

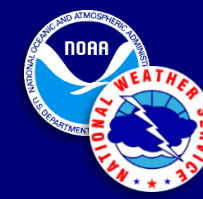
Hurricane Preparedness 2020 Season Recap 2021 Season Outlook

Hawaii Ocean Safety Team – June 17, 2021

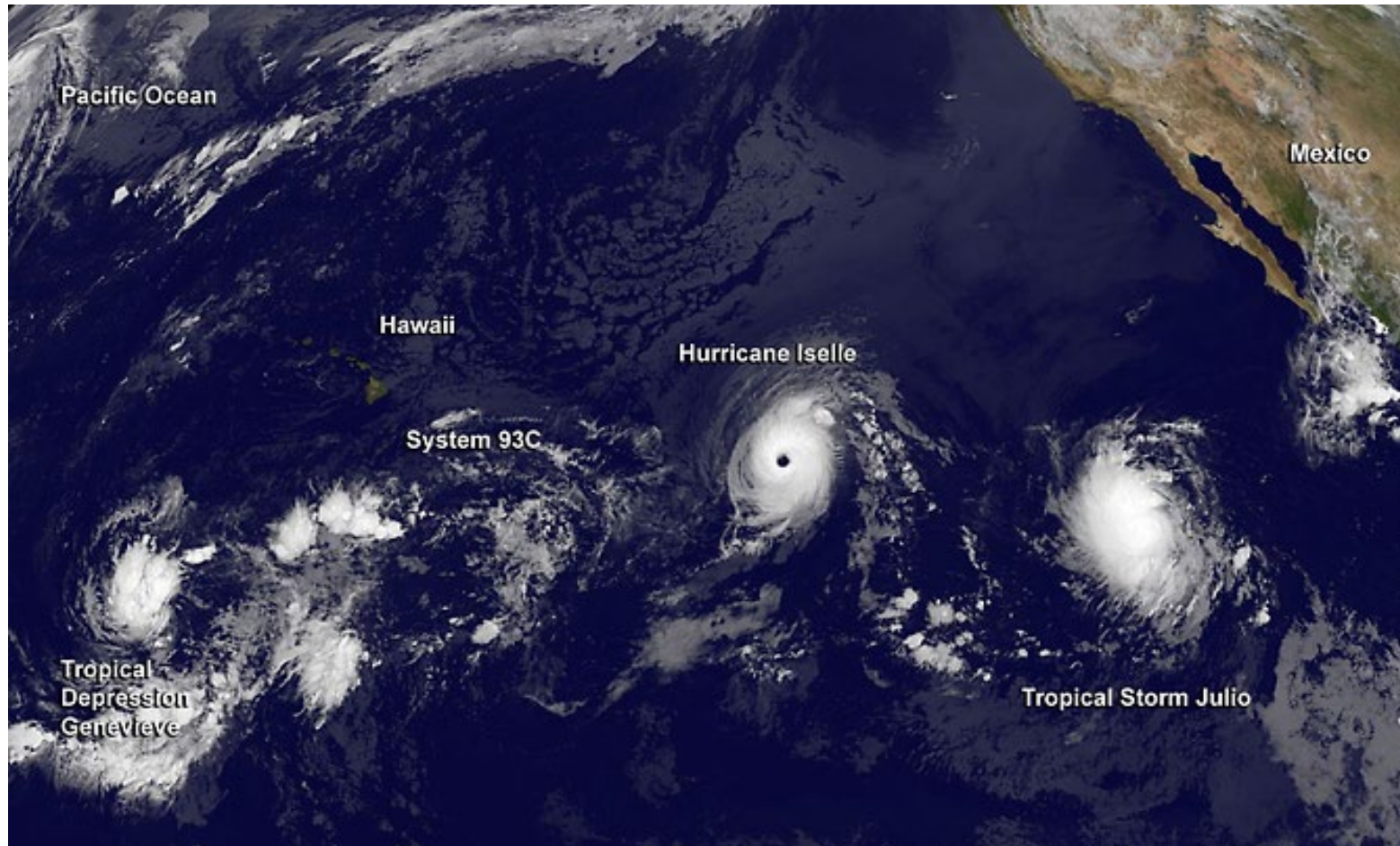
**John Bravender, Warning Coordination Meteorologist
Central Pacific Hurricane Center**

What is a Tropical Cyclone?

Hurricane, Tropical Storm, Tropical Depression



Central Pacific
Hurricane Center



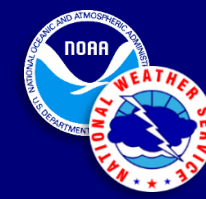
- Classified by maximum sustained surface wind speed (1-min average at 30 feet over open ocean)
 - Tropical depression: <39 mph (<34 kt)
 - Tropical storm: 39-73 mph (34-63 kt)
 - Hurricane: >74 mph (>64 kt)
 - Major hurricane: >111 mph (>96 kt)

GOES-West satellite image from August 4, 2014

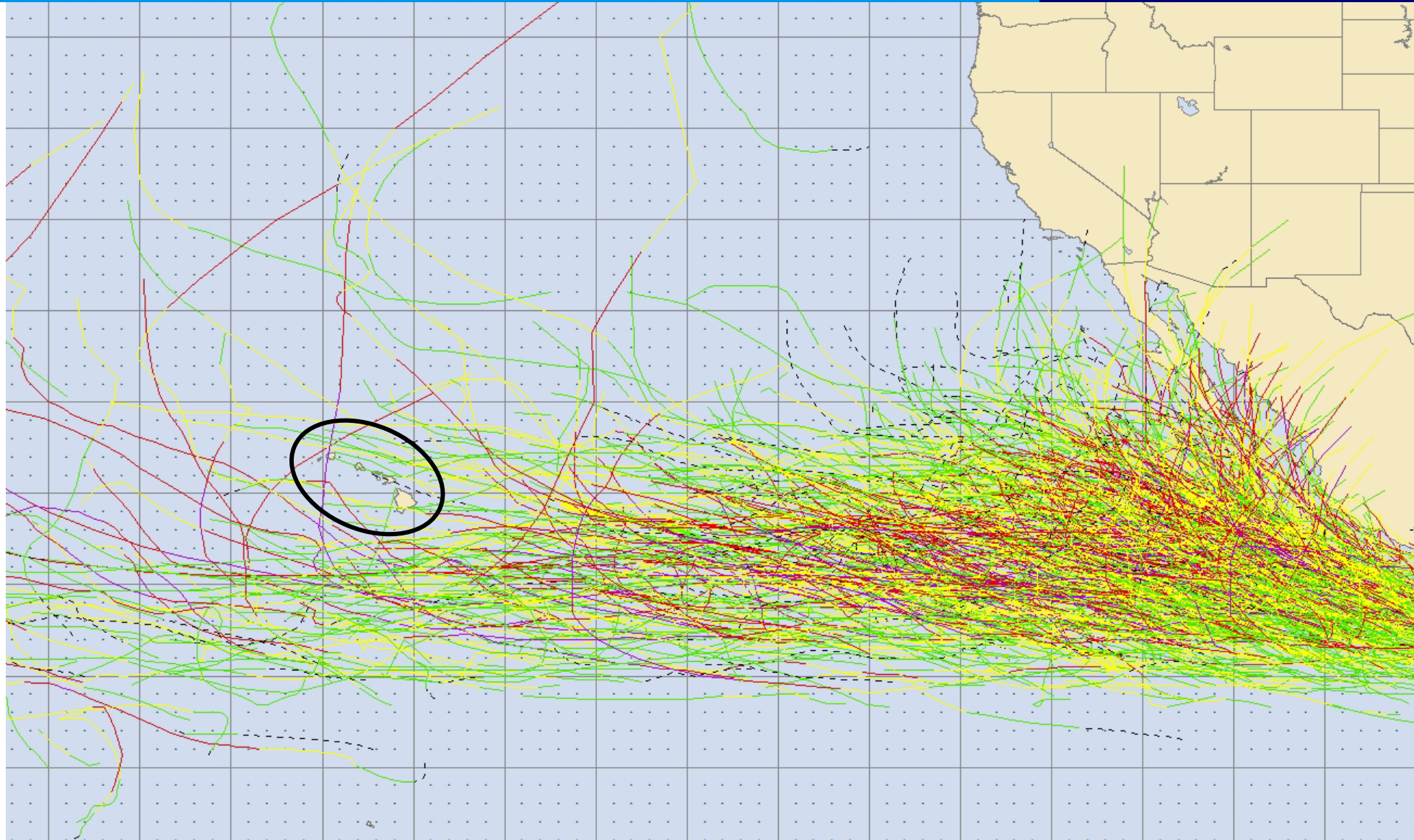
<https://www.nasa.gov/content/goddard/iselle-eastern-pacific-ocean/>

Tropical Cyclone Climatology

All tropical cyclone tracks from 1970-2016

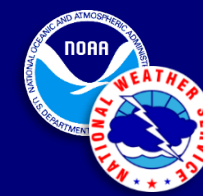


Central Pacific
Hurricane Center

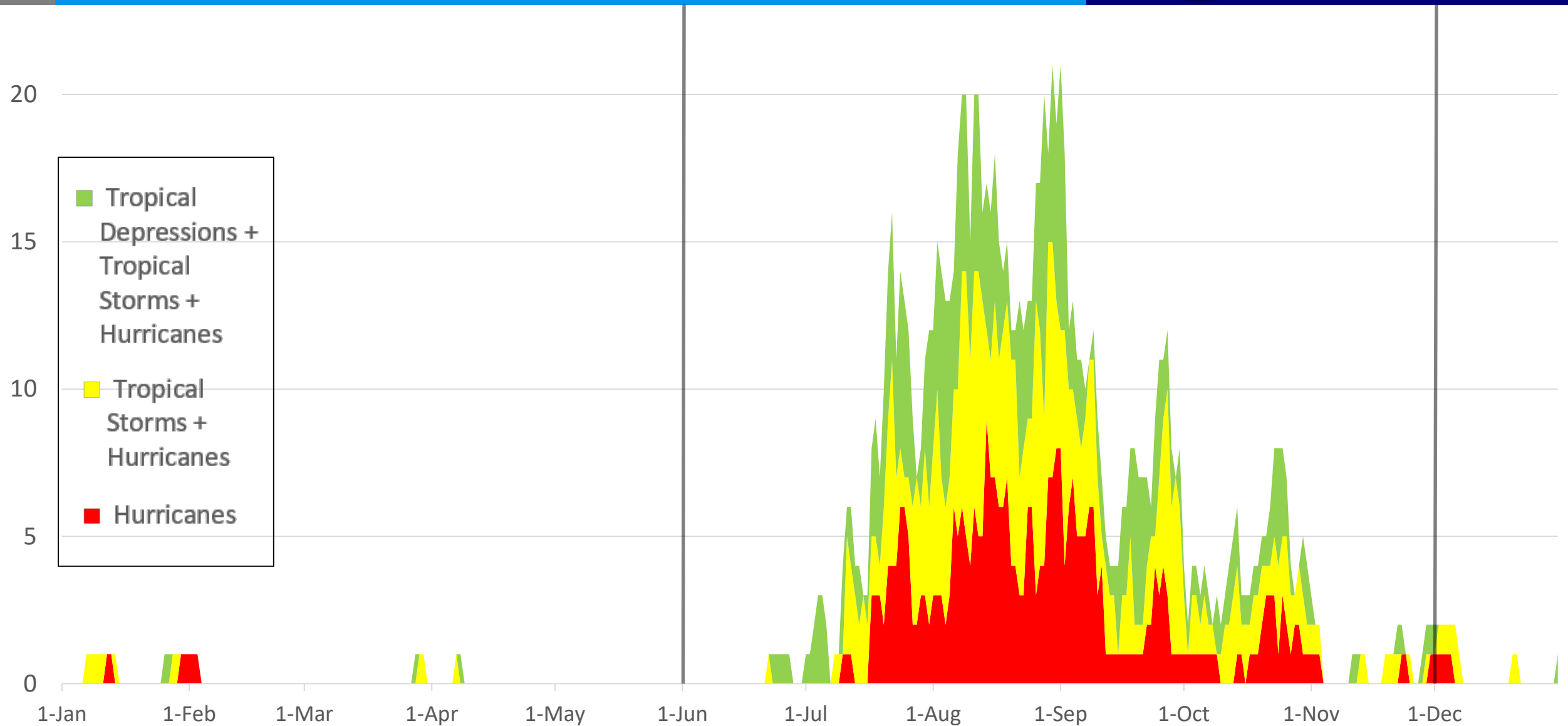


Tropical Cyclone Activity By Day

Hurricanes/Tropical Storms/Tropical Depressions 1950-2020

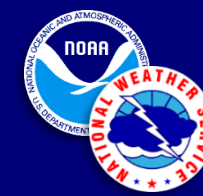


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Hurricane Center

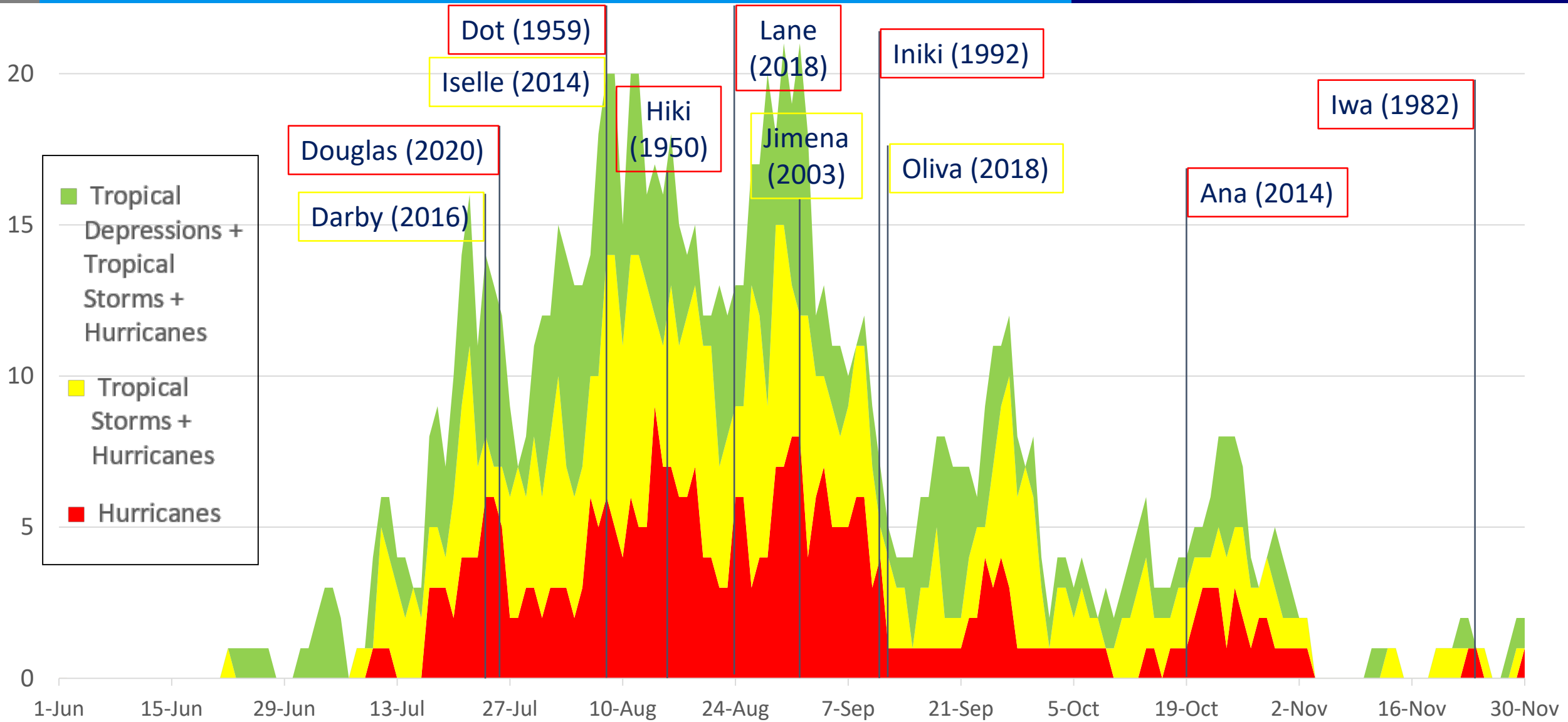


Tropical Cyclone Activity By Day

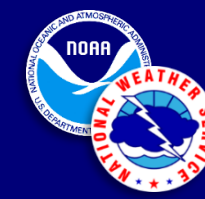
Hurricanes/Tropical Storms/Tropical Depressions 1950-2020



