


Hawaii Hazards Awareness & Resilience Program


Produced by
Hawaii State Civil Defense



HAWAII HAZARDS AWARENESS & RESILIENCE PROGRAM:

GOAL: To enhance community resilience to multiple hazards through a facilitated education and outreach program that promotes hazard understanding and awareness, and offers tools and information resources to guide mitigation, preparedness, response and recovery.

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FLOOD BASICS


Module 1: Hazard Awareness

Contents

- What is a Flood?
 - Flood Types and Characteristics
- Effects of Flooding
- Hawaii’s Flood History
- Where to Get More Information?

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Module 1: Hazard Awareness



Source: PDC

WHAT IS A FLOOD?

What is a Flood?

- **Flood:** An overflow of water onto lands that are used or usable by man and not normally covered by water. Floods have two essential characteristics:
 - The inundation of land is temporary; and
 - The land is adjacent to and inundated by overflow from a river, stream, lake, or ocean. (USGS)
- **Hydrology** is the science dealing with the occurrence, circulation, distribution, and properties of the waters of the earth and its atmosphere.

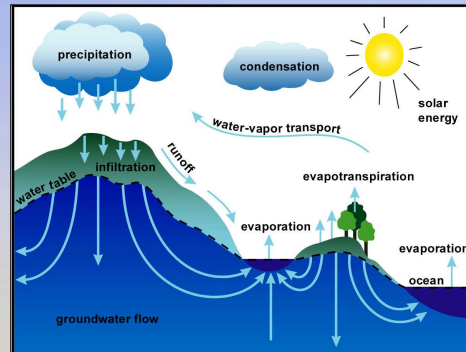
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Conditions Contributing to Floods

- Rate of precipitation
- Topography (slope)
- Ground conditions (soil type and condition)
- Vegetation (presence or lack there of)
- Water levels in rivers and streams prior to rainfall
- Condition of hydraulic structures (e.g., dams)
- Conditions of coastal areas (e.g., distance and elevation in relation to the ocean)

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The Water Cycle of the Earth



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Flood Magnitude & Frequency

- Flood magnitude is often described in terms of recurrence intervals or probability of occurrence.
- Flood events are commonly referred to as "10-year," "25-year," "50-year," "100-year," or "500-year" floods.
 - A "500-year flood" has a 0.2% chance of occurring in any given year.
 - A "100-year flood" has a 1% chance of occurring in any given year.
 - A "50-year flood" has a 2% chance of occurring in any given year.
 - A "25-year flood" has a 4% chance of occurring in any given year.
 - A "10-year flood" has a 10% chance of occurring in any given year.
- Special Flood Hazard Area (SFHA)
 - Area defined using the 100-year flood event. SFHAs are used by the National Flood Insurance Program (NFIP) to determine flood insurance requirements.

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Types of Flooding in Hawaii

- Flash flooding
- Riverine
- Coastal
- Urban
- Inundation caused by Dam Failure

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Flash Flooding

- Can occur within a few minutes or hours of excessive rainfall, or a dam or levee failure. Many flash floods have a dangerous wall of roaring water carrying rocks, mud and other debris. (getreadyhawaii.org)
- Can occur in dry areas if there is heavy rainfall upstream.



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Riverine Flooding

- The most common type of flood event. Typically occurs when waterways such as rivers or streams overflow their banks as a result of rainwater or a possible levee breach and cause flooding in surrounding areas. (FEMA 2013)
- Heavy rains can occur at any time of the year in Hawaii, but are more frequent between October and April.



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Coastal Flooding

- Flooding along coastal areas.
- Can be caused by high surf, excessively high tides, storm surge and waves due to a hurricane, or tsunami inundation.



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Urban Flooding

- Occurs when rainfall exceeds the capacity of streets and drains or underground pipes designed to carry flood waters away from urban areas. (FEMA 2013)
- Can also occur when drainage systems become blocked with debris.



