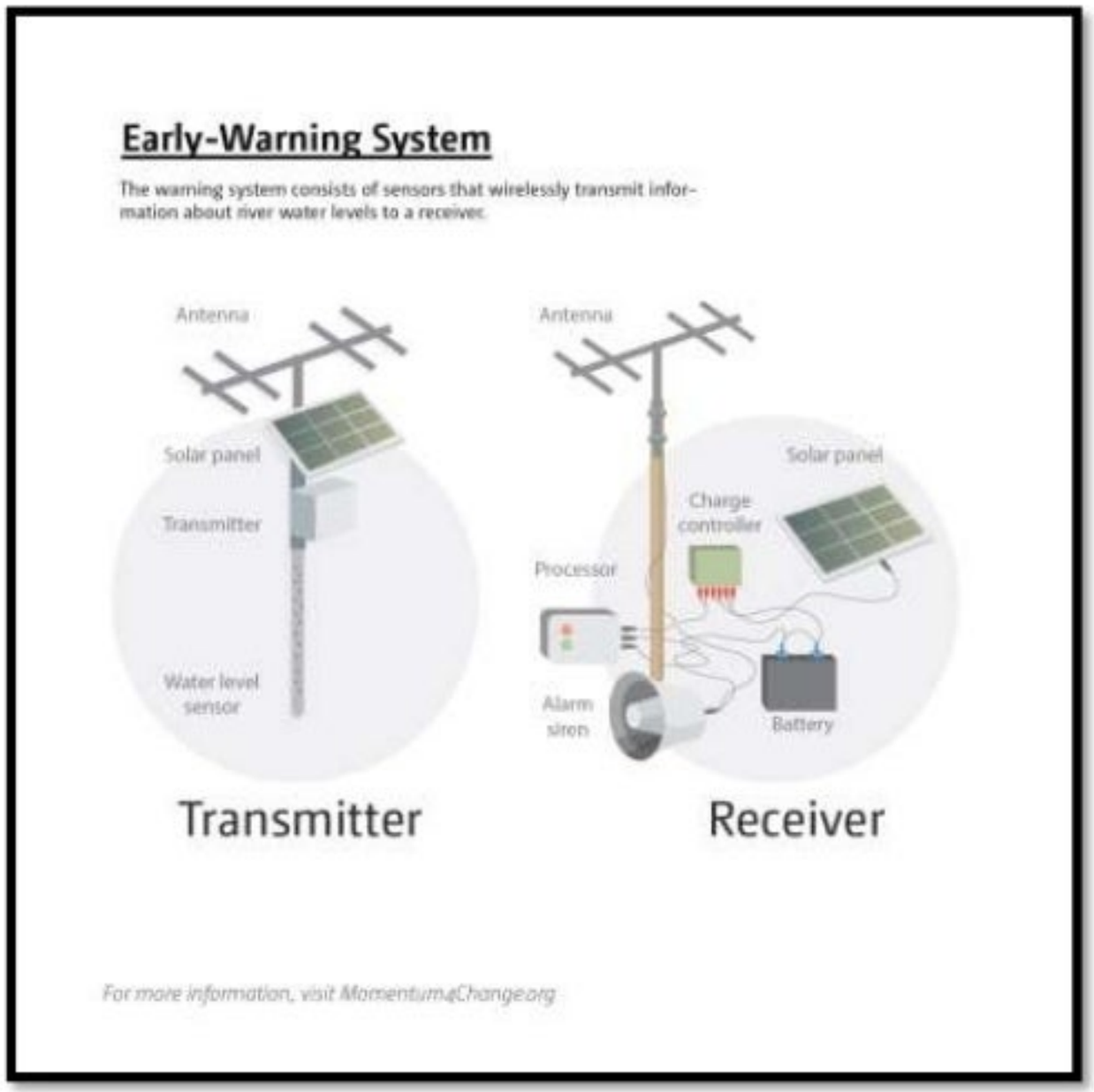
The warning system consists of sensors that wirelessly transmit information about river water levels to a receiver.

INDIA





TRANSMITTER AND RECEIVER



WORKING OF TWS

- Network of seismic monitoring station at sea floor detects presence of earthquake.
- Seismic monitoring station determines location and depth of earthquake having potential to cause tsunami.
- Any resulting tsunami are verified by sea level monitoring station such as DART buoys, tidal gauge.