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Hurricane Center

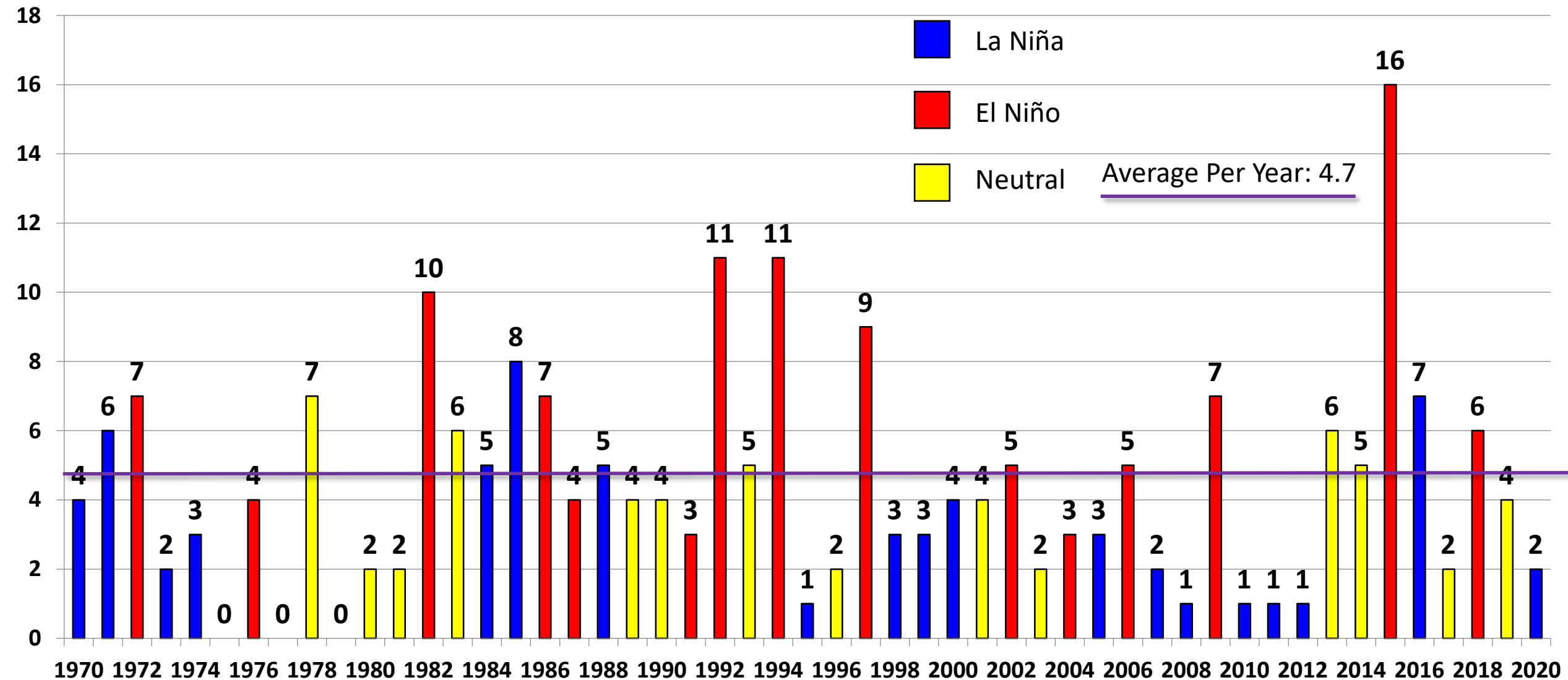


Annual Tropical Cyclones since 1970



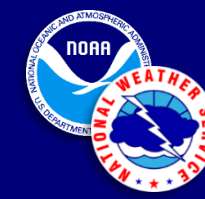
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Central Pacific Tropical Cyclones by Year (1970 – 2020)

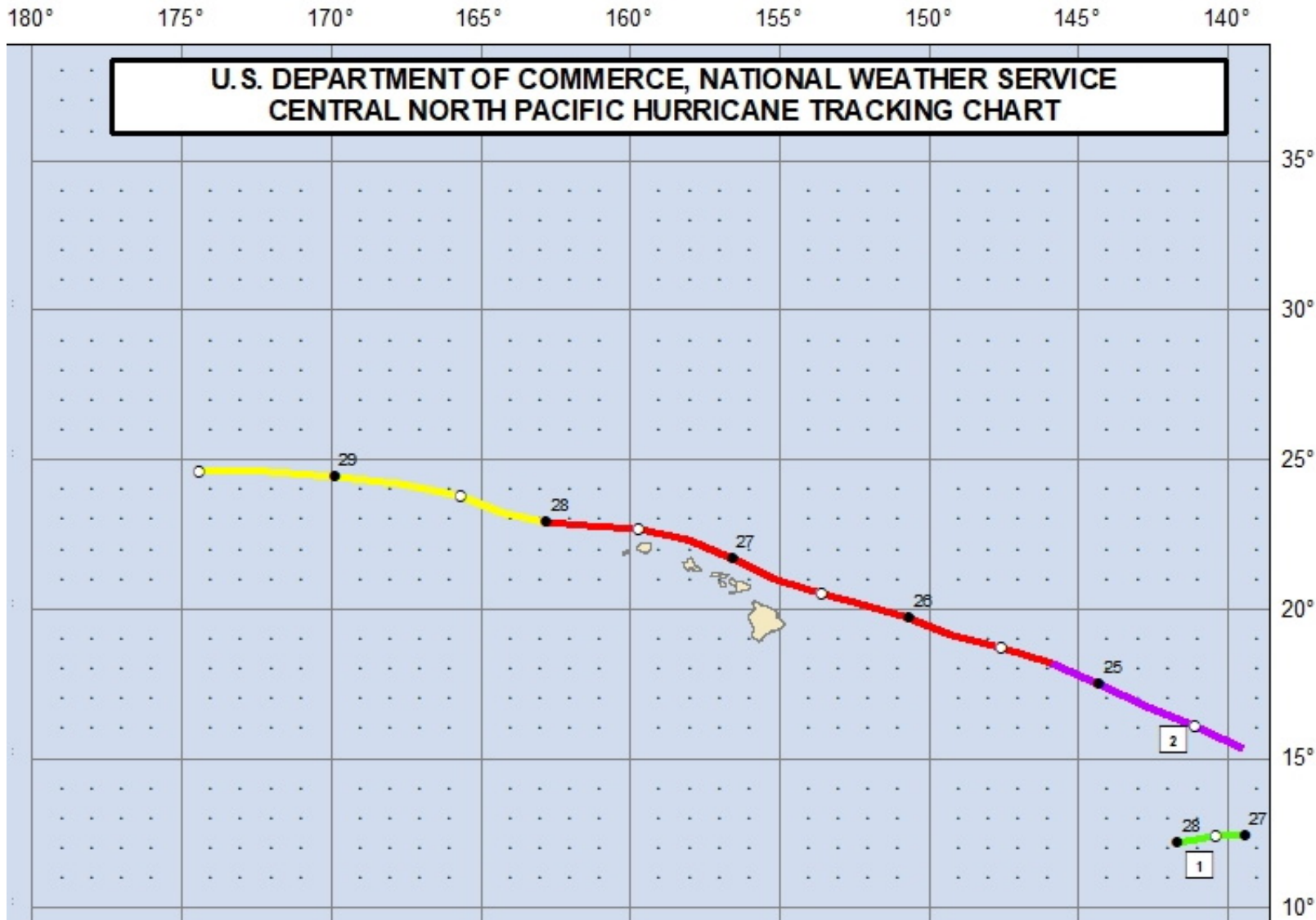


2020 Hurricane Season

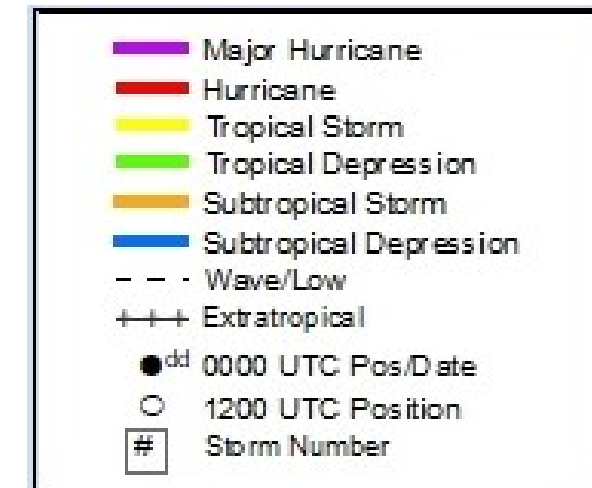
Two Tropical Cyclones



Central Pacific
Hurricane Center

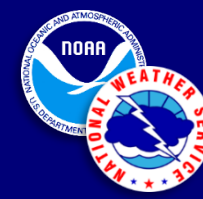


- 1. Boris**
Peak: Tropical Depression
Fri June 26 to Sat June 27
(06/27/20 to 06/28/20 UTC)
- 2. Douglas**
Peak: Category 4
Thu July 23 to Wed July 29
(07/24/20 to 07/29/20 UTC)

