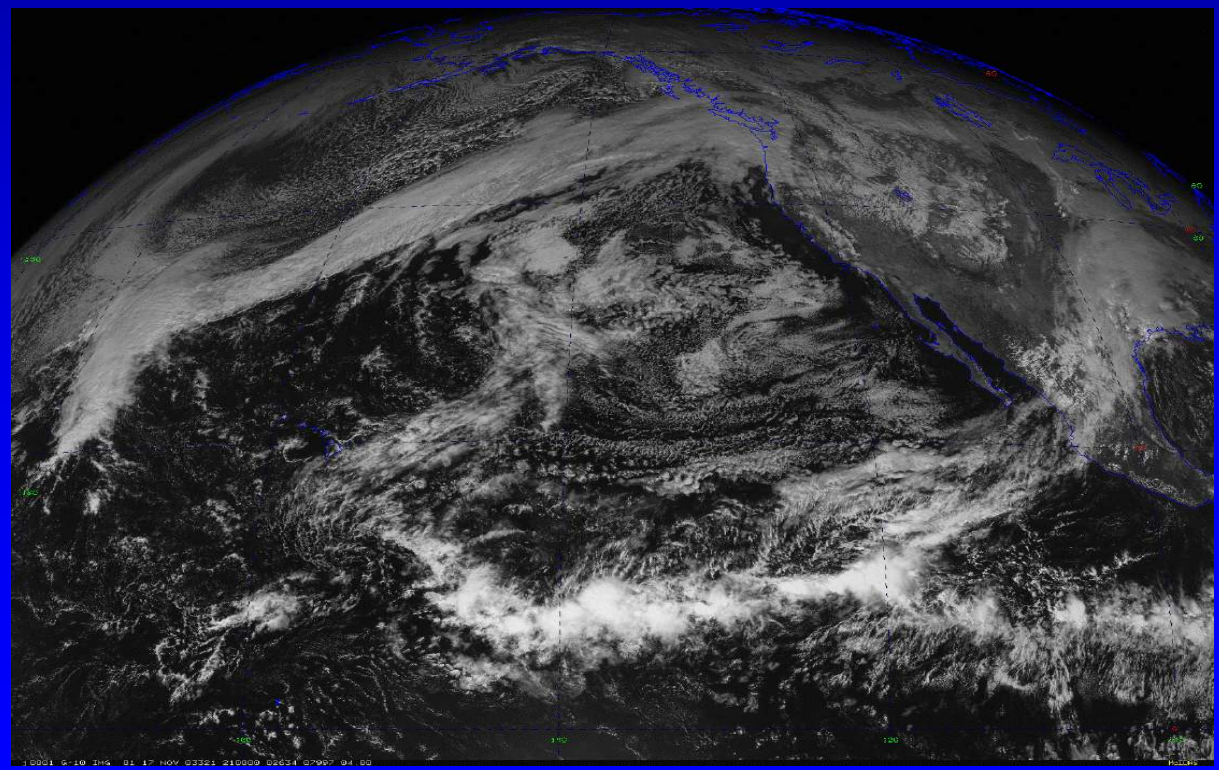
Lack of Weather Observations over the Pacific: The Achilles Heel of Northwest Weather Prediction

Cliff Mass
University
of
Washington



- Although Northwest weather forecasts have improved greatly over the past decade, there are still major forecast failures or “busts”

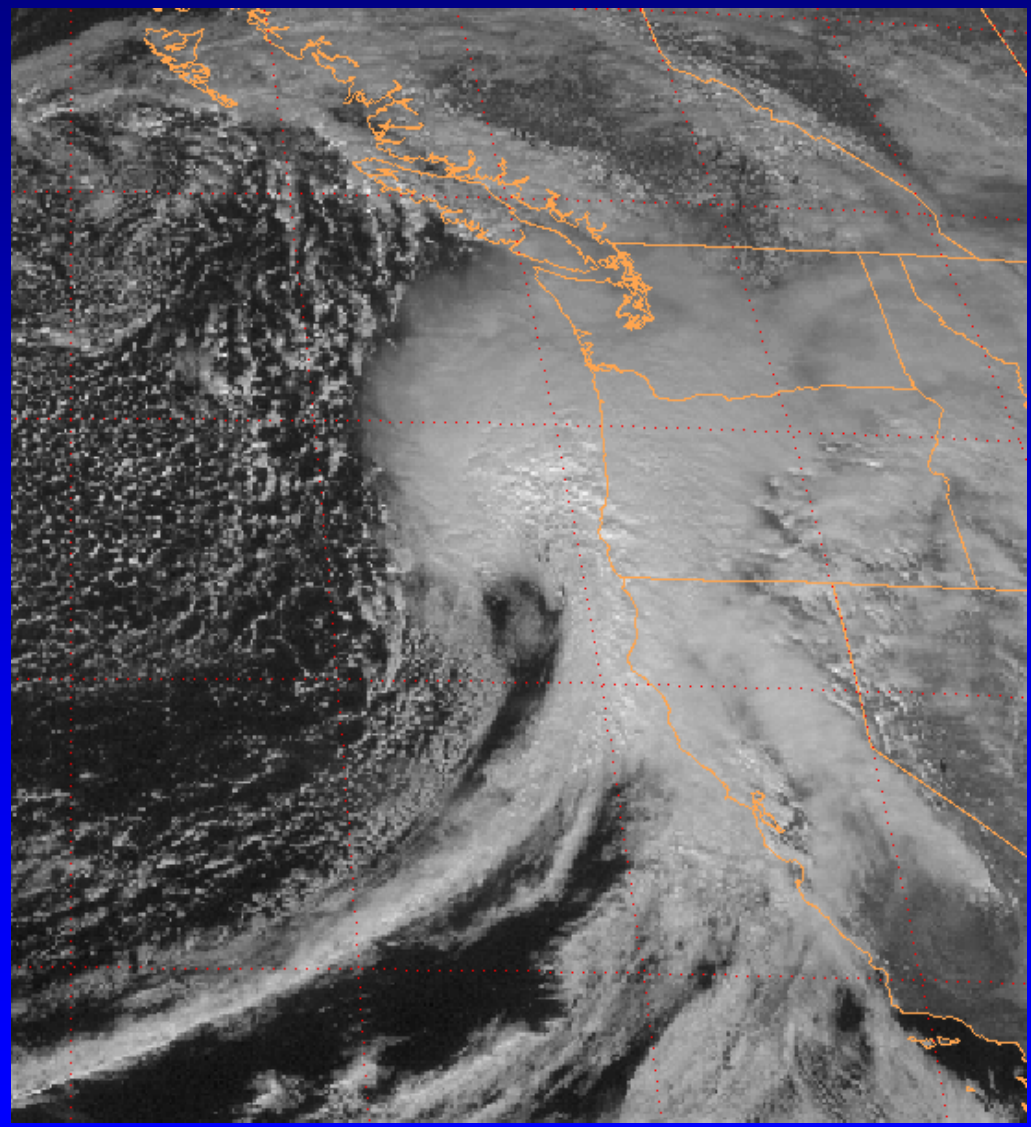
- Such busts are more frequent and larger over the U.S. West Coast than the East Coast.

- Prediction failures have substantial negative implications for public safety and the economic vitality of the region.