DETECTORS

- **COAST TIDAL GAUGES**
  - Measure sea level near coastal area.
  - Continuously monitors and confirms tsunami waves following an earthquake.
  - If tsunami occurred other than earthquake we depend solely on data of tidal gauge.
- **DART BUOYS**
  - Report to tsunami warning Centre, when tsunami occur.
  - Information are processed to produce a new and more refined estimate of tsunami source.
  - Result is an accurate forecast of tsunami.

WORKING OF DART BUOYS

- DART BUOY consist of two main component:
  - Bottom Pressure Recorder (BPR)
  - Surface Buoy
- BPR consisting of a modem to transmit data to surface buoy.
- Surface buoy transmit data to warning centre via satellite communication.

- **BOTTOM PRESSURE RECORDER:**
- Digiquartz Broadband depth Sensor is the main sensing element.
- This sensor continuously monitors pressure and if pressure exceeds threshold value, it automatically report to warning Centre.

- **SURFACE BUOYS:**
- Surface buoys makes satellite communication to warning centers that evaluate the threat and issue a tsunami warning.

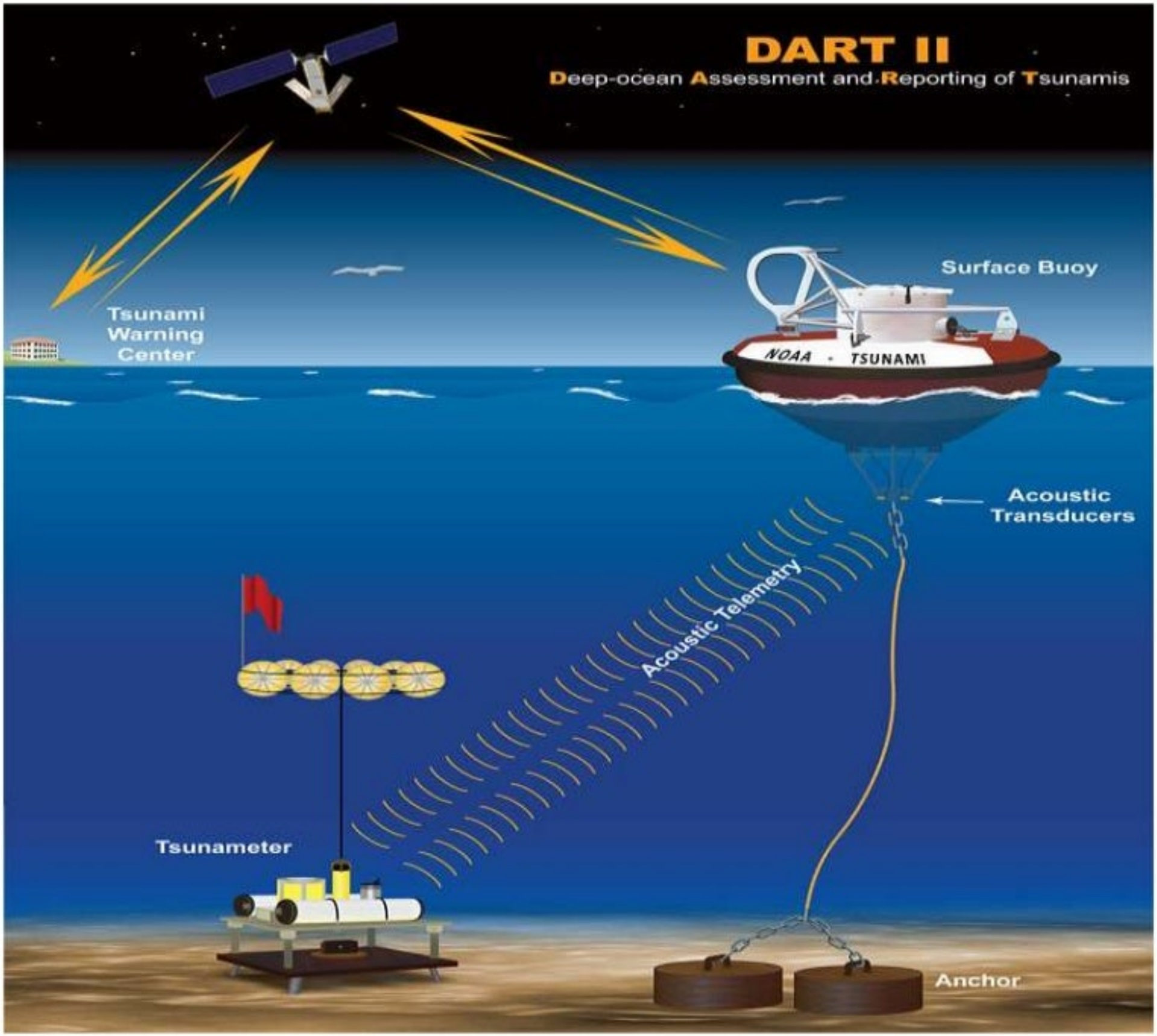


DIAGRAM OF DART BUOY

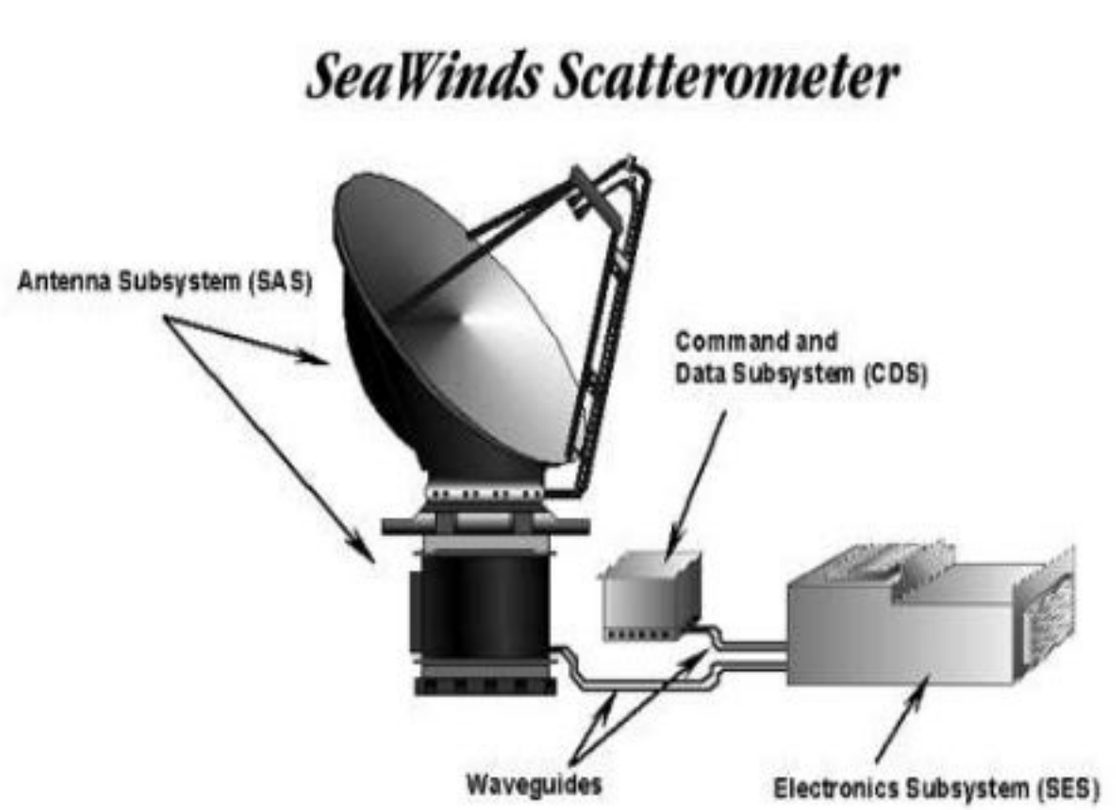
CYCLONES

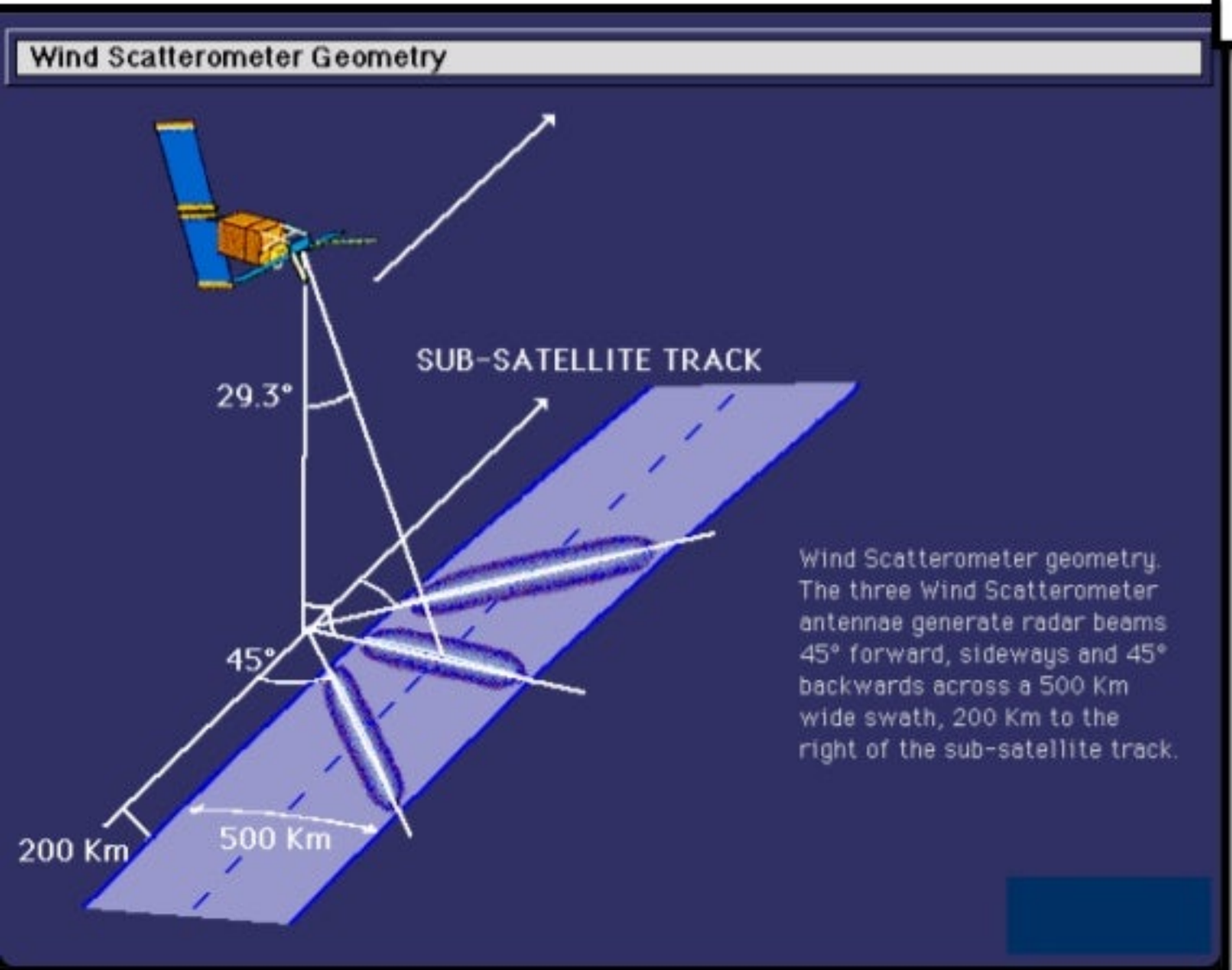
- Earlier detection of TCs would be beneficial in many areas.
- Earlier notice would give the public more time to prepare for a potential future threat.
- Earlier detection allows scientists more time to plan research missions into storms.
- In research applications, it also allows the study of determining what promotes tropical cyclogenesis.
- The detection algorithm described herein is based on vorticity.