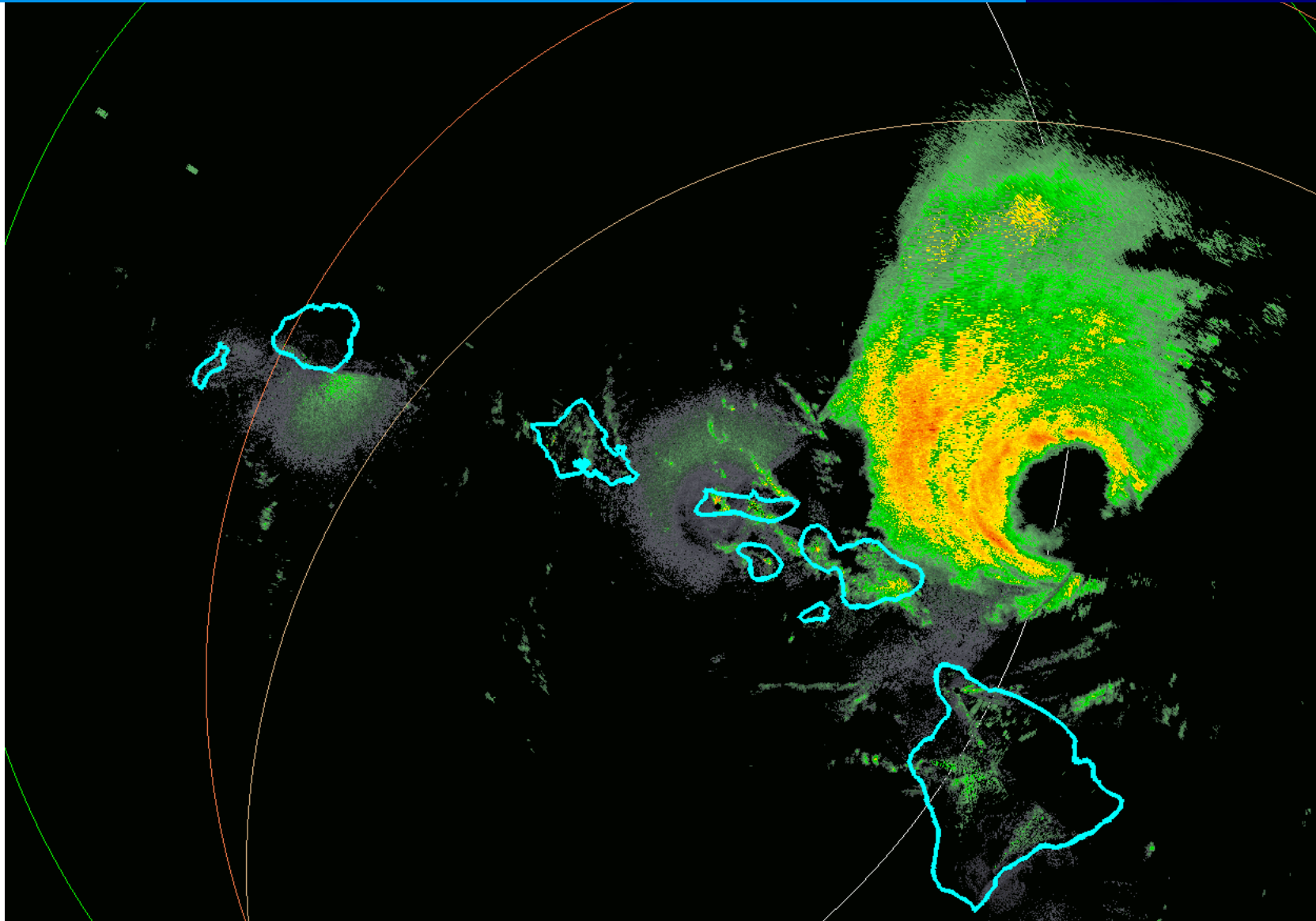


Hurricane Douglas – Radar Composite

Too close for comfort

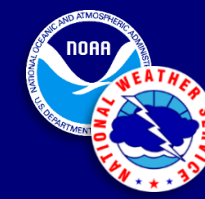


Central Pacific
Hurricane Center

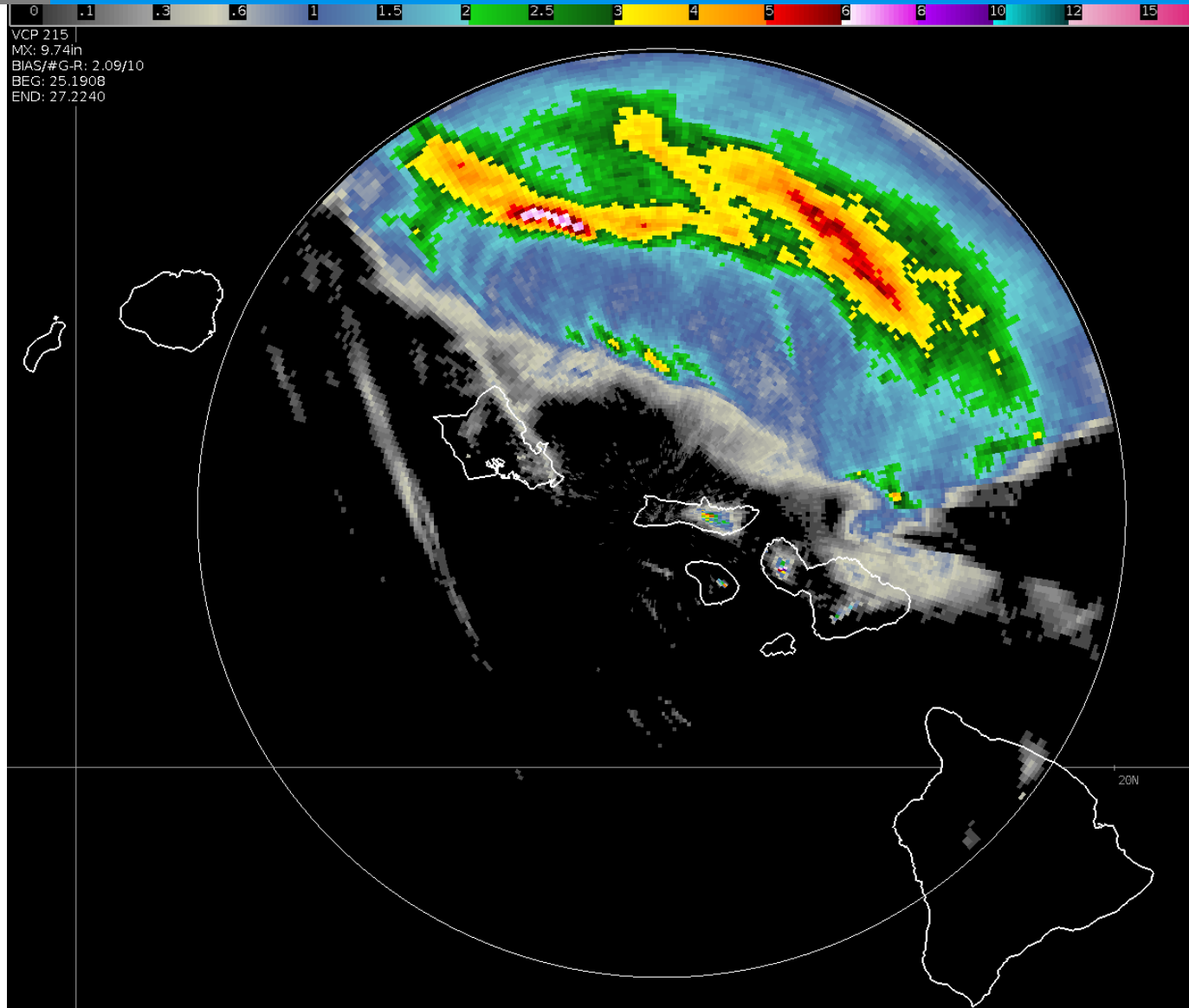


Hurricane Douglas – Radar Rainfall

Too close for comfort



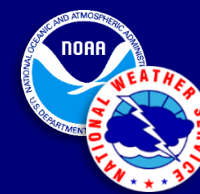
Central Pacific
Hurricane Center



- **Peak Rainfall**
48 hour rainfall 6 pm Sat 7/25
through 6 pm Mon 7/27:
 - **Kauai County:**
Mount Waialeale 6.35"
 - **Honolulu County:**
Kahuku 2.18"
 - **Maui County:**
Puu Kukui 5.20"
 - **Hawaii County:**
Kawainui Stream 3.39"

Historical El Niño/La Niña

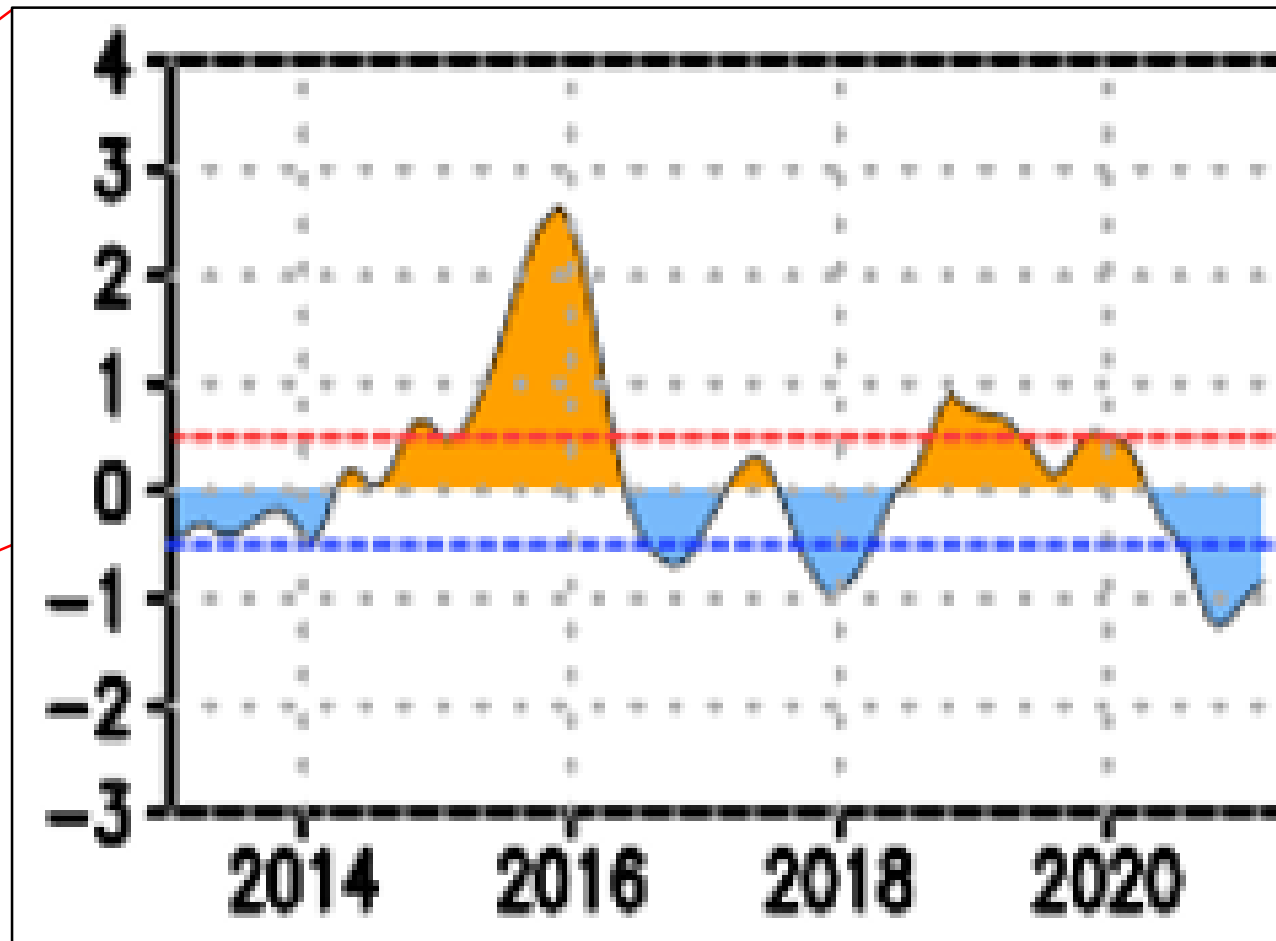
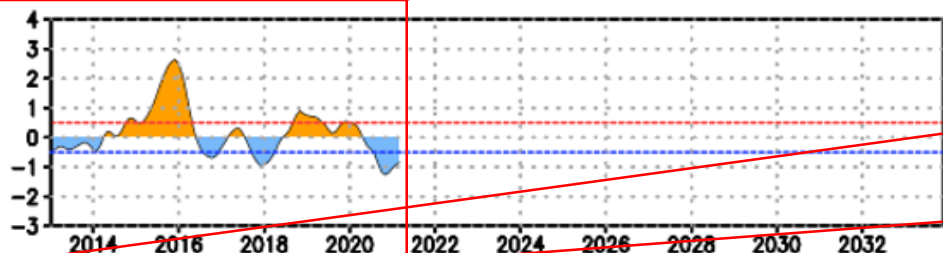
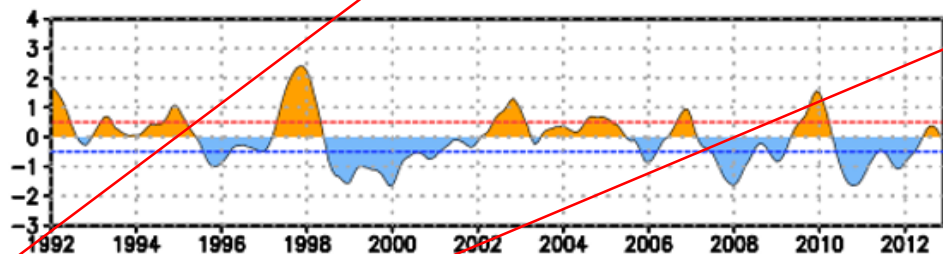
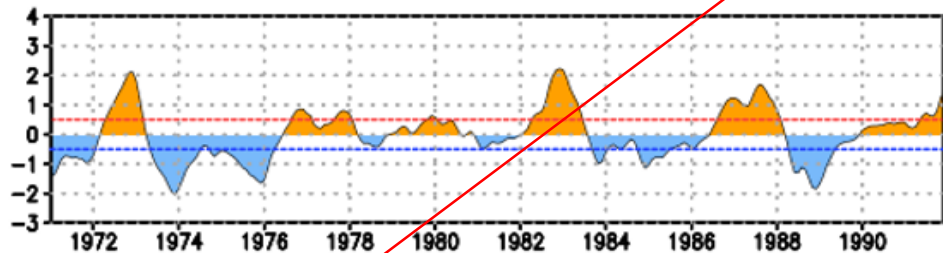
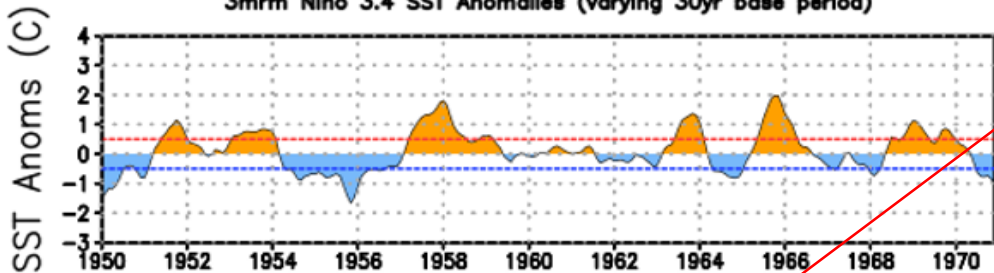
Oceanic Nino Index



Central Pacific
Hurricane Center

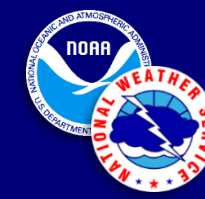
Oceanic Nino Index (ERSST.v5 ONI)

3mm Nino 3.4 SST Anomalies (varying 30yr base period)



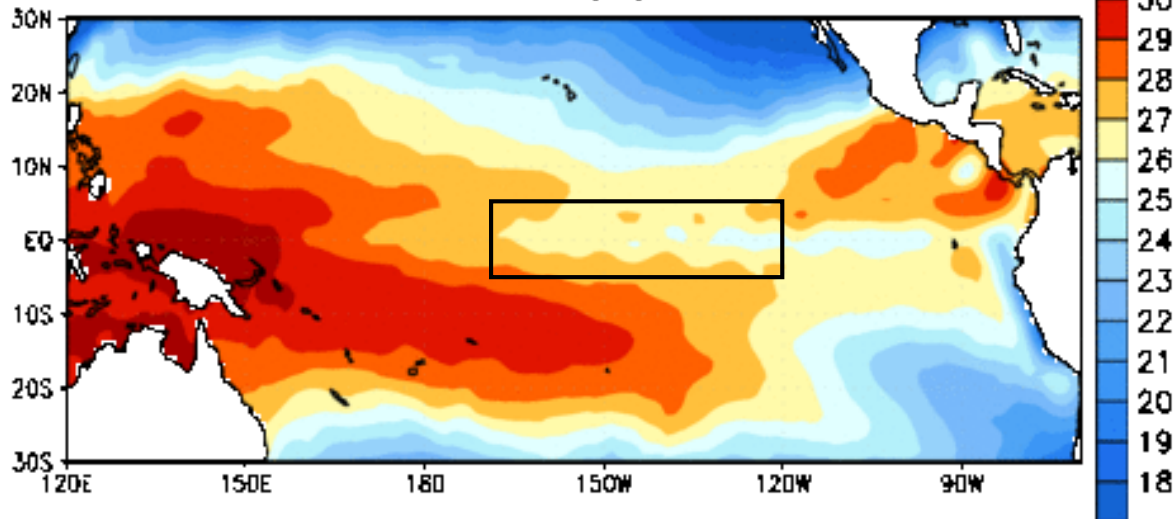
Recent Ocean Temperatures

Weekly Sea Surface Temperatures and SST Anomalies

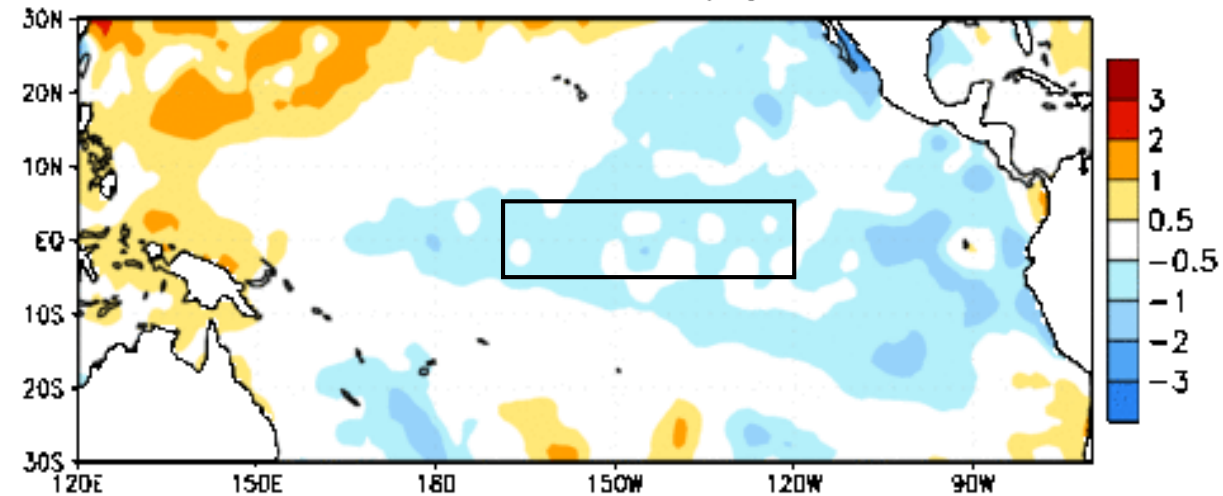


Central Pacific
Hurricane Center

Week centered on 24 MAR 2021
SST (°C)