Some Recent Examples

February 7, 2002

- On the morning of 7 February 2002 an intense low center moved into the central Oregon coast, with absolutely no warning by the National Weather Service.
- Produced strong winds with gusts exceeding 70 mph



The result: massive tree falls and damage


The Register-Guard

STORMY WEATHER

Winds land sneak punch

Surprise storm packing 70 mph gusts downs trees, damages property

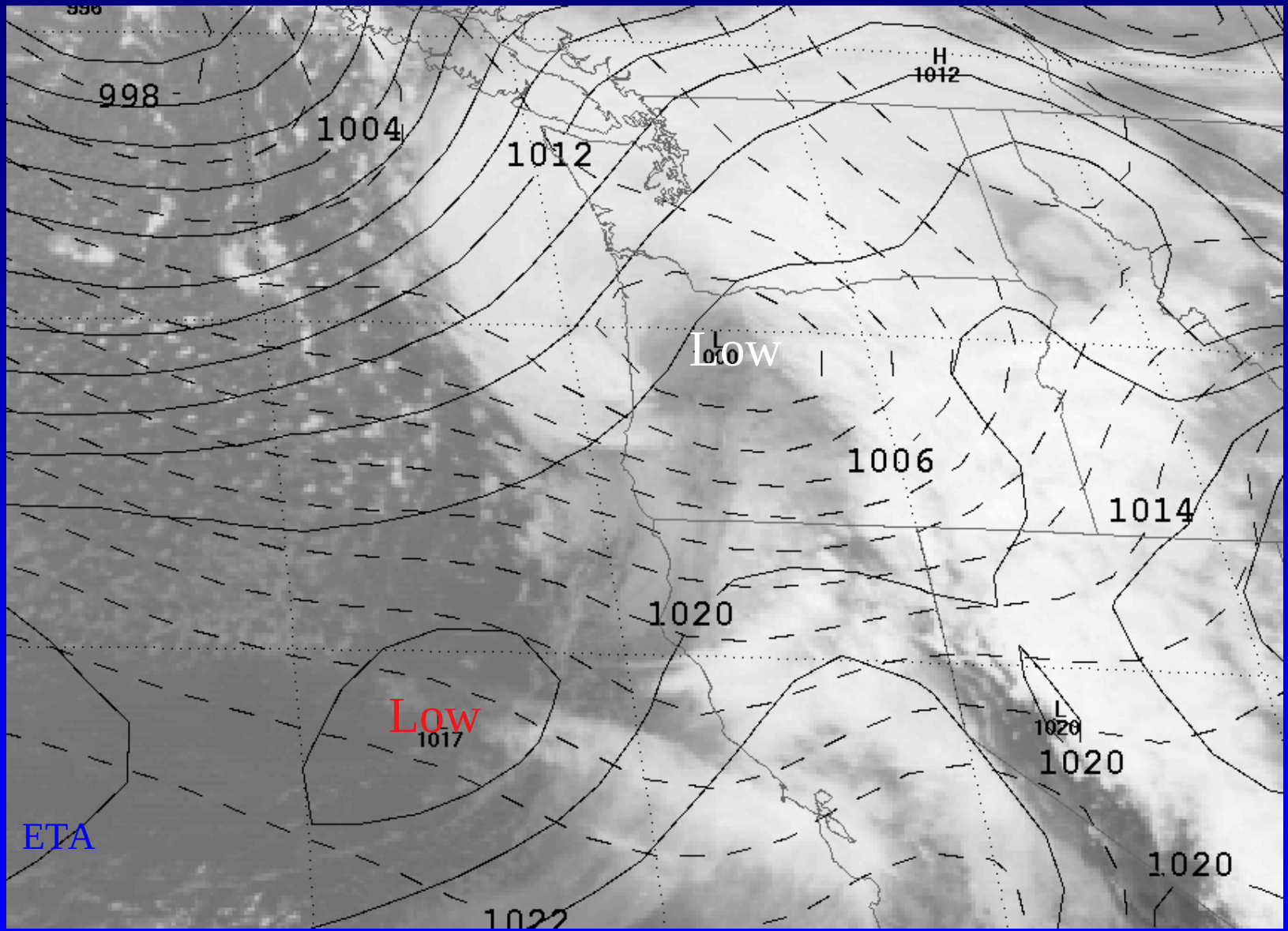
UTILITY HELP

TRAVEL

SCHOOLS

Three men freed after tree flattens their pickup truck

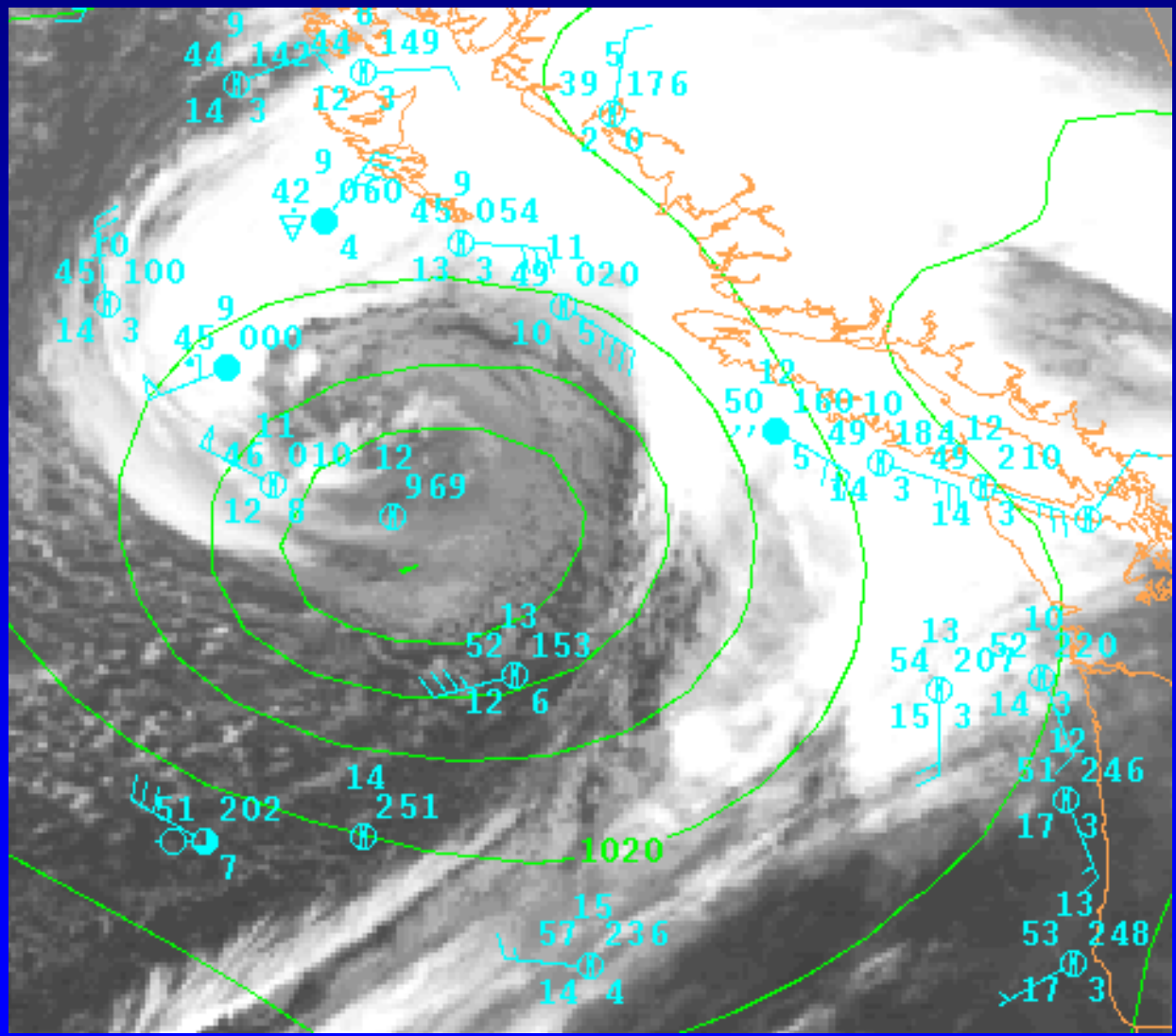
48-hr Model Forecast Valid at 00 UTC 8 February 2002