CYCLONES - SCATTEROMETER

- Scatterometers are unique among satellite remote sensors in their ability to determine surface wind speed and direction.
- Microwaves are scattered by short water waves (capillary and ultra gravity waves), which respond quickly to changes in winds.
- The backscatter cross section (the fraction of transmitted energy that returns to the satellite) is a function of wind speed and wind direction relative to the orientation of the Scatterometers
- Scatterometers actually determine “equivalent neutral wind speeds” at a height of 10 m above the local mean water surface, which differ from wind speeds that would be measured by anemometers after adjustment to a height of 10m

SCATTEROMETER





CYCLONES

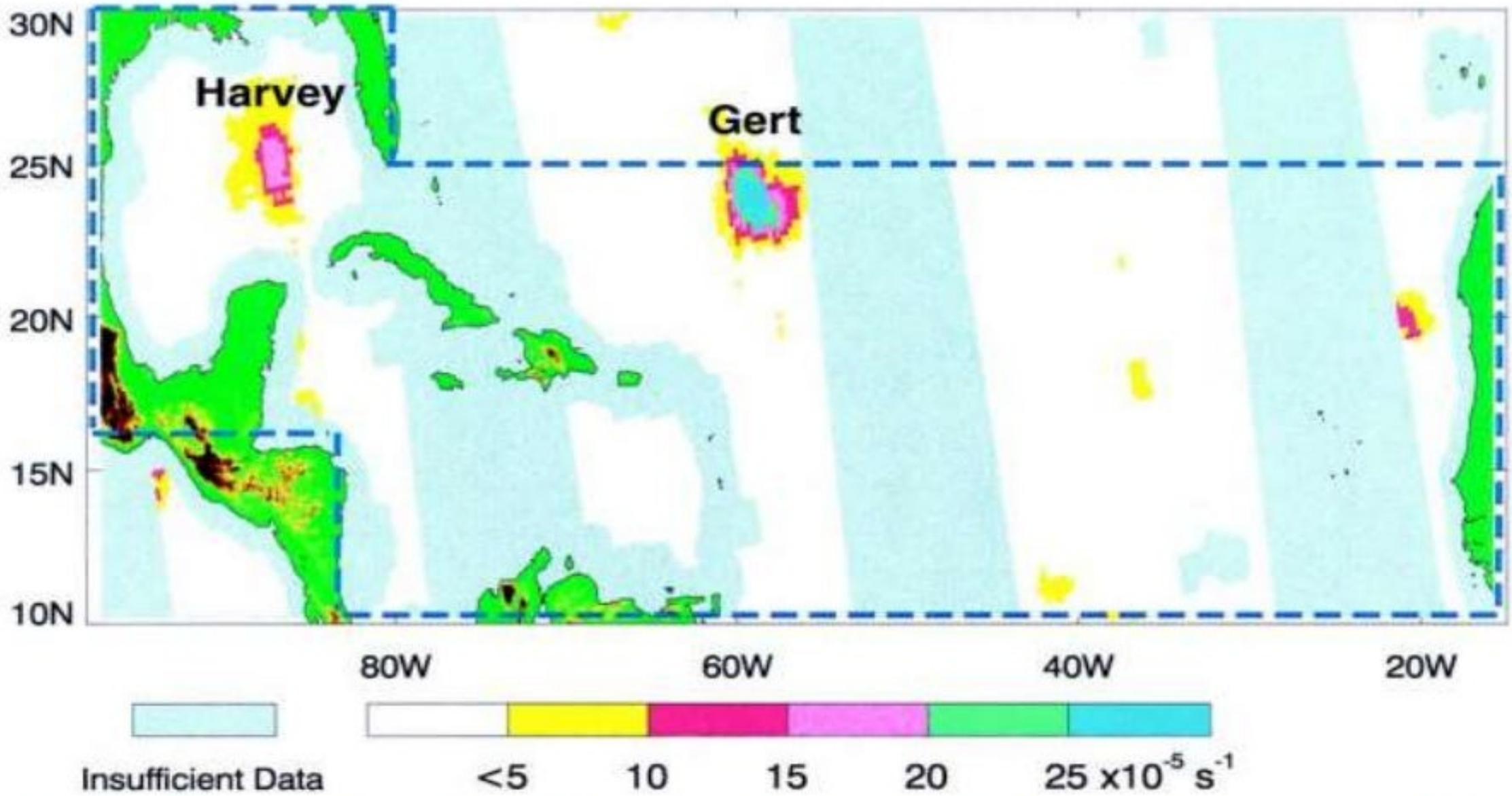
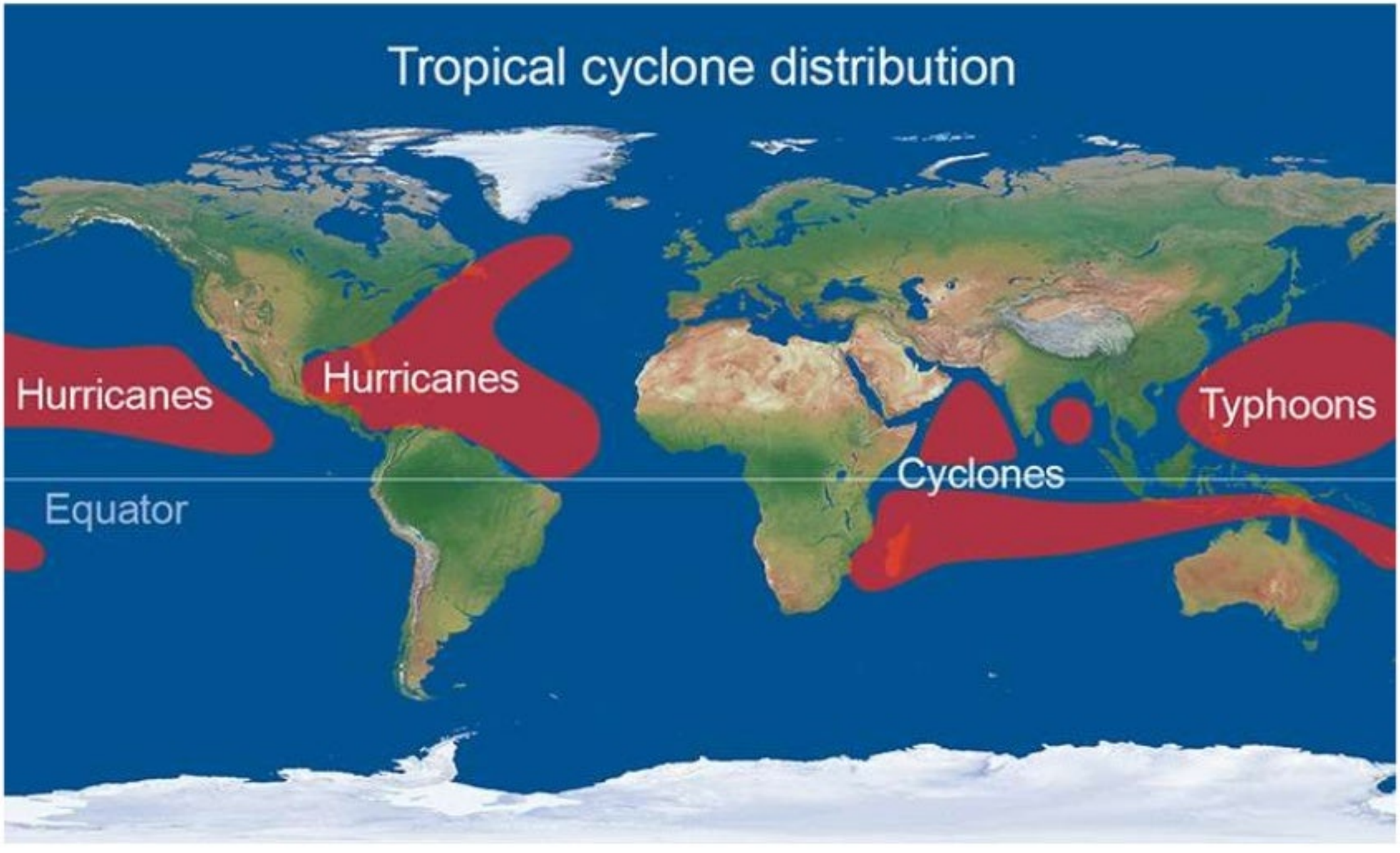


FIG. 1. Vorticity field example from ascending swaths on 19 Sep 1999. Vorticity (see background color scale) is calculated from the scatterometer winds and then averaged over a 175 km by 175 km box within the swaths. The gray regions represent areas where the average vorticity was not calculated. Hurricane Gert and Tropical Storm Harvey give a clear signal in this field.

TROPICAL CYCLONE DISTRIBUTION



REFERENCE

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- www.ntlapp.nt.gov.au
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THANK YOU