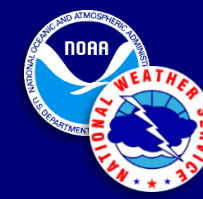


Week centered on 24 MAR 2021
SST Anomalies (°C)



2021 Hurricane Season – Outlook

Central Pacific: 2 to 5 Tropical Cyclones



Central Pacific
Hurricane Center



NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Central Pacific Hurricane Center/Climate Prediction Center



2021 Central Pacific Season Outlook

2-5 Tropical Cyclones

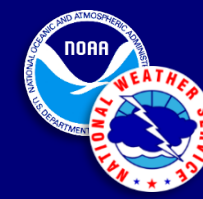
80% chance of a near to below normal season

20% chance of an above normal season

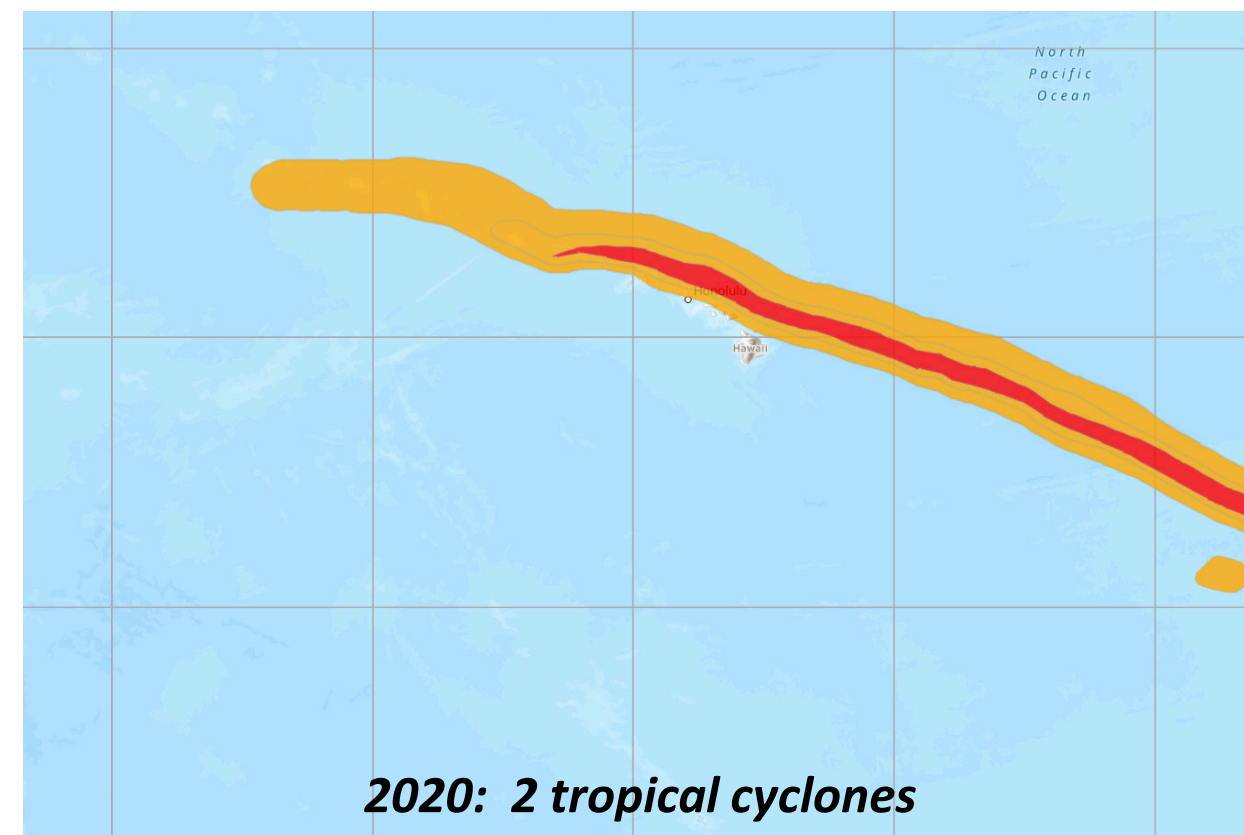
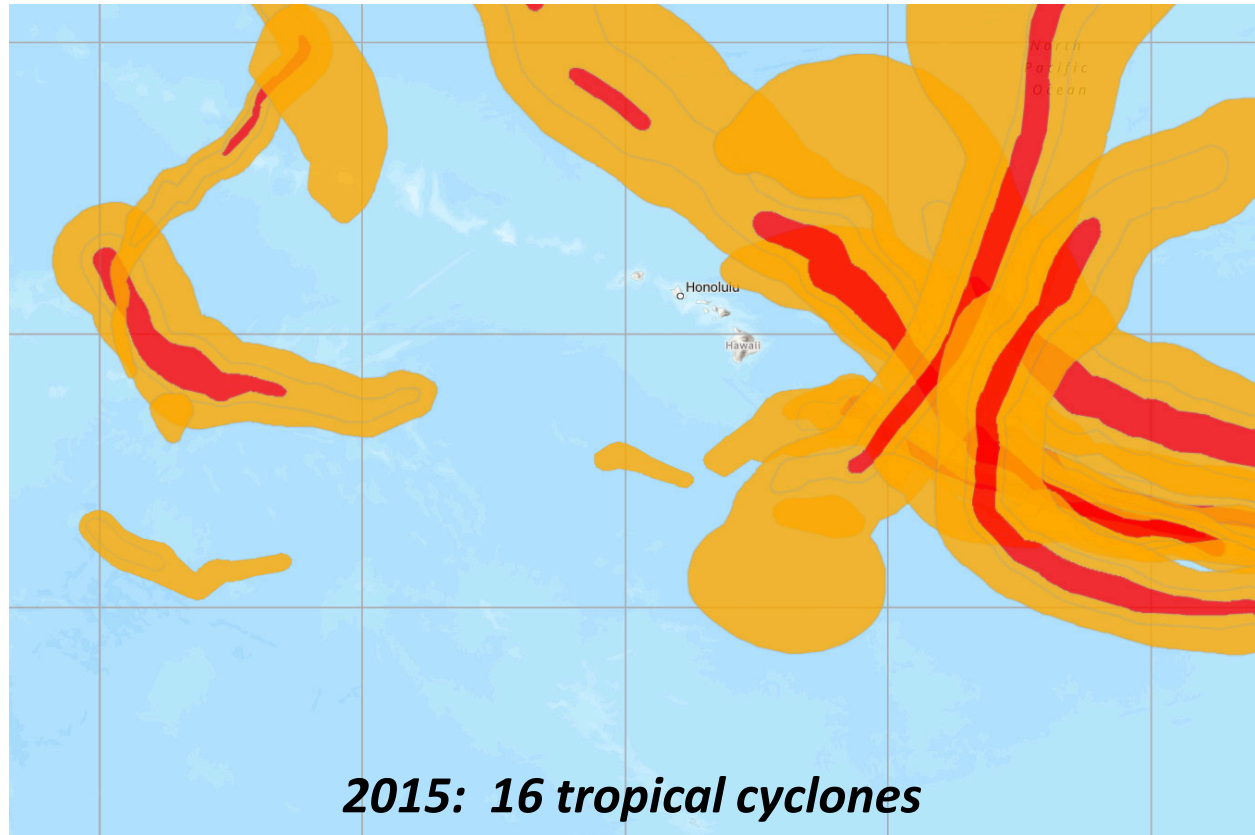
- **ENSO-Neutral through summer; possible transition back to La Niña this winter**
- ***Does not address potential impacts to Hawaii***

Composite Wind Field – 2015 vs 2020

Cliché: “It only takes one”



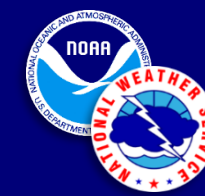
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Hurricane Center



- **Orange: tropical storm (≥ 39 mph); Red: hurricane (≥ 74 mph)**

Tropical Weather Outlook

Issued between June 1 and November 30



Central Pacific Hurricane Center

Tropical Weather Outlook
NWS Central Pacific Hurricane Center Honolulu HI
200 PM HST Wed Sep 26 2018

For the central North Pacific...between 140W and 180W:

1. Showers and thunderstorms associated with a surface trough located about 990 miles southeast of Hilo, Hawaii are becoming slightly more organized, but continue to flare up and down in coverage and intensity. A low-level circulation center is now apparent on visible satellite imagery. Environmental conditions remain conducive for gradual development of this system over the next few days as it moves westward across the central Pacific.

* Formation chance through 48 hours...low...30 percent.

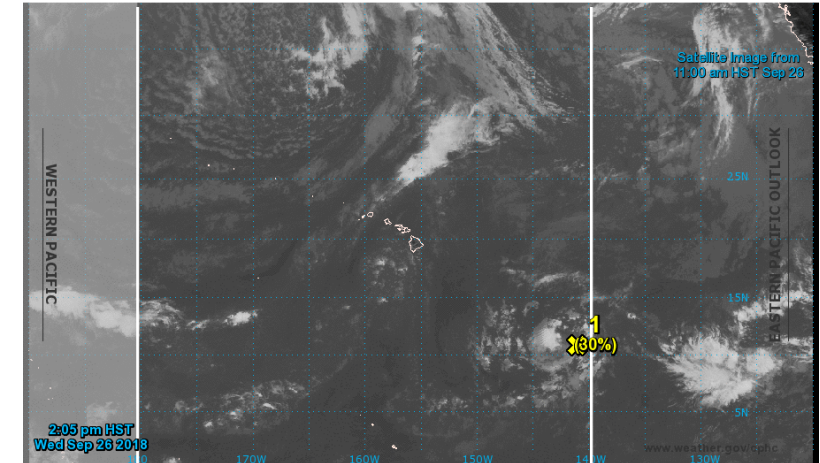
* Formation chance through 5 days...high...70 percent.

Elsewhere, no tropical cyclones are expected during the next 5 days.

Forecaster TS



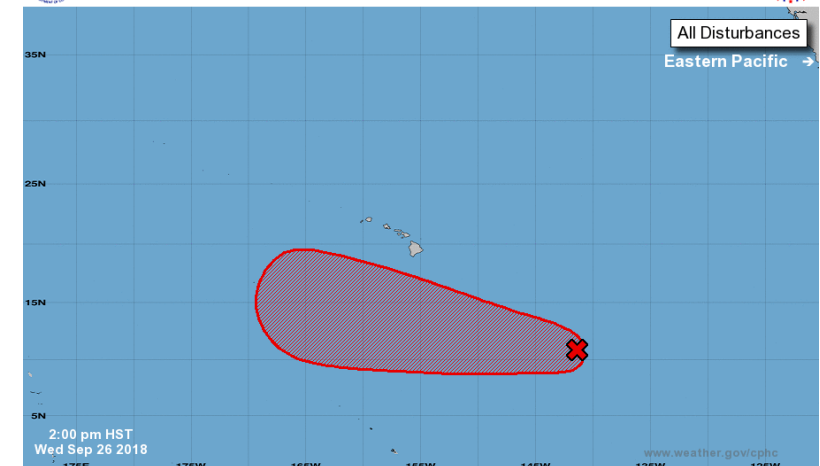
Two-Day Graphical Tropical Weather Outlook
Central Pacific Hurricane Center Honolulu, Hawaii



Current Disturbances and Two-Day Cyclone Formation Chance: < 40% 40-60% > 60%
Tropical or Sub-Tropical Cyclone: Depression Storm Hurricane
 Post-Tropical Cyclone or Remnants



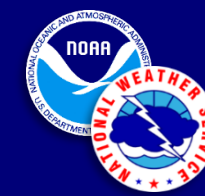
Five-Day Graphical Tropical Weather Outlook
Central Pacific Hurricane Center Honolulu, Hawaii