Dashed-observed, solid-forecast

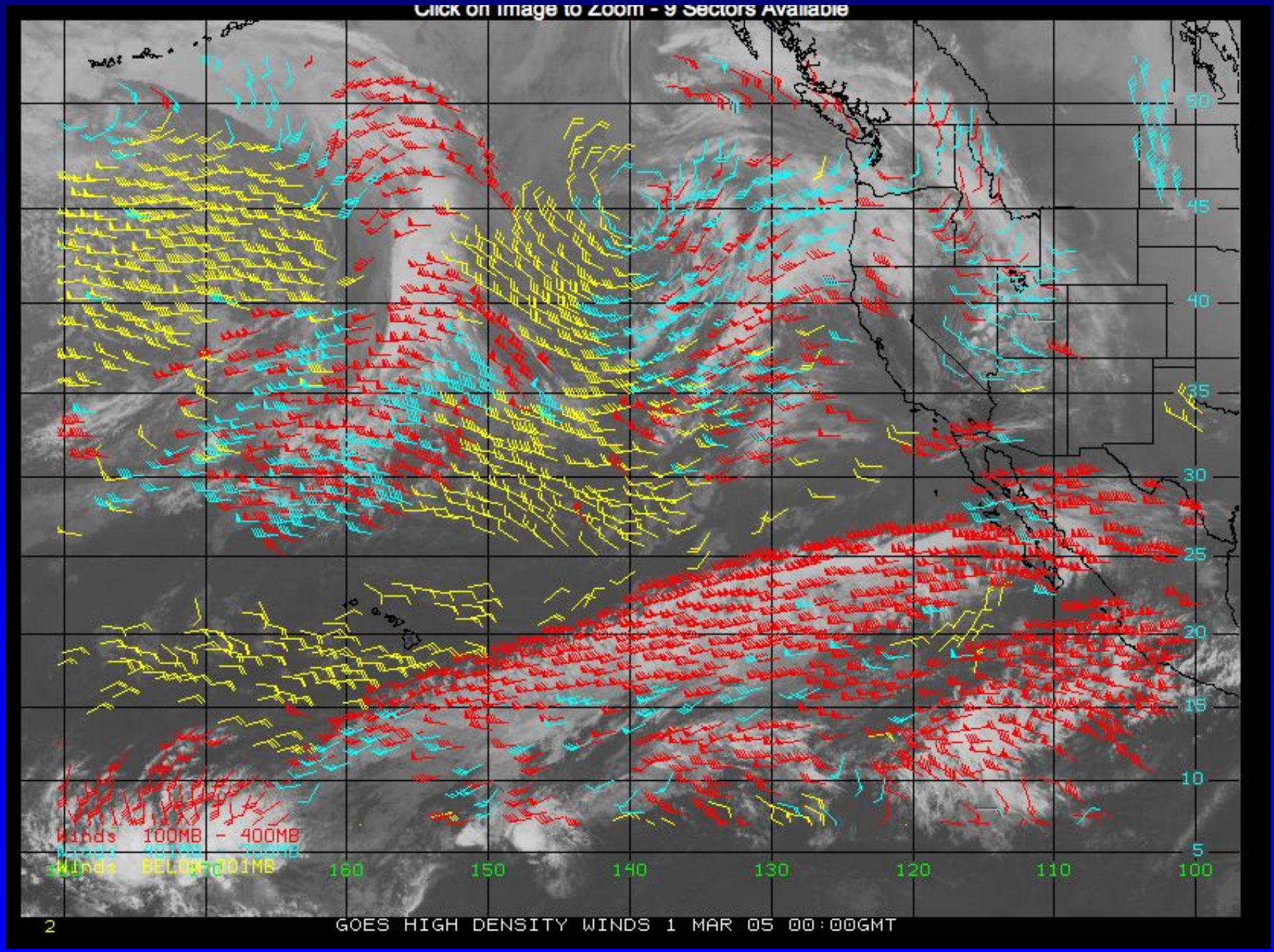
And Many"Garden Variety" Failures Occur Even At Short Projections

November 18
2004
0000 UTC
12 h
forecast

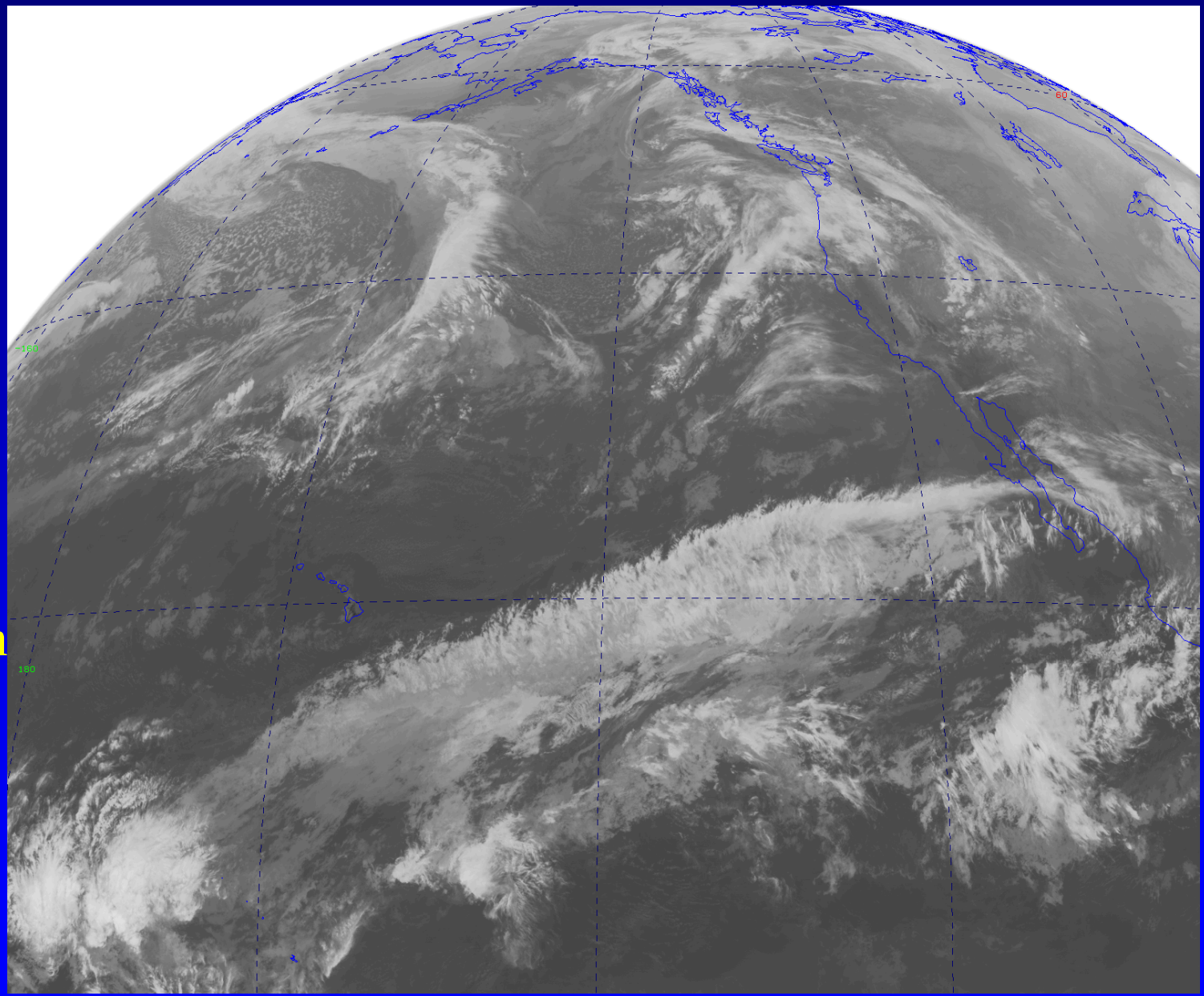


These failures occur even with a huge increase of observations from weather satellites and increased amounts of upper-tropospheric aircraft observations.