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Downstream Inundation due to Dam Break

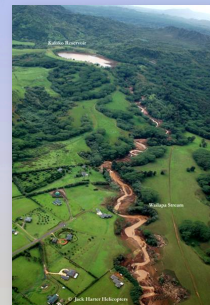
- Dams and levees typically hold back vast amounts of water.
- If these structures fail, huge amounts of water wash downstream in a short time, destroying property, washing away crops, and devastating entire communities.



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Downstream Inundation due to Dam Break (Continued)

- Causes of structural failure can include:
 - Unsuitable construction.
 - Lack of, or poor maintenance.
 - Modifications to the original structure (e.g., altering the spillway).
 - Location of the structure in a geologically unstable setting (e.g., prone to earthquakes).



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Learning Check

1. What types of flooding occur in Hawaii?
2. During which months are heavy rains more frequent in Hawaii?



Module 1: Hazard Awareness

EFFECTS OF FLOODING

Effects of Flooding

- **High water** can result in damage to infrastructure, homes and property, and loss of life. It only takes six inches of rapidly moving water to knock a person off his/her feet or sweep a vehicle off the road.
- **Debris** (rocks, tree branches, cars) submerged or caught up in the flow of water can cause damage and block drainage systems.
- **Landslides/Mudslides** can result when super-saturated soils along steep slopes fail. This can result in damage to houses and roads, and loss of life.

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Effects of Flooding

- **Contaminated Water** – Water may become contaminated with sewage, chemicals or other threats. Drinking water may be affected if flood waters contaminate water tanks, or pipes fail in flooded areas.
- **Erosion** by heavy rains and associated flooding can wash out roadways, damage bridges, as well as cause significant damage to property and agriculture.
- **Falling Trees and high-voltage power poles** can result from over-saturated soils.

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Flood Safety Concerns

- Turn Around, Don't Drown! Don't drive across flooded roadways or bridges, even shallow water can be dangerous.
- Check the "lay of the land" at your home and in areas that you visit frequently. If the surrounding land is higher than your location, there is a risk of flooding.
- Be aware of the location of dams and retaining basins in your area.
- Check the National Flood Insurance Program's (NFIP) flood zone maps to determine if your home, place of business, school, etc. is located in a flood zone.

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Learning Check

1. What hazards are associated with flooding?
2. How many inches of rapidly moving water are required to knock a person off his/her feet and/or sweep a car downstream?