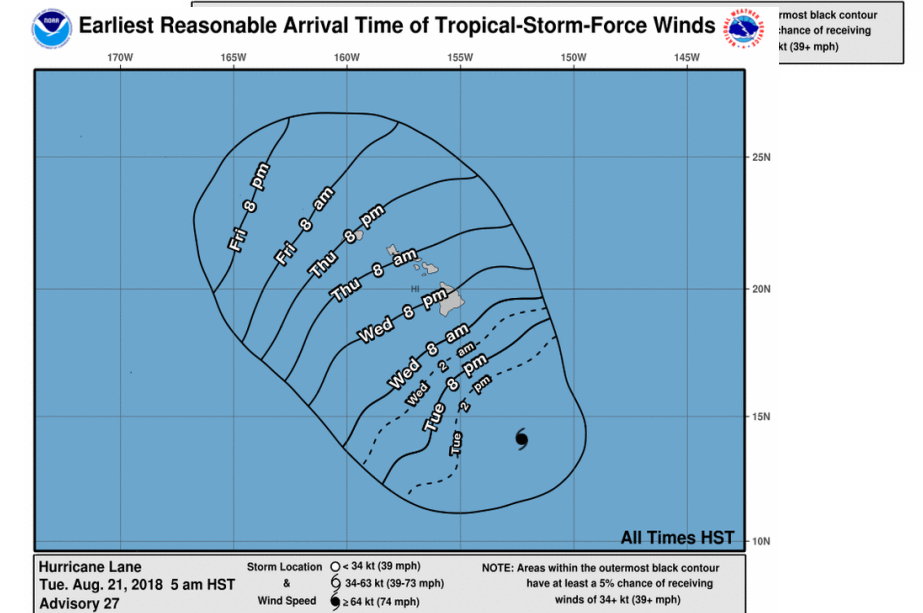
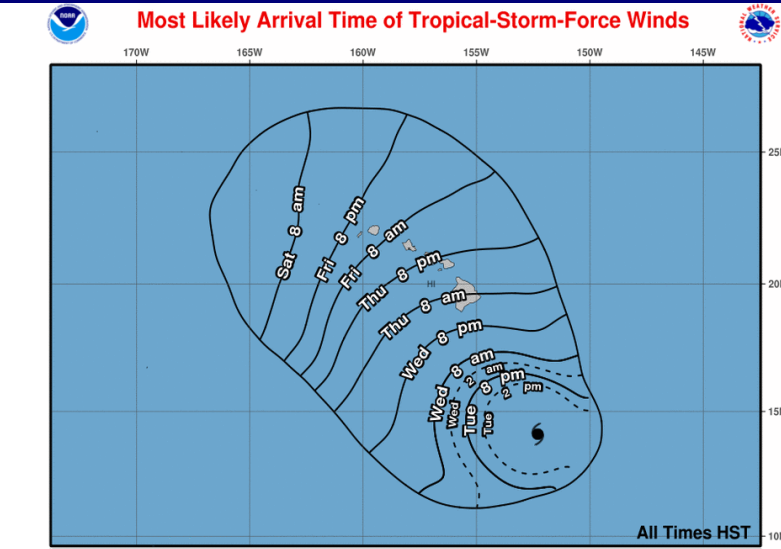
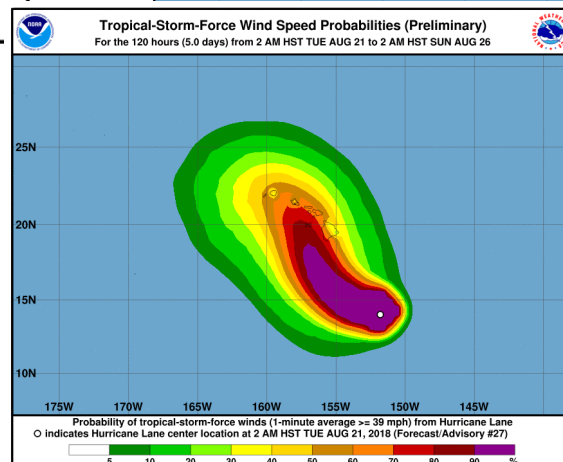
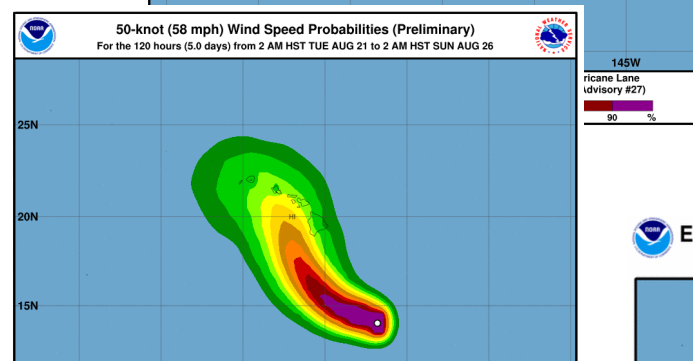
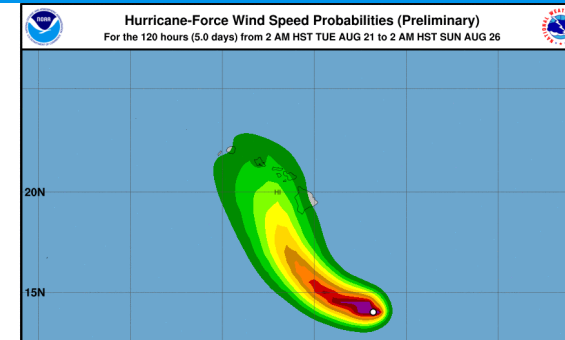
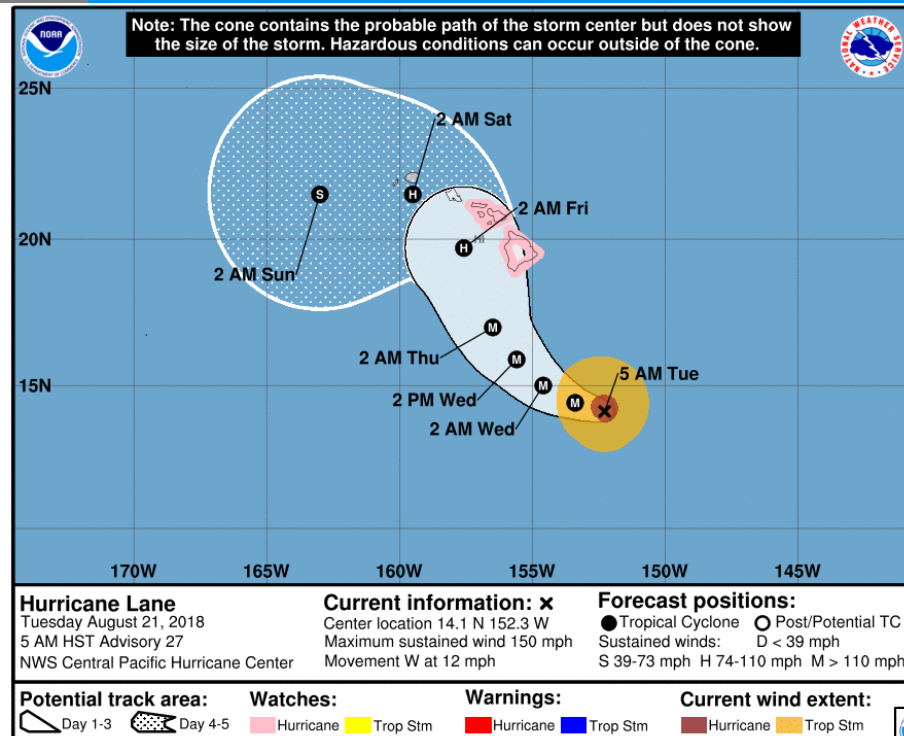
Current Disturbances and Five-Day Cyclone Formation Chance: < 40% 40-60% > 60%
Tropical or Sub-Tropical Cyclone: Depression Storm Hurricane
 Post-Tropical Cyclone or Remnants

Tropical Cyclone Graphics

Hurricane Lane Example – Tuesday Aug 21, 2018, 5 am HST

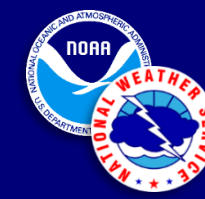


Central Pacific Hurricane Center



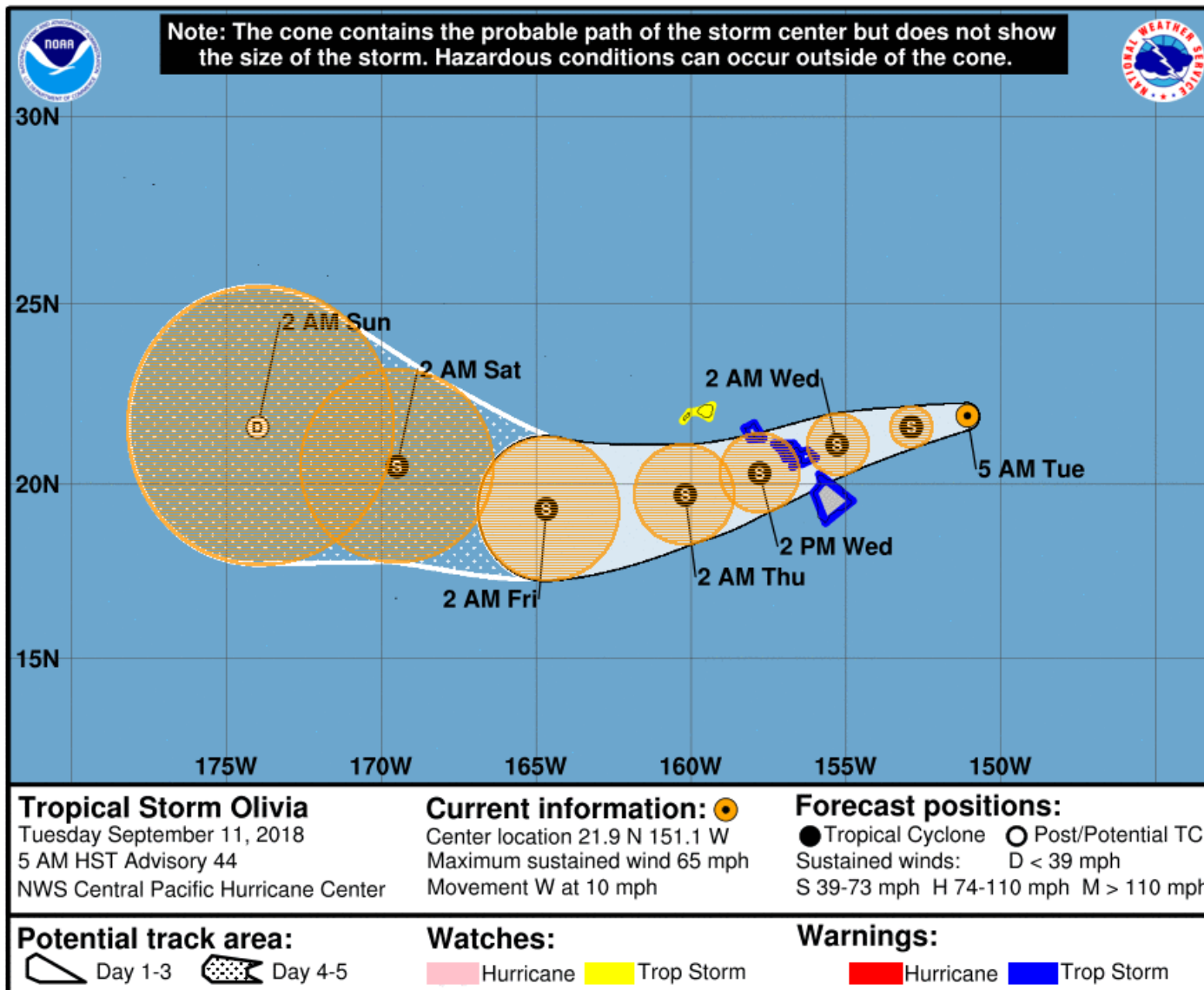
- Track, Wind Speed Probabilities, Time of Arrival
- Updated every 6 hours: 5 am/pm, 11 am/pm HST

Graphics – Error Cone Definition



Central Pacific
Hurricane Center

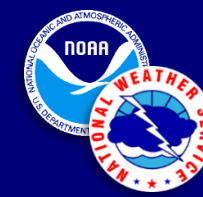
How do we get the error cone?



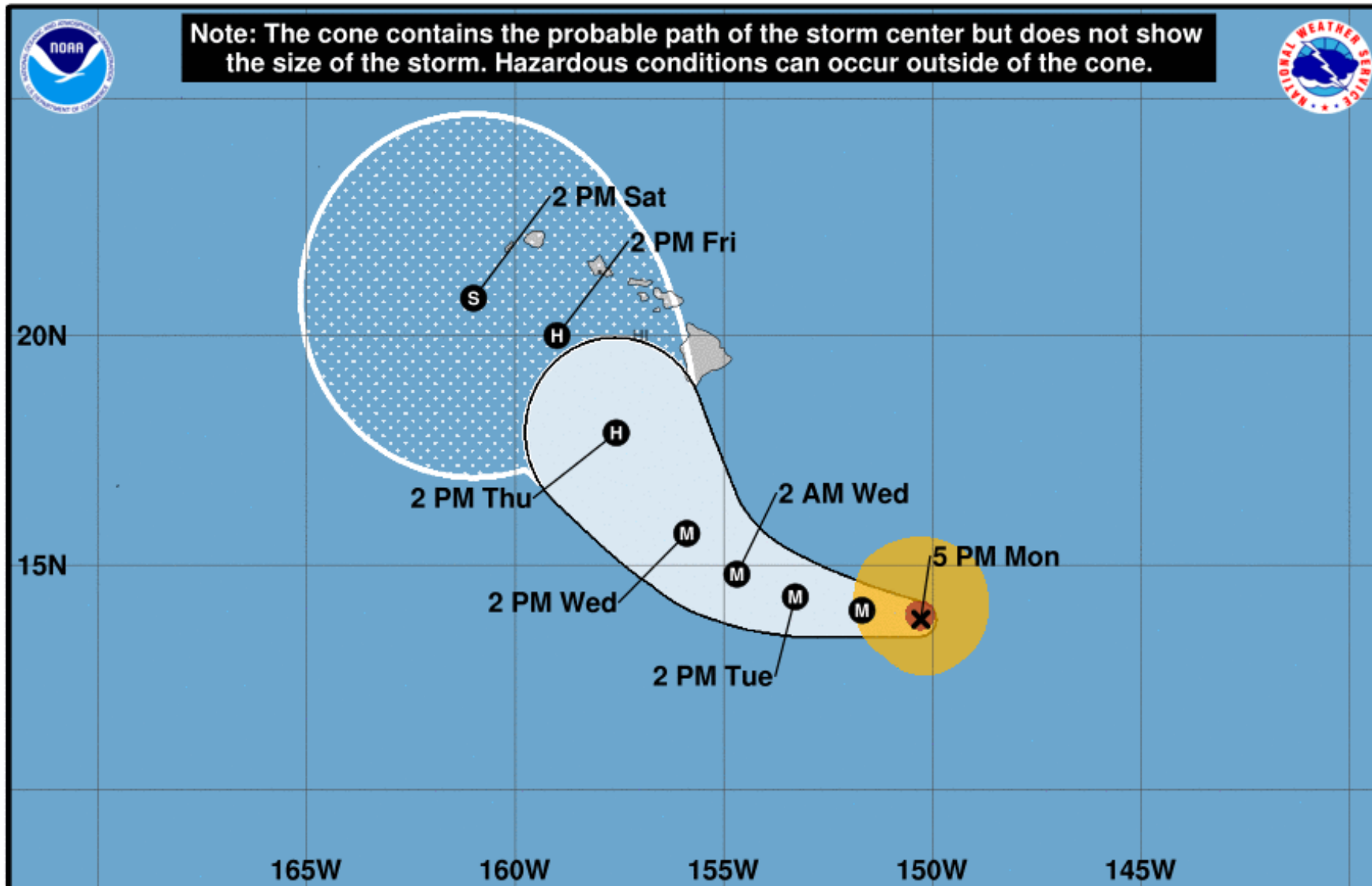
- Based on forecast errors over the past 5 years
- Draw a circle around each forecast point and connect them
- 2 out of 3 chance the center of the TC will be within the circle
- 1 out of 3 chance the center will be OUTSIDE of the circle

Error Cone – What about impacts?