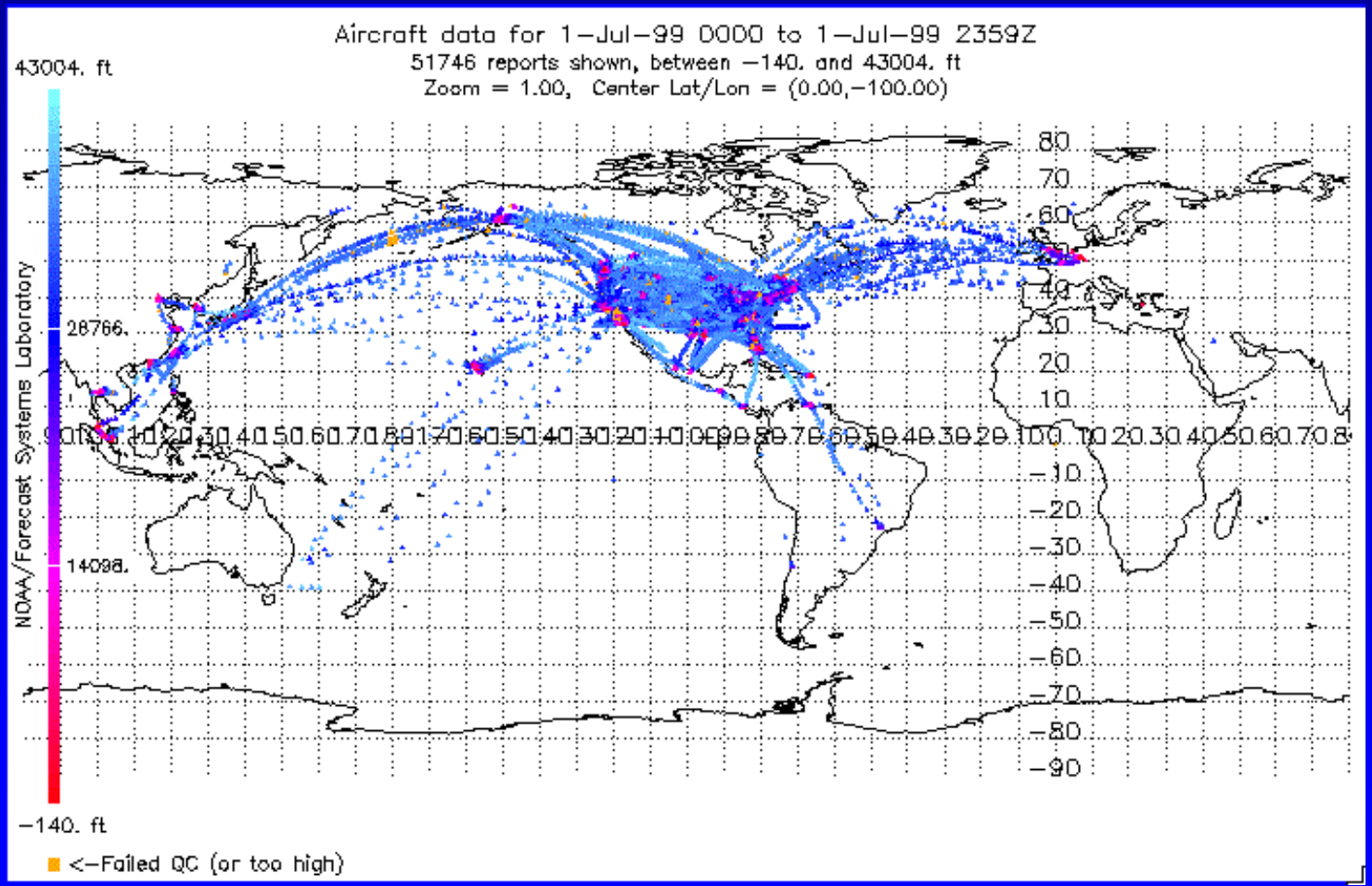
Cloud Track Winds



Infrared Satellite Radiances Now Used In Data Assimilation



ACARS: Aircraft Weather Observations



Two Main Reasons for Such Failures

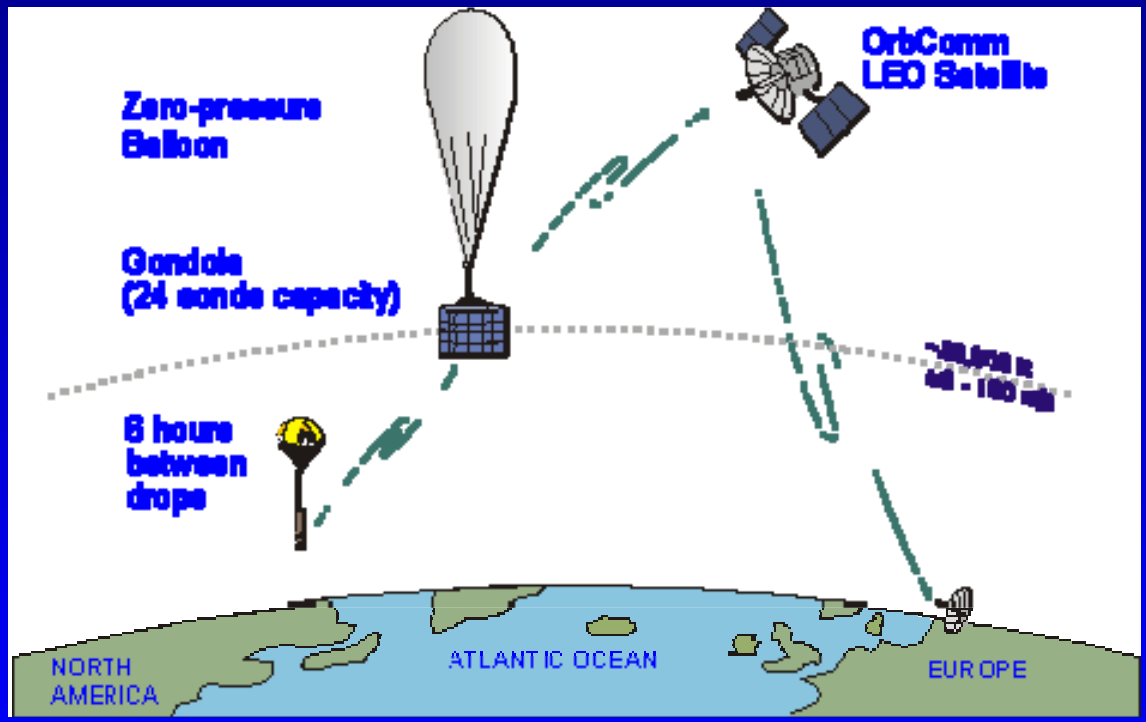
- Lack of critical information within deep cloud masses. Most of the information from satellites is on the outside of major weather systems and in cloud-free regions, except for limited observations at the surface.
- Data assimilation systems do not wring out all the information possible for observations.