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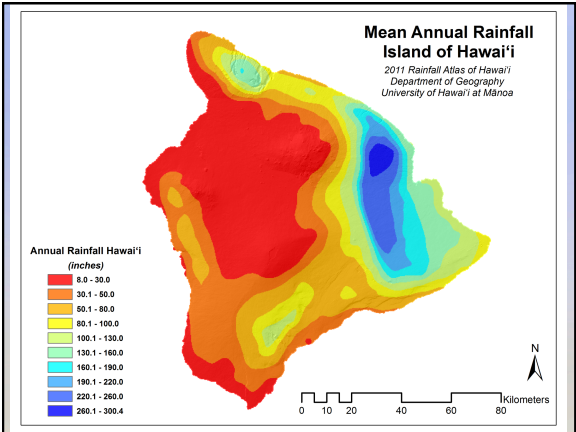
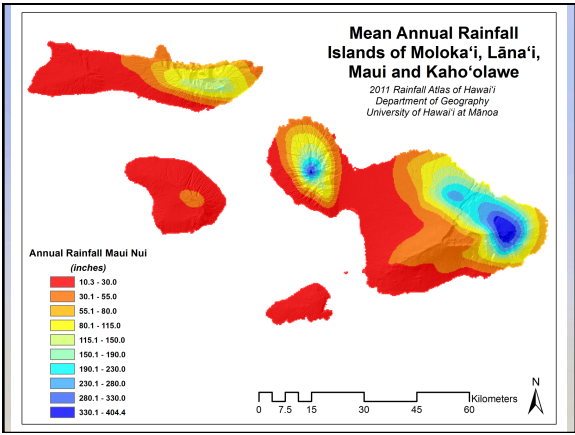
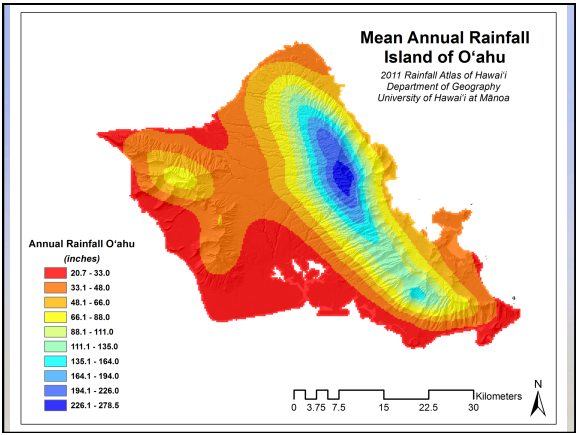
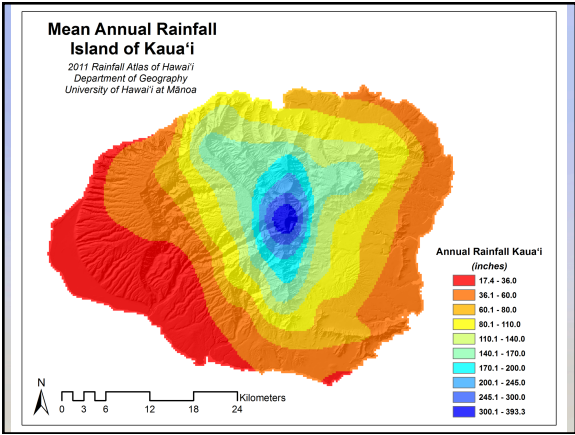
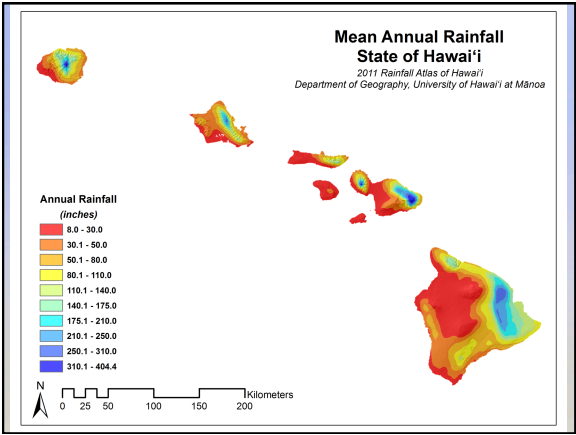
HAWAII'S FLOOD HISTORY

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Flooding in Hawaii

- Flooding occurs frequently in all counties and is sometimes very destructive.
- Flash floods occur during or within a few hours of extended rainfall events.
- The rapid flooding of streams, valleys, and other flood-prone areas can occur during any month of the year, but are more frequent during the period between October and April.

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Historical Flood Events

- 1960 to the Present (August 2013):
 - 14 Major Disaster Declarations in Hawaii
 - Two in the 1960s
 - Two in the 1970s
 - Three in the 1980s
 - One in the 1990s
 - Five between 2000 – 2009
 - One between 2010 – 2013
 - 1 Emergency Declaration
 - 1996 flood

February 20 – April 2, 2006

- Disaster Declaration for Kauai and Oahu
- Weak La Niña
- A series of Kona storms over a 7-week period
- Damages - \$10.7 million
 - Heavy rainfall over all islands
 - Flooding
 - Ka Loko Dam Failure – Kauai
 - Snow storms on Big Island summits – 2 to 4 feet of snow
- Fatalities:
 - 7 on Kauai due to dam failure