Hurricane Lane – Monday Aug 20, 2018, 5 pm HST



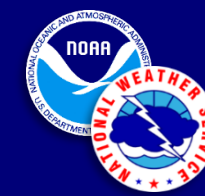
Central Pacific
Hurricane Center



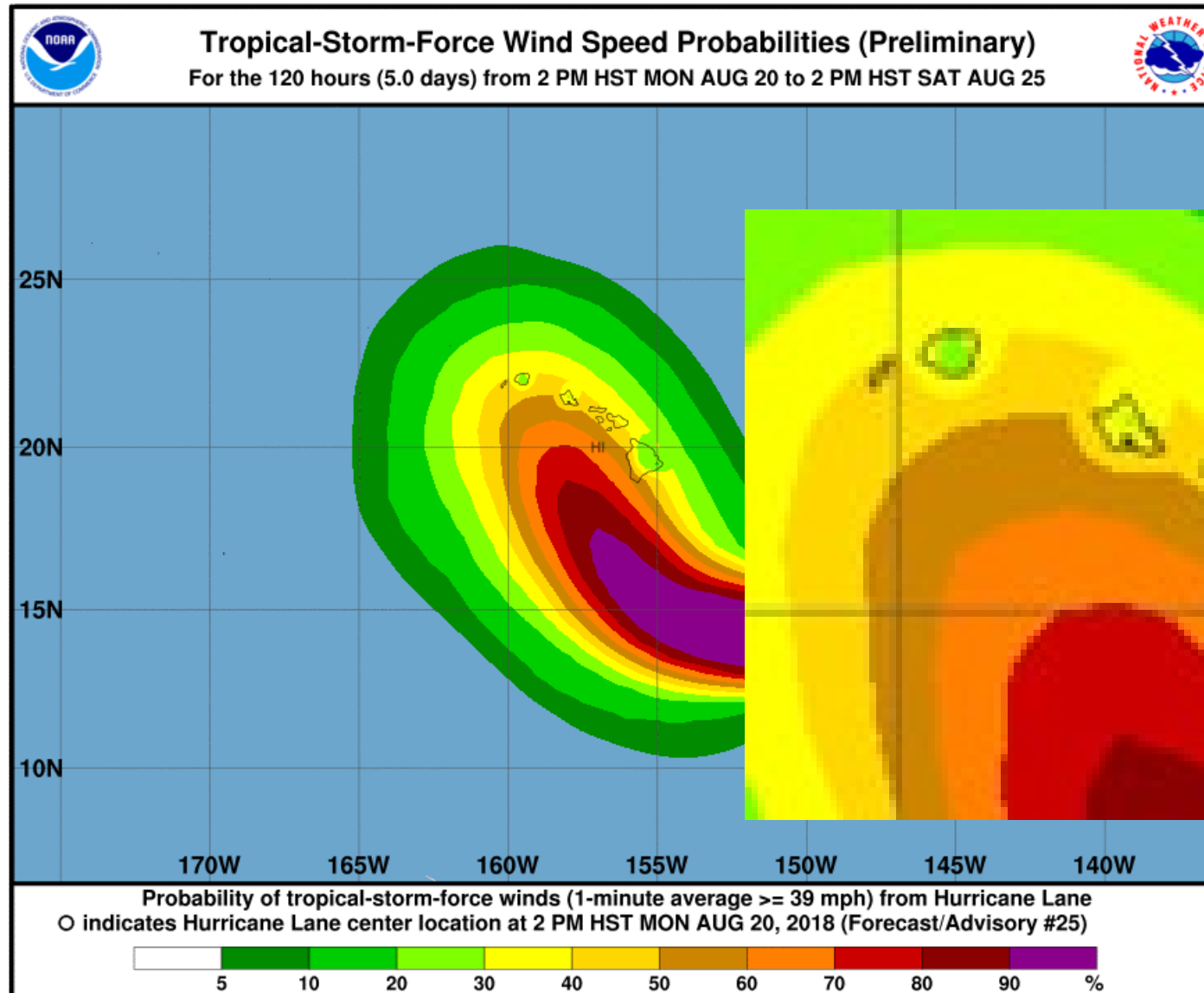


Graphics – Wind Speed Probabilities

Hurricane Lane – Monday Aug 20, 2018, 5 pm HST

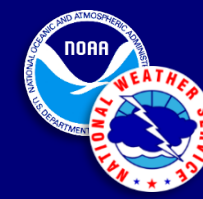


Central Pacific
Hurricane Center

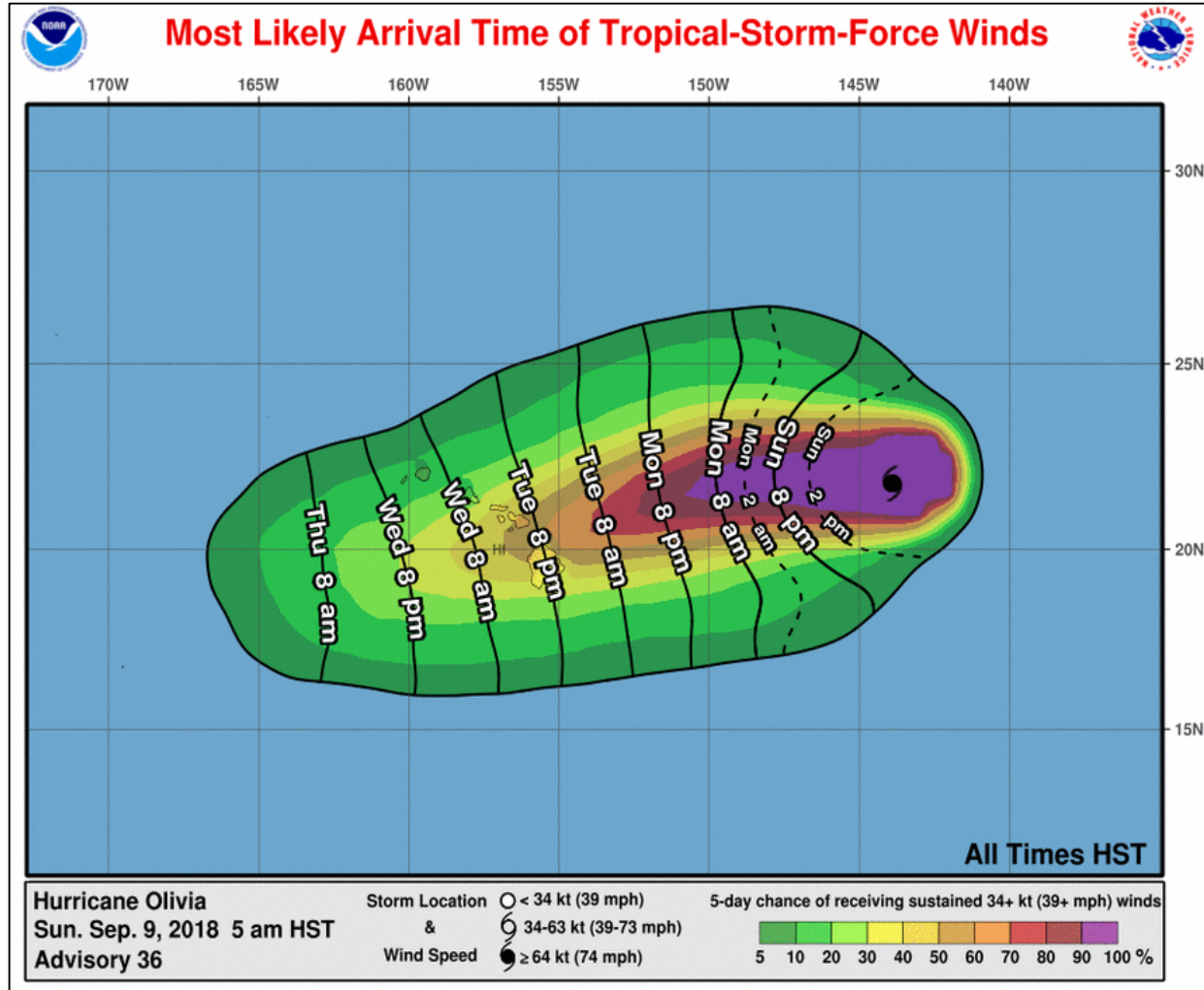
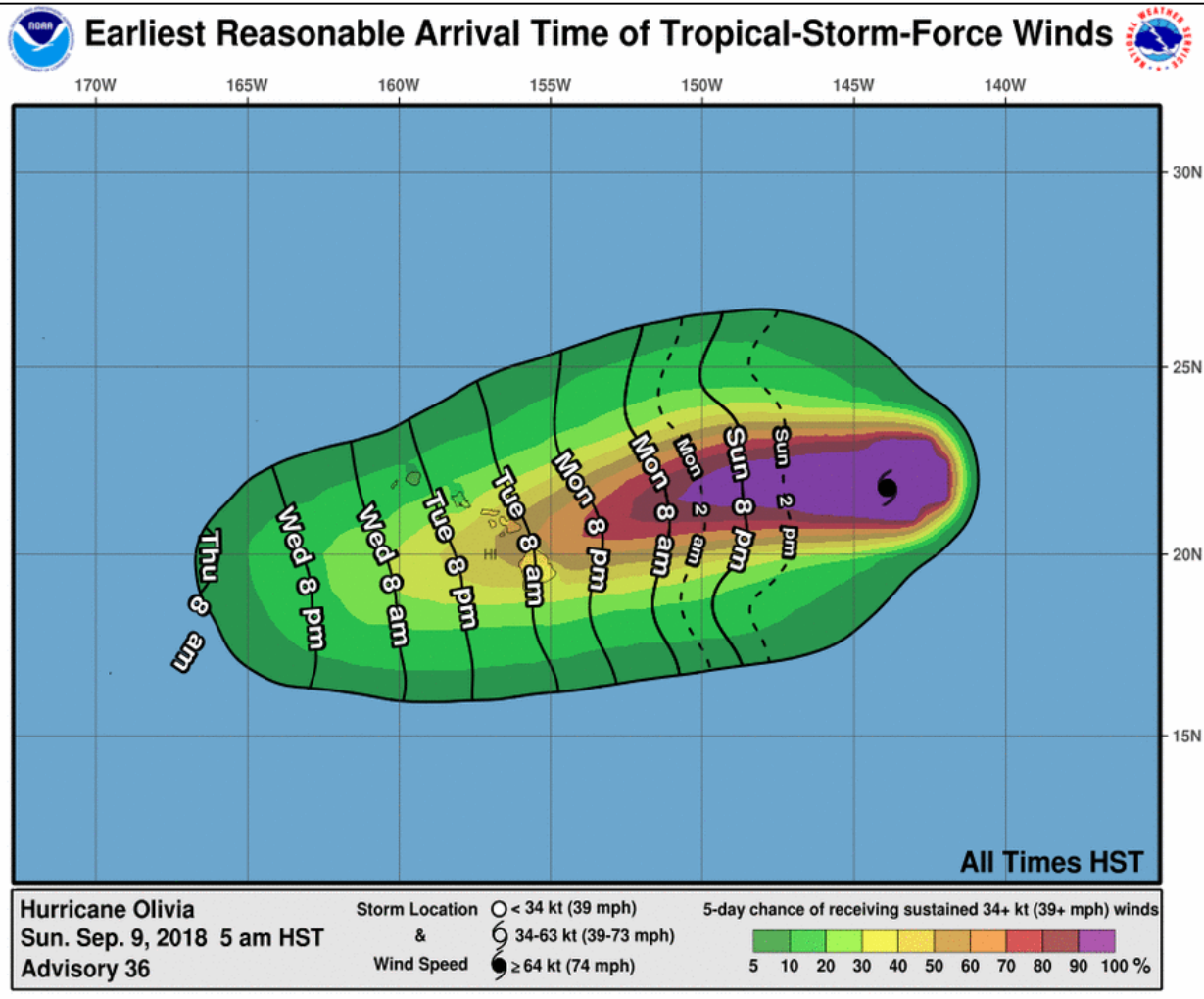


Time of Arrival

Earliest Reasonable vs Most Likely

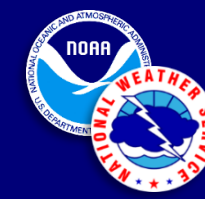


Central Pacific
Hurricane Center

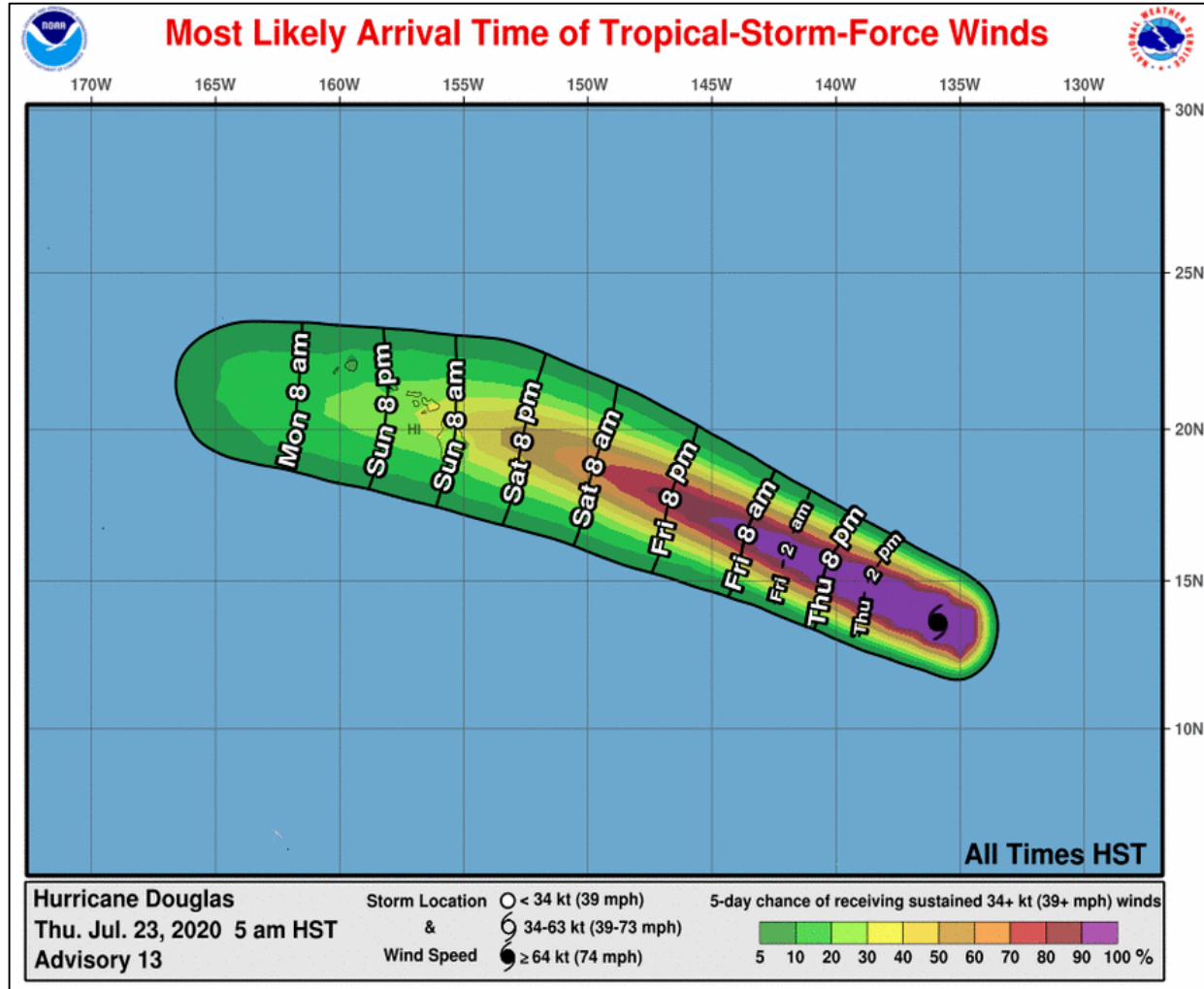
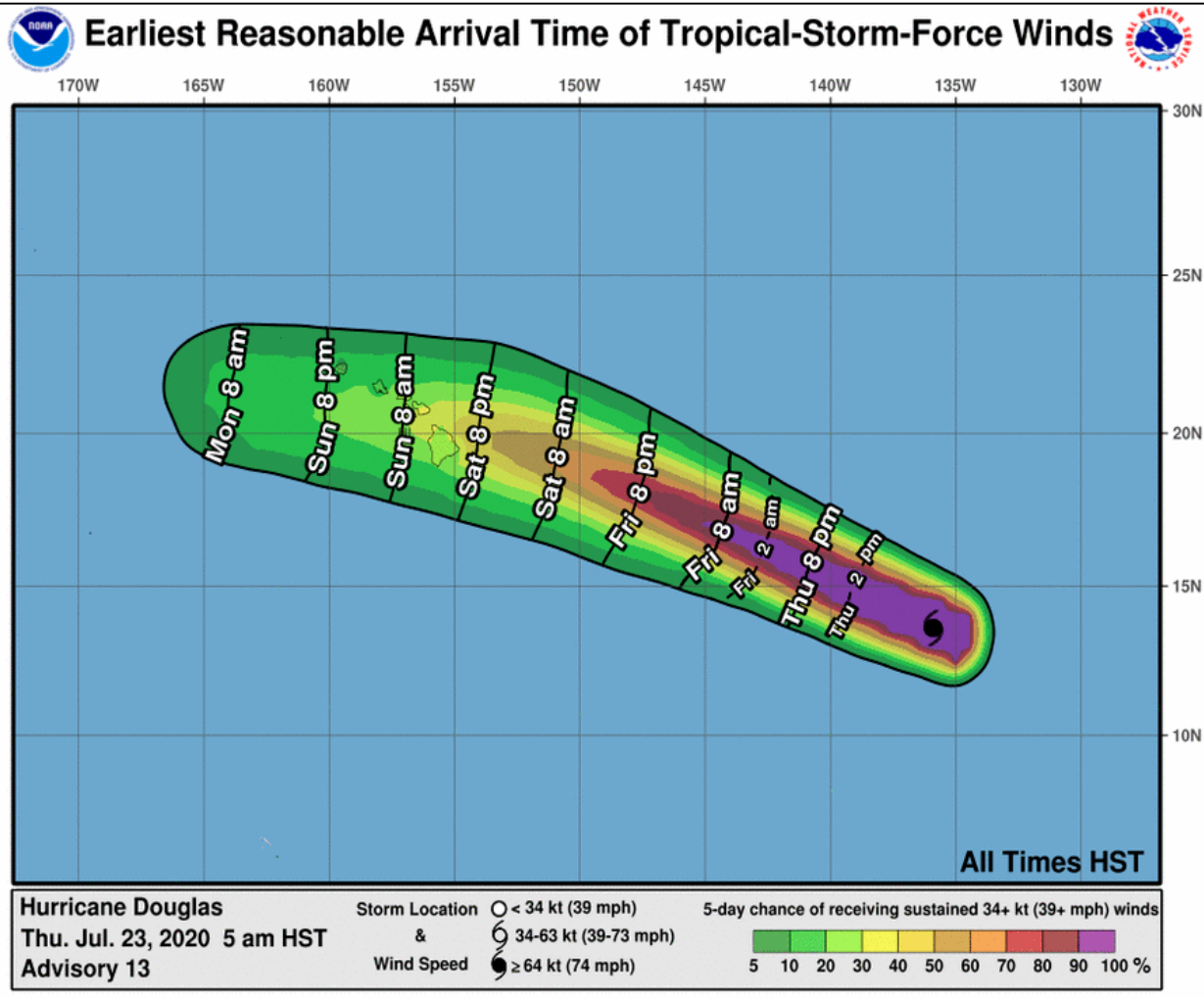