An Important Need

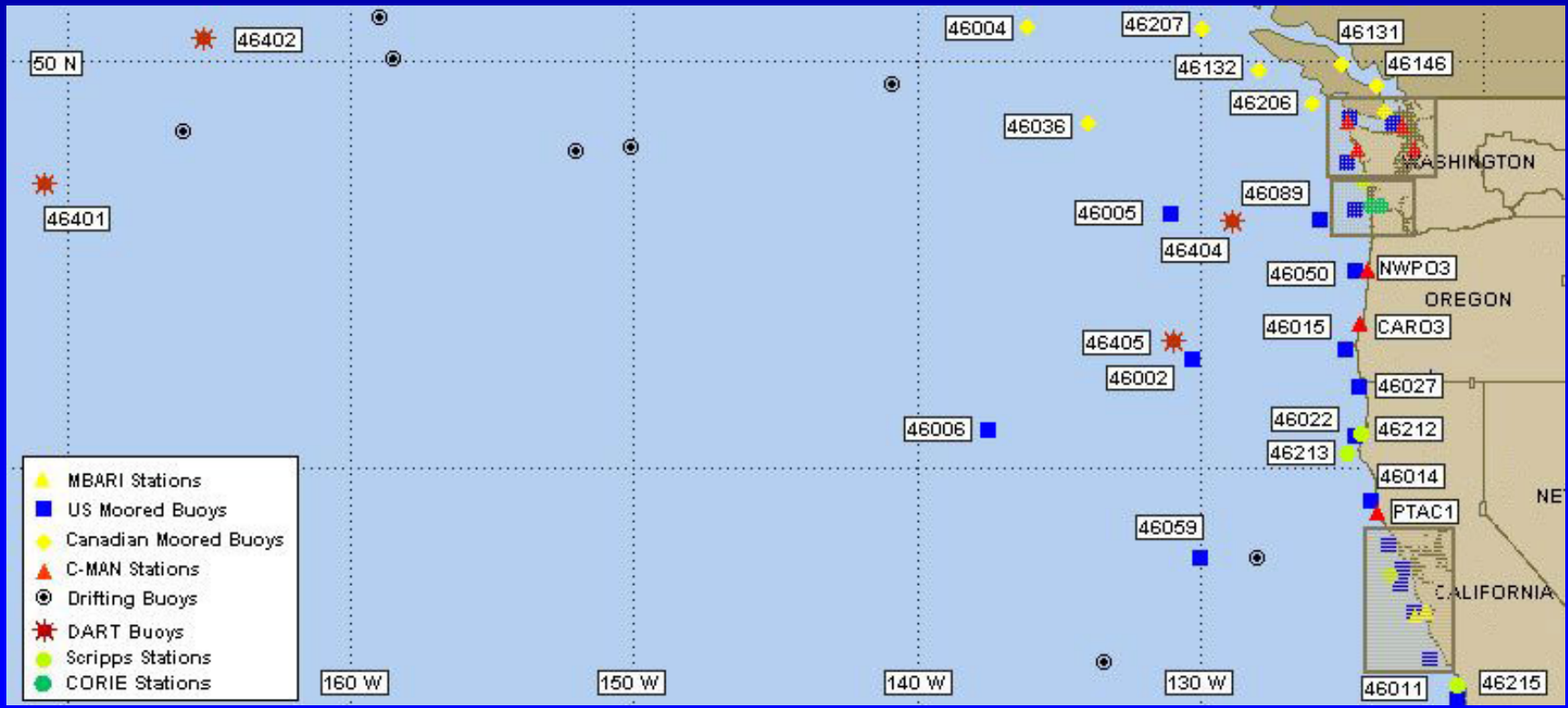
Need more insitu observations over the Pacific to provide critical information on the structure and evolution of Pacific weather systems.

Unmanned aircraft might be useful weather observers.