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December 4 – 7, 2007

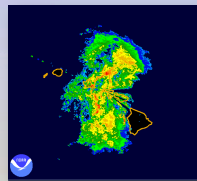
- Disaster Declaration for counties of Kauai, Maui and Hawaii
- Cold front brought heavy rainfall
- Heavy, widespread flooding
- Damages - \$3.4 million
 - Roofs blown off
 - Damaged utilities
 - House swept off foundation – Maui
- Fatalities:
 - None reported

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December 10 – 14, 2008

- Disaster Declaration for Oahu
- Kona storm – low-pressure
- Significant flooding
- Damages ~\$1.6 million
 - Severe damage on Oahu
 - 10 to 13 inches of rain in 12 hours
 - Tornado on Kauai
 - Two bouts of flooding
- Fatalities:
 - None



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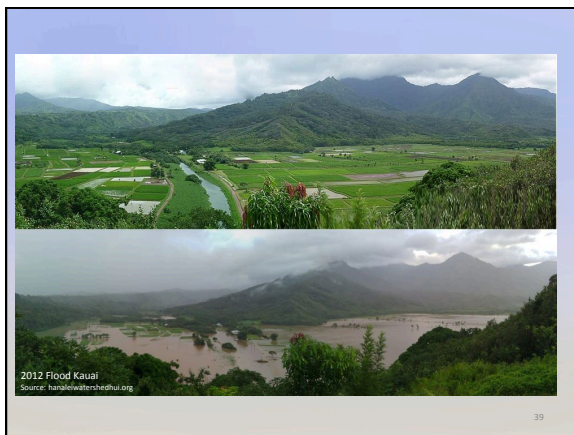
March 3 - 11, 2012


- Disaster Declaration for islands of Kauai and Oahu.
- Three days of steady rainfall
- Significant flooding
- Schools closed
- Damages ~\$12 million
 - Heavy rains
 - Sewage spill
 - Dangerous surf
- Fatalities:
 - None reported



Source: PDC

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Learning Check

1. How many Disaster Declarations were declared for Hawaii due to floods from 1960 to the present?
2. What were some of the damages caused by flooding?

Module 1: Hazard Awareness

FOR MORE INFORMATION

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For More Information

<ul style="list-style-type: none"> • Hawaii State Civil Defense <ul style="list-style-type: none"> – www.scd.hawaii.gov • National Weather Service, Honolulu <ul style="list-style-type: none"> – http://www.prh.noaa.gov/pr/hnl/ • NWS Turn Around, Don't Drown <ul style="list-style-type: none"> – http://tadd.weather.gov/ • FEMA National Flood Insurance Program <ul style="list-style-type: none"> – http://www.fema.gov/national-flood-insurance-program • Hawaii Department of Land and Natural Resources Dam Safety Program <ul style="list-style-type: none"> – http://www.state.hi.us/dlnr/eng/ds/ 	<ul style="list-style-type: none"> • City and County of Honolulu Department of Emergency Management <ul style="list-style-type: none"> – http://www1.honolulu.gov/dem/index.htm • Maui County Civil Defense Agency <ul style="list-style-type: none"> – http://www.co.maui.hi.us/index.aspx?id=73 • Hawaii County Civil Defense Agency <ul style="list-style-type: none"> – http://www.hawailcounty.gov/civil-defense/ • Kauai Civil Defense Agency <ul style="list-style-type: none"> – http://www.kauai.gov/civildefense
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For More Information (Continued)

- American Red Cross - Flood
 - <http://www.redcross.org/prepare/disaster/flood>
- FEMA Map Service Center
 - <https://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1&userType=G>
- Ready.gov – Flood
 - <http://www.ready.gov/floods>
- Pacific Disaster Center
 - <http://www.pdc.org>



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Questions?



MAHALO

The Hawaii Hazards Awareness & Resilience Program (HHARP) is the result of a collaborative partnership between Hawaii State Civil Defense and the Pacific Disaster Center.

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