Time of Arrival

Earliest Reasonable vs Most Likely

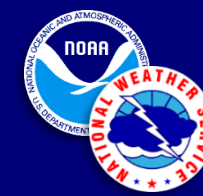


Central Pacific
Hurricane Center

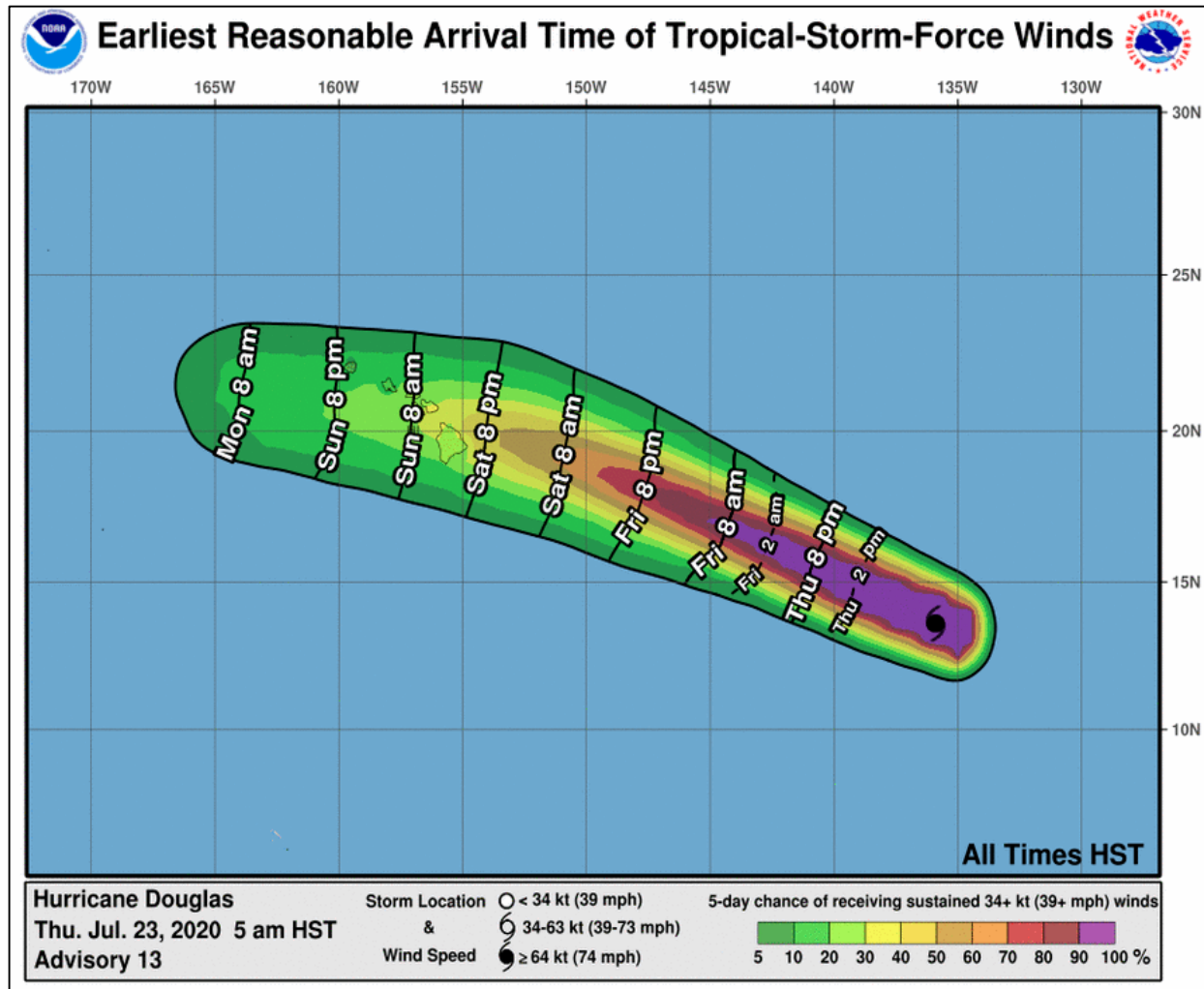
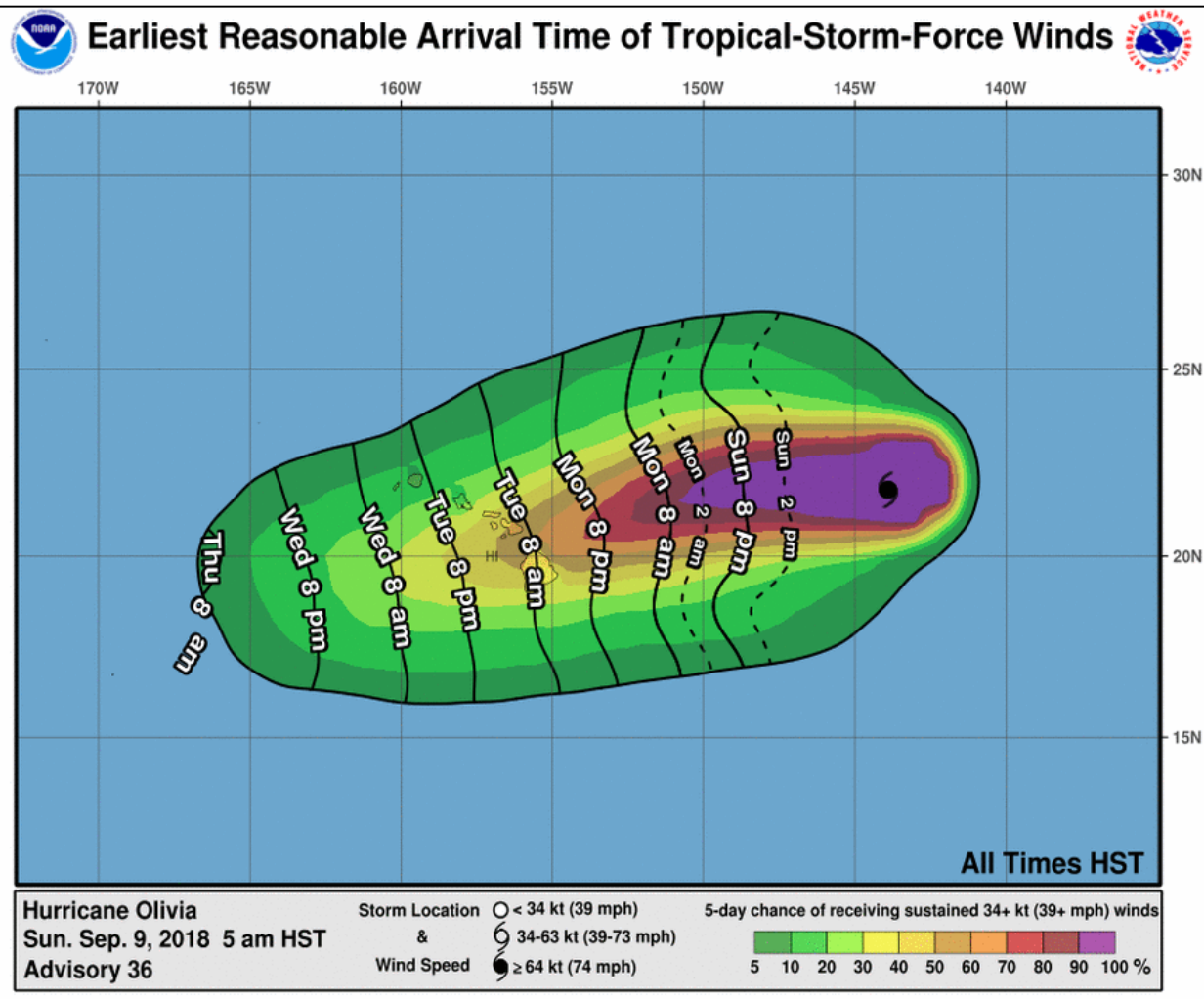


Wind Speed Probabilities

Model spread reflected in Monte Carlo simulation

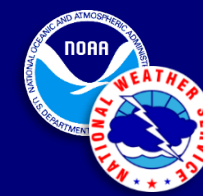


Central Pacific
Hurricane Center



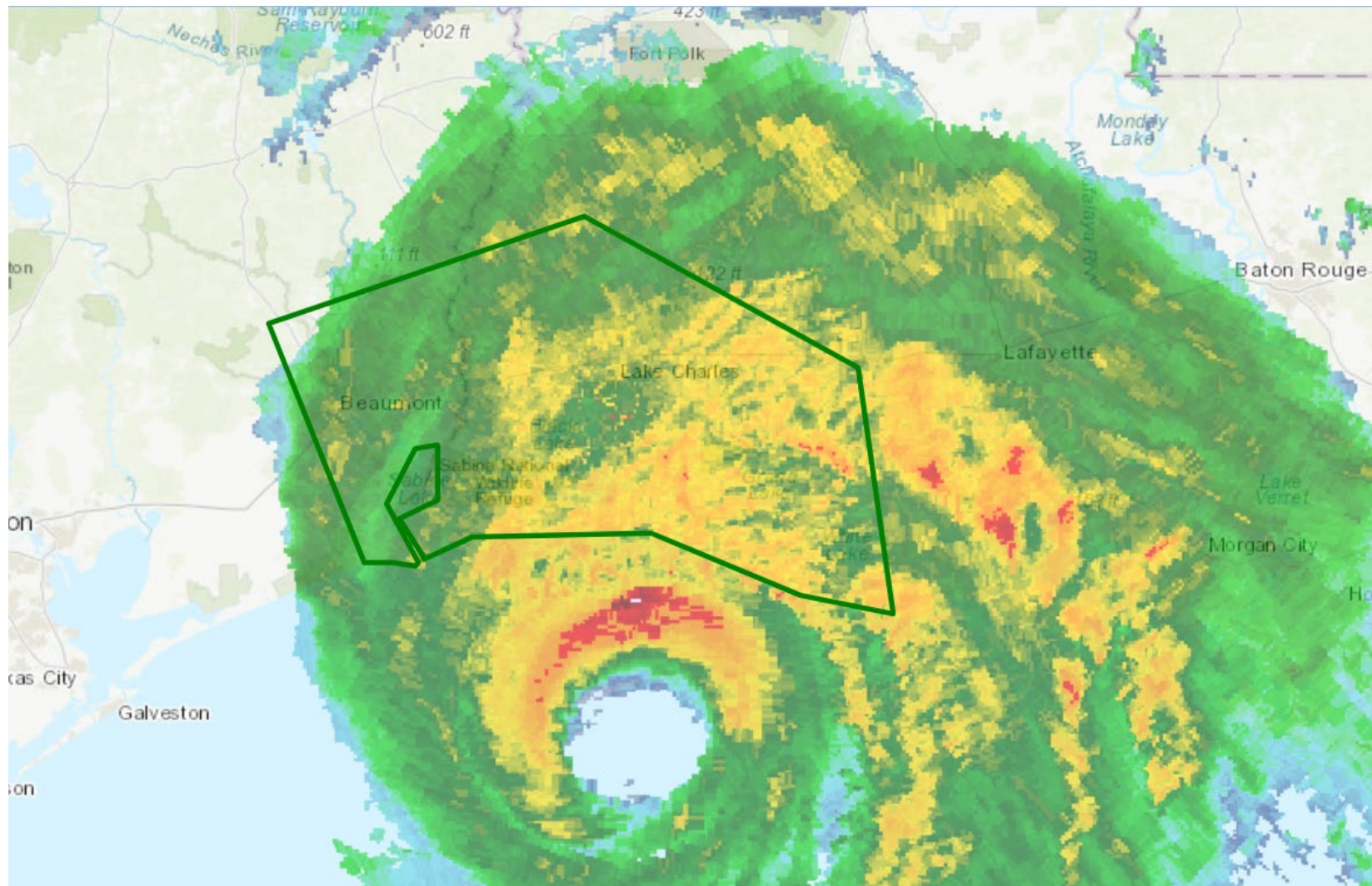
Extreme Wind Warning (EWW)

EWW example from Hurricane Laura



Central Pacific
Hurricane Center

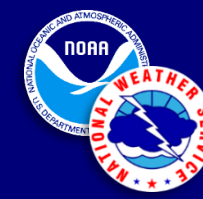
- **Short-fused warning (2 hours or less) for a major hurricane eyewall landfall**
- **EAS/WEA activation**
- **Approved for Hawaii as of June 1st**



https://www.weather.gov/media/notification/scn21-40hfo_extreme_wind.pdf

Extreme Wind Warning (EWW)

EWW text example – Hurricane Michael



Central Pacific
Hurricane Center

WFUS52 KTAE 101511
EWWTAE
FLC005-037-045-101815-
/O.NEW.KTAE.EW.W.0001.181010T1511Z-181010T1815Z/

BULLETIN - EAS ACTIVATION REQUESTED
Extreme Wind Warning
National Weather Service Tallahassee FL
1111 AM EDT WED OCT 10 2018

The National Weather Service in Tallahassee has issued a

- * Extreme Wind Warning for...
Gulf County in the Panhandle of Florida...
Southern Bay County in the Panhandle of Florida...
Southwestern Franklin County in Big Bend of Florida...