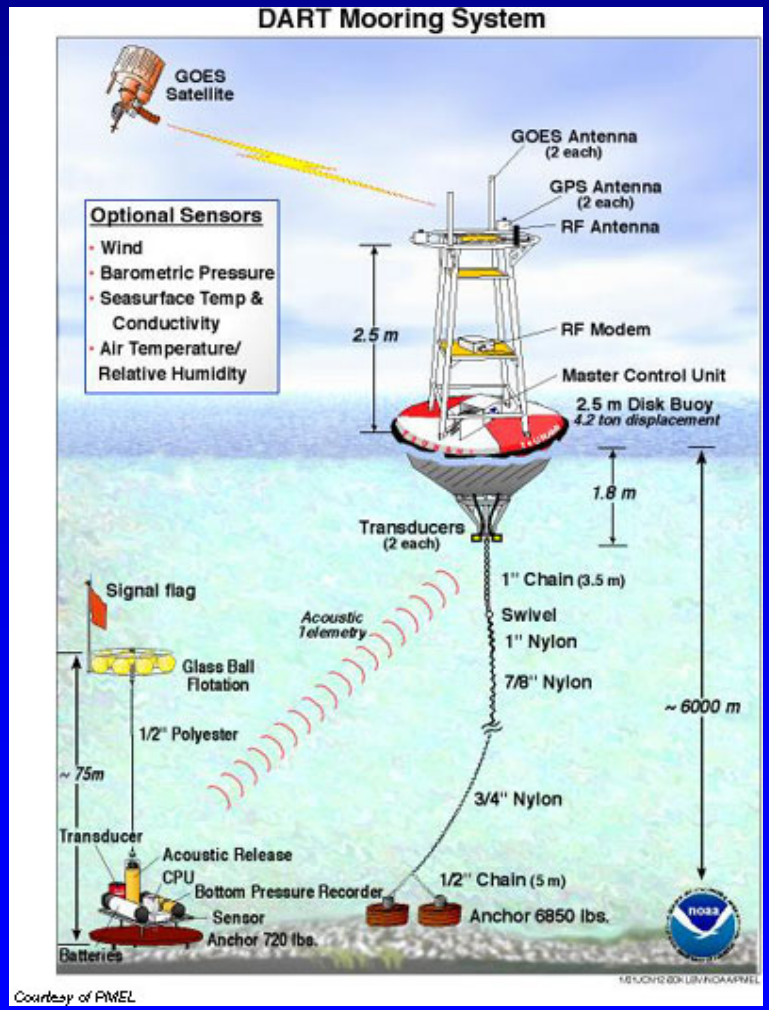
The Driftsonde

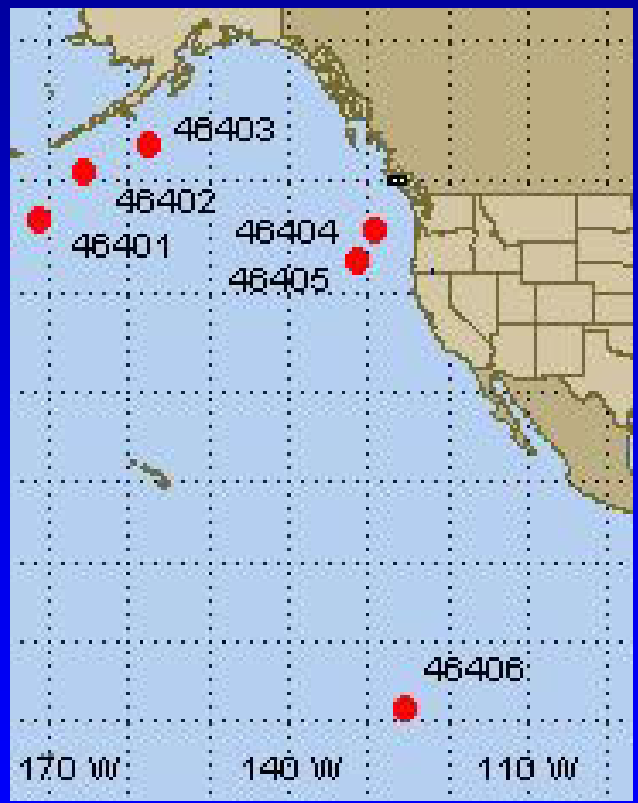


Weather Buoys



Even Tsunami Buoys





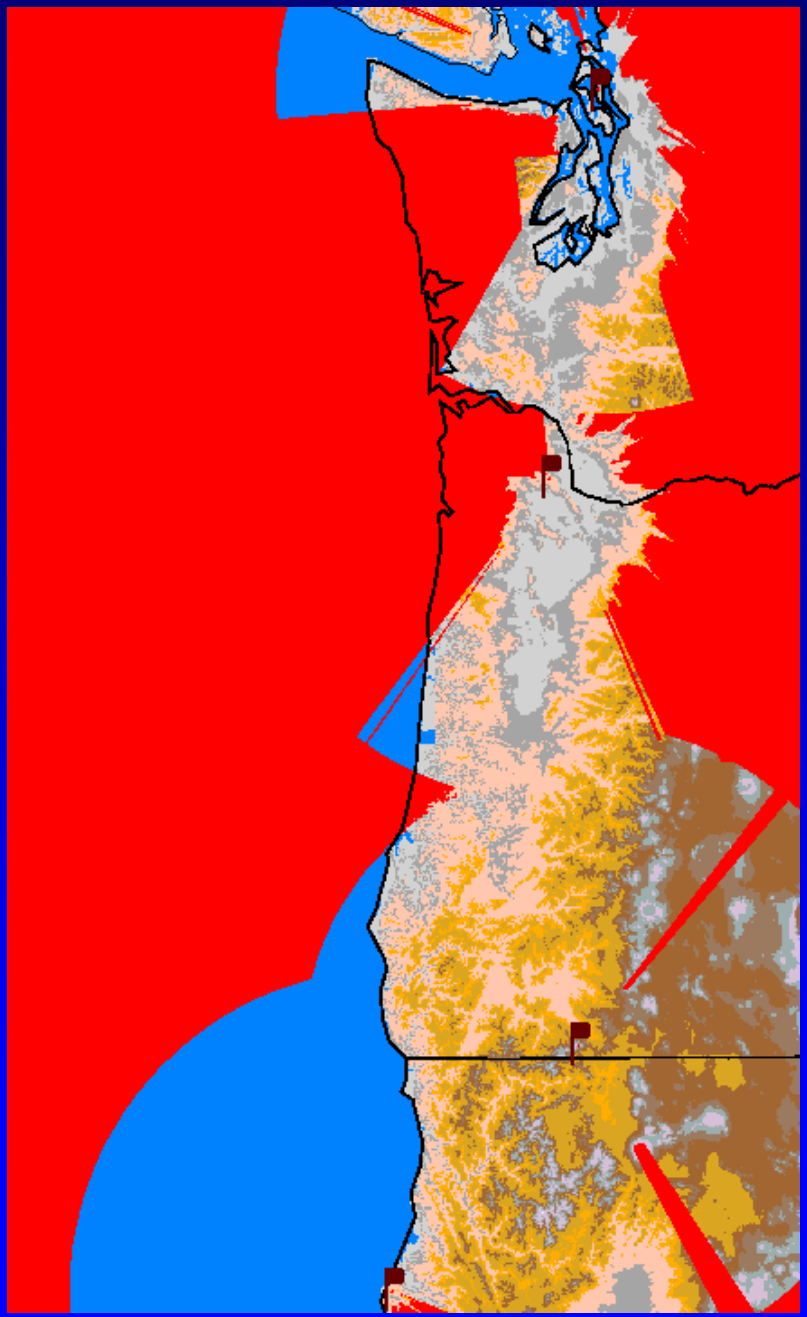
But there is another major problem…

The virtual absence of weather radar coverage over the Northwest coastal zone and nearby offshore waters makes a bad situation even worse.

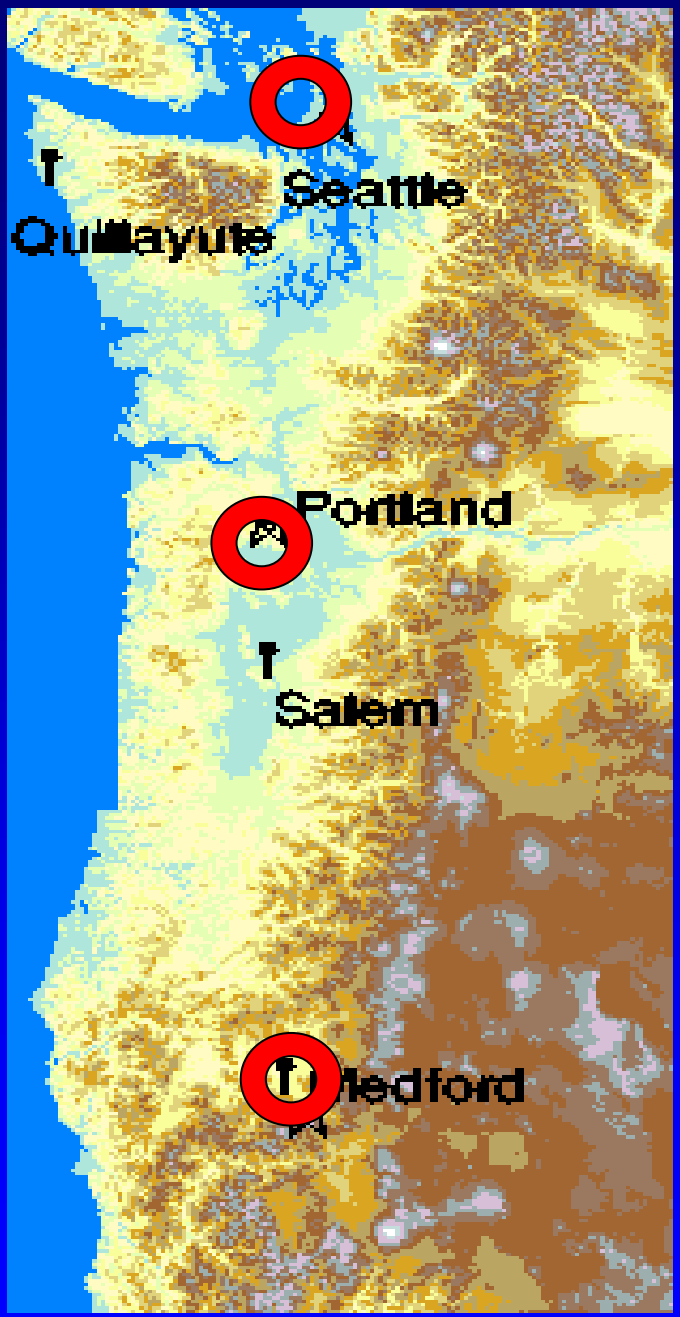
Northwest Coastal Radar Problem

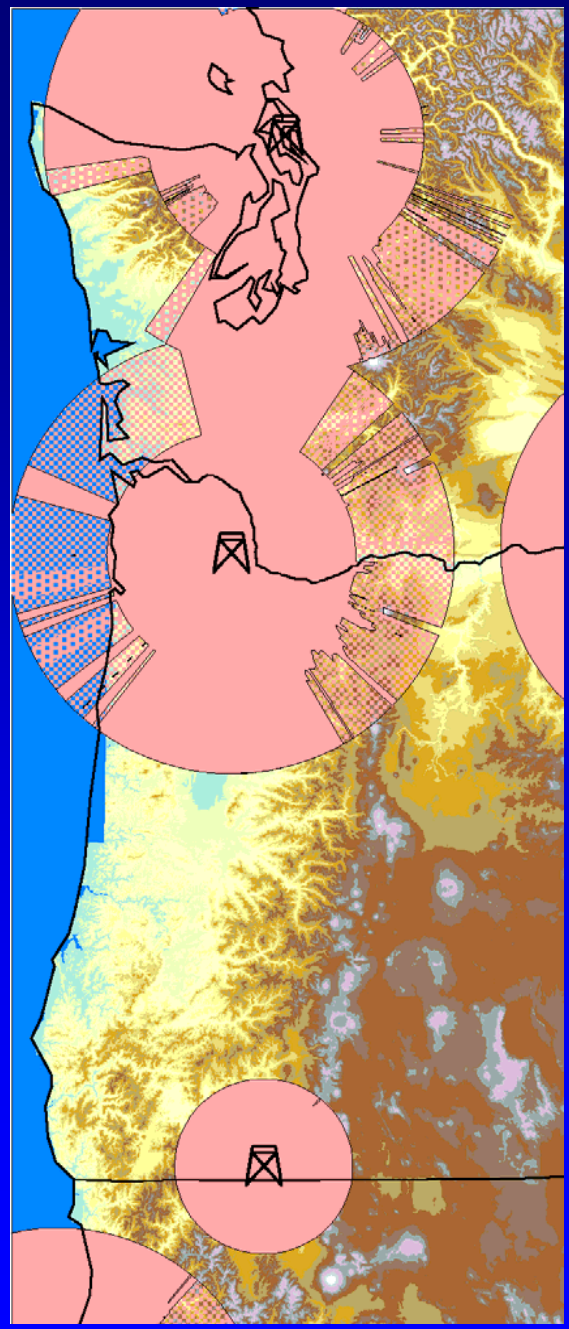
- The Pacific Northwest has the **worst** coastal radar coverage of any coastal region of the lower 48-states.
- There is virtually no radar coverage for the lower atmosphere over the coastal zone and the near-shore waters.
- It is particularly disturbing that such poor coverage exists for a region of often intense storms AND a great deal of military, shipping, fishing and other marine traffic.

FIG. 1. WSR-88D network coverage at 10 000 ft (3.05 km) above site level for the contiguous United States. Hatched regions represent



Radar coverage for the lowest beam (.5 degree elevation angle) for the current network. Red areas indicate no coverage below 8000 m (25,000 ft). Radar coverage calculations by Ken Westrick





The right diagram indicates the effective coverage of the Weather Service radars (at 3-km, above mean sea level), with hatching indicating substantial blockage.

The Implications of Poor Coastal Radar Coverage

- Northwest forecasters often have a poor idea of the structure of weather systems approaching the area.
  - There have been several major forecast busts in the 0-24 h range that could have been mitigated if coastal radar coverage was better.
  - The ability to provide short-term forecasts (nowcasting) over western Oregon and Washington is greatly lessened.

The Implications of Poor Coastal Radar Coverage

- With no low level Doppler wind and reflectivity from radar, critical warnings and weather guidance over the coastal zone are degraded. No assistance for emergency situations, pollutant spills, and the like.

When the New Carisa grounded Near Coos Bay, Oregon, there was no radar coverage to help manage salvage operations.

The Implications of Poor Coastal Radar Coverage

- There is no radar coverage of the heavy orographic precipitation on the western and southern sides of the Olympics and coastal mountains….thus, degrading flood and river forecasting.

The Implications of Poor Coastal Radar Coverage

- There is a distinct lack of weather data offshore for use in initializing mesoscale prediction models. A coastal radar would provide both Doppler winds and reflectivities that could be assimilated. Without such radars, future short-term forecast skill over **all** of the Northwest will be limited

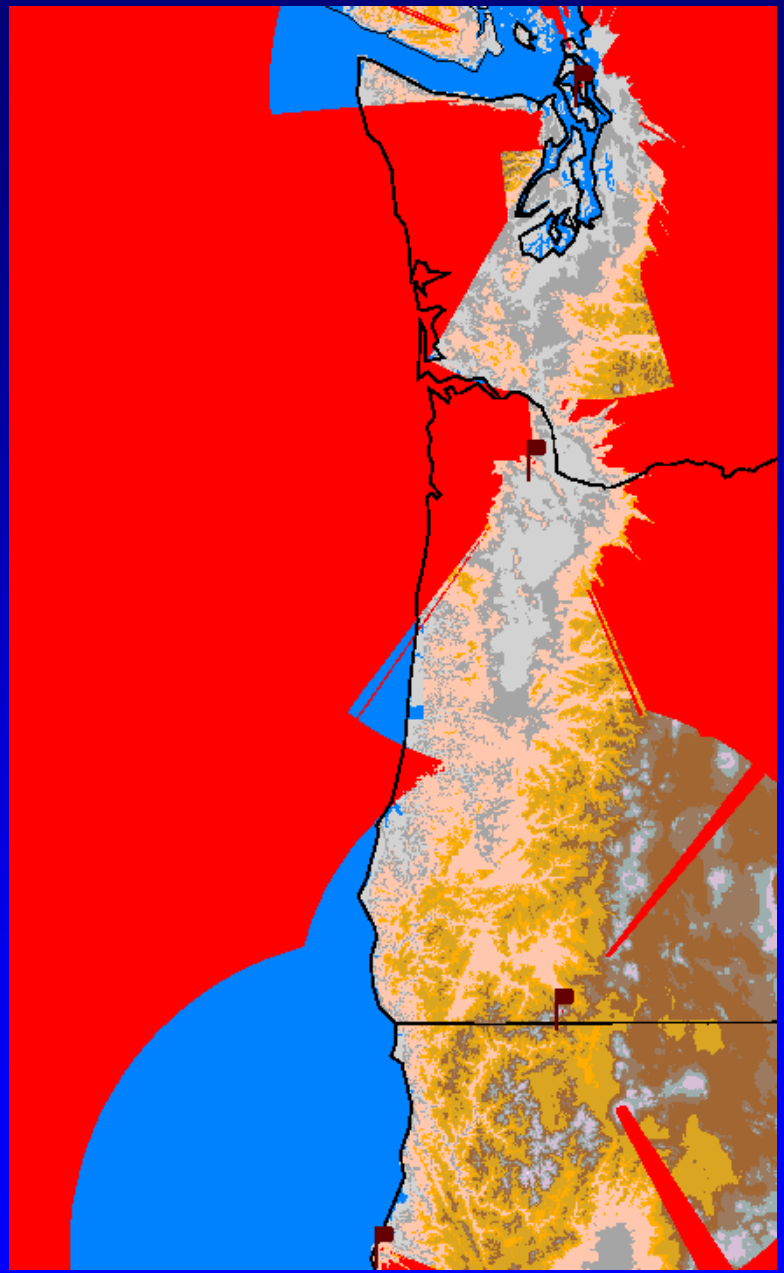
The Solution: Acquisition of Additional Coastal Radars

- By adding one or two coastal radars, the National Weather Service could greatly improve the current situation.
- Although the WSR-88D production line is now closed, Enterprise Electronics has a similar (if not better) product available (DWSR-8501S/K).
- Cost: Approximately $ 4.5 million per radar, plus a few million for NWS site surveys and other needs.