* Until 215 PM EDT/115 PM CDT/.

- * At 1109 AM EDT/1009 AM CDT/, National Weather Service Doppler radar indicated extreme winds in excess of 130 mph, associated with the eyewall of Hurricane Michael, were moving onshore. THIS IS AN EXTREMELY DANGEROUS AND LIFE-THREATENING SITUATION!

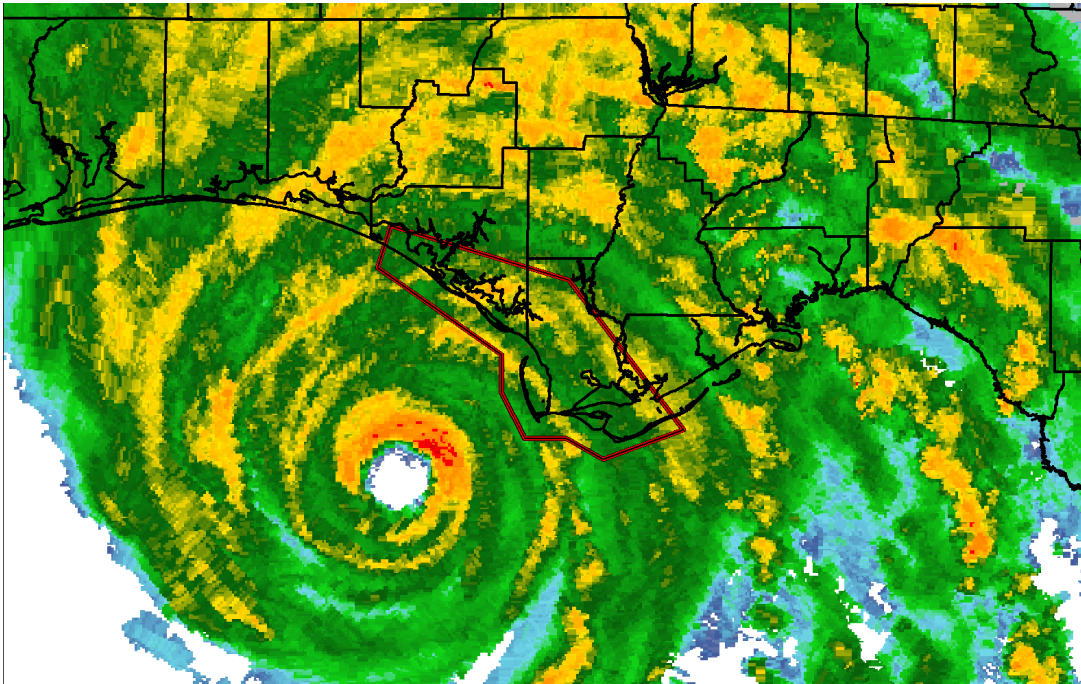
PRECAUTIONARY/PREPAREDNESS ACTIONS...

TAKE COVER NOW! Treat these imminent extreme winds as if a tornado was approaching and move immediately to the safe room in your shelter. Take action now to protect your life!

&&

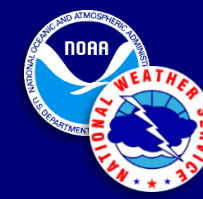
LAT...LON 2960 8524 2960 8540 2975 8549 2988 8549
3017 8597 3031 8592 3013 8523 2963 8479
2953 8510

TIME...MOT...LOC 1509Z 219DEG 14KT 2948 8588



Preparedness Information

Hawaii: Prepare for 14 days



Central Pacific
Hurricane Center

HURRICANE PREPAREDNESS 2021



weather.gov/hurricane

ready.gov

ready.gov/hurricanes

ready.gov/kit

hawaiianelectric.com/prepare

County-specific contact/notification resources:

<https://dod.hawaii.gov/hiema/get-ready/>

National Flood Insurance Program:

<https://www.floodsmart.gov/>

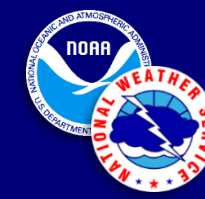
<https://seagrant.soest.hawaii.edu/homeowners-handbook-to-prepare-for-natural-hazards/>

<https://www.redcross.org/local/hawaii/about-us/our-work/disaster-preparedness.html>

For kids: https://www.weather.gov/media/jetstream/tropics/owlie_hurr.pdf

Preparedness Information

Messages from Hurricane Preparedness Week



Central Pacific
Hurricane Center

Hurricane Preparedness **ASSEMBLE DISASTER SUPPLIES**



Make a list of supplies and assemble them before hurricane season begins. Have enough food and water for each person for at least three days. Fill your prescriptions and have medicine on hand. Radios, batteries and phone chargers are also must-haves. Gas up your vehicle and have cash on hand.

- Food & water
- Medicine & prescriptions
- Keep gas tank full
- Radio, batteries, phone chargers
- Cash on hand

weather.gov/hurricane

Hurricane Preparedness **STRENGTHEN YOUR HOME**

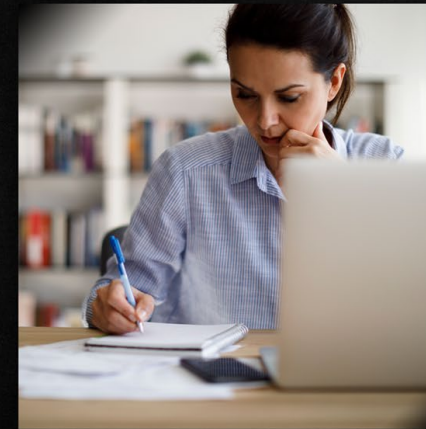


There's a lot you can do around your home to help protect it from hurricane winds. Before hurricane season, trim trees on your property and get approved window coverings. Ahead of storms, collect loose outdoor items, secure all doors on your property, and find a safe location for your vehicle.

- Cover windows
- Secure loose outdoor items
- Trim trees
- Move vehicle to a safe location
- Secure all doors

weather.gov/hurricane

Hurricane Preparedness **COMPLETE A WRITTEN PLAN**



Writing down your hurricane plan will help you avoid mistakes during an emergency, and ensure everyone in your home is prepared for the storm. Have a list of essential contacts, including outside the potential impact area. Review and practice your plan with your family and friends.

- Have a contact list (family, friends, doctor, vet, utilities)
- Keep your important documents together for quick access
- Have at least one contact outside of the impact area
- Share your plan

weather.gov/hurricane

Hurricane Preparedness **DETERMINE YOUR RISK**



Hurricanes bring many hazards to U.S. coastlines and inland areas, including storm surge along the coast, inland flooding due to heavy rainfall, tornadoes, strong wind, rip currents and large waves.

- Storm surge
- Strong winds
- Tornadoes
- Inland flooding
- Rip currents

weather.gov/hurricane

Hurricane Preparedness **HELP YOUR NEIGHBOR**



Many people, especially senior citizens, rely on the assistance of neighbors before and after hurricanes. Help your neighbors collect the supplies they'll need before the storm. Assist them with evacuation if ordered to do so, or check on them after it's safe for you to head outside.

- Help your neighbors prepare
- Help your neighbors evacuate
- Check-in after the storm passes

weather.gov/hurricane

Hurricane Preparedness **GET AN INSURANCE CHECKUP**



Check in with your insurance agency before hurricane season. Remember that flood insurance must be obtained separately. Prepare your home and vehicles according to your policy. Know where your insurance documents are located and take them with you if evacuating. Visit floodsmart.gov for more.

- Check with your agent
- Keep documents with you
- Know your policy
- Consider flood insurance

weather.gov/hurricane

Hurricane Preparedness **DEVELOP AN EVACUATION PLAN**



Find out today if you live in a hurricane evacuation zone and identify trusted sources for receiving evacuation orders. Plan for multiple options on where to go and how to get there. Have a go bag for supplies and a plan for your pets. Be prepared to leave immediately if ordered to evacuate.

- Find out if you live in an evacuation zone
- Plan several routes
- Have a go bag for supplies
- Plan for your pets
- Follow evacuation orders if given

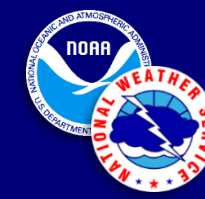
weather.gov/hurricane

- More information available at:

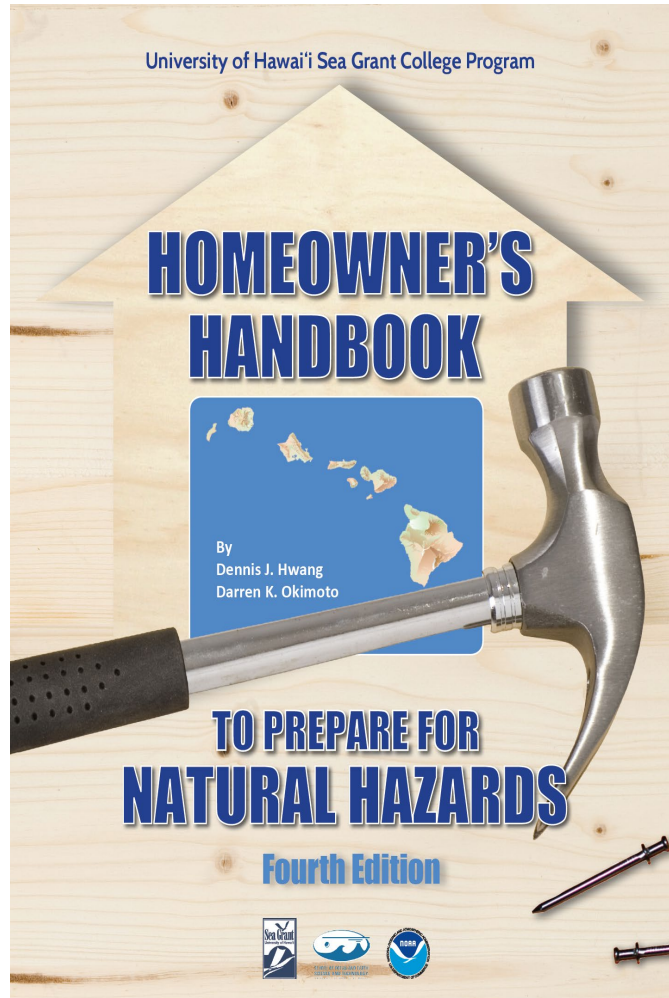
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Preparedness Information

Determine your risk



Central Pacific
Hurricane Center



| ABILITY TO SHELTER IN PLACE DURING A HURRICANE | | | | | | | | | | |
|--|---|---|---|---|---|---------------------------------------|--|---|--|--|
| PLEASE READ INSTRUCTIONS BEFORE USING THIS TABLE | | | | | | | | | | |
| Safe room | | | | | | FEMA or Hawai'i Residential Safe Room | | | | |
| Concrete or CMU wall house | Concrete CMU wall house in poor condition | → | Concrete CMU wall house in good condition | → | Concrete CMU wall house with hurricane clips | → | Concrete CMU wall house with hurricane clips & window protection | → | Concrete CMU wall house with hurricane clips exceeding code & window protection | |
| | Double wall house in poor condition | → | Double wall house in good condition | → | Double wall house with hurricane clips | → | Double wall house with hurricane clips & window protection | → | Double wall house with hurricane clips, window protection, garage & roof reinforced | |
| Double wall house | Single wall house in poor condition | → | Single wall house in good condition | → | Single wall house with hurricane clips | → | Single wall house with hurricane clips & window protection | → | Single wall house with clips, window protection and foundation upgrades | |
| | Double wall house with complete load path | → | Double wall house with complete load path | → | Double wall house with complete load path & window protection | → | Double wall house with complete load path, window protection, garage & roof reinforced | → | Double wall house with complete load path, window protection, garage & roof reinforced | |
| Single wall house | Single wall house in poor condition | → | Single wall house in good condition | → | Single wall house with hurricane clips | → | Single wall house with hurricane clips & window protection | → | Single wall house with clips, window protection and foundation upgrades | |
| | Single wall house with clips, window protection and foundation upgrades | → | Single wall house with clips, window protection and foundation upgrades | → | Single wall house with clips, window protection and foundation upgrades | → | Single wall house with clips, window protection and foundation upgrades | → | Single wall house with clips, window protection and foundation upgrades | |
| Suggested Action | Unsafe Evacuate! Do Not Shelter in place | | Marginal Shelter in place up to a Tropical Storm | | Good Shelter in place up to Category 1 hurricane | | Better Shelter in place up to Category 2 hurricane | | Best Shelter in place up to Category 3 hurricane | |

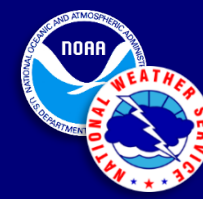
*Based on discussions and review with Ian Robertson, Professor, UH Mānoa, Civil and Environmental Engineering; Gary Chock, Structural Engineer, Martin & Chock Inc.; Tim Waite, PE, Simpson Strong-Tie; and Kevin Richards, Natural Hazards Officer, Hawai'i Emergency Management Agency.

- Shelter in place or evacuate? Hazards to consider:
 - Wind
 - Heavy rain
 - Storm surge

FEMA Flood Map search: <https://msc.fema.gov/portal/home>

NOAA storm surge: <https://www.nhc.noaa.gov/nationalsurge>

<https://seagrant.soest.hawaii.edu/homeowners-handbook-to-prepare-for-natural-hazards/>



Any Questions?

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