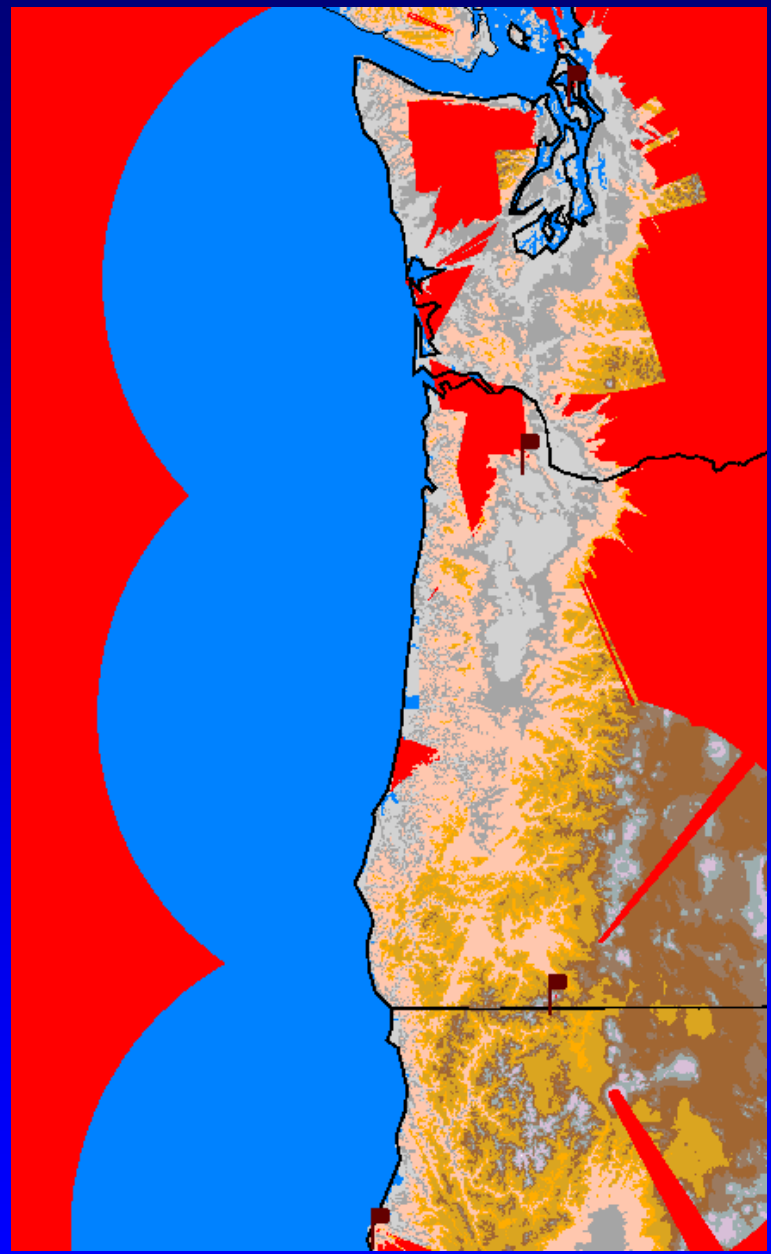
Enterprise DWSR-8501S/K Doppler Radar. The National Weather Service has already purchased two of these to fill in their radar network in other locations.

Acquisition of Additional Coastal Radars

- Ideally two radars would be acquired with one positioned on the central WA coast (e.g., Westport) and the other on the central Oregon coast (Florence)
- If we could secure only one, Westport would be the best choice…since it provides coverage of entrances to both the Columbia River and the Strait.



Now



With Two New Radars

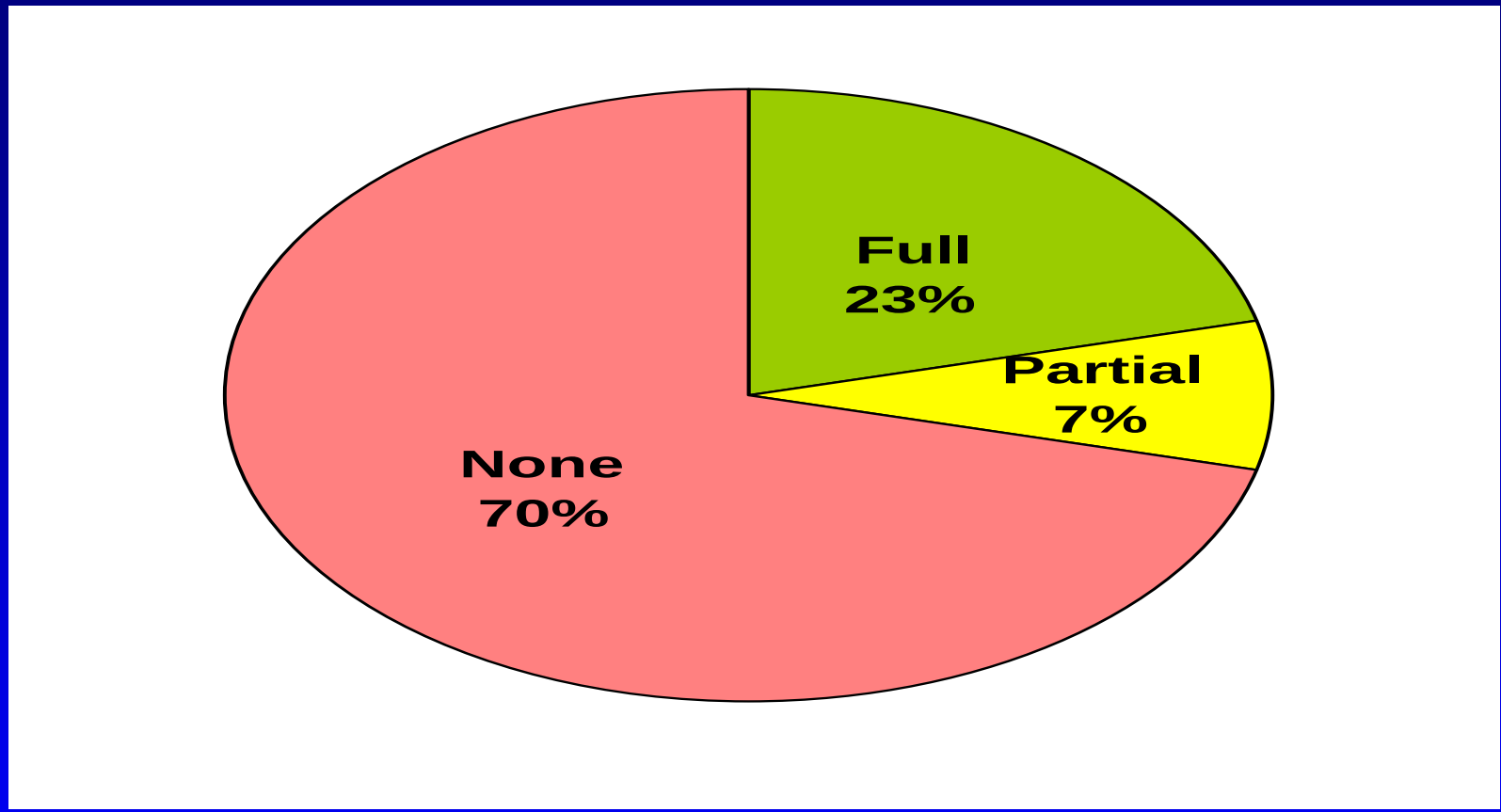
Current Status

- Several of us have talked to Senator Murray's and Cantwell's offices.
- Senator Cantwell's office seems modestly interested.
- The meteorological and weather user communities needs to keep up the pressure (letters, media attention)….
- A coastal radar represents the ultimate in homeland security!

For More Information Check the Web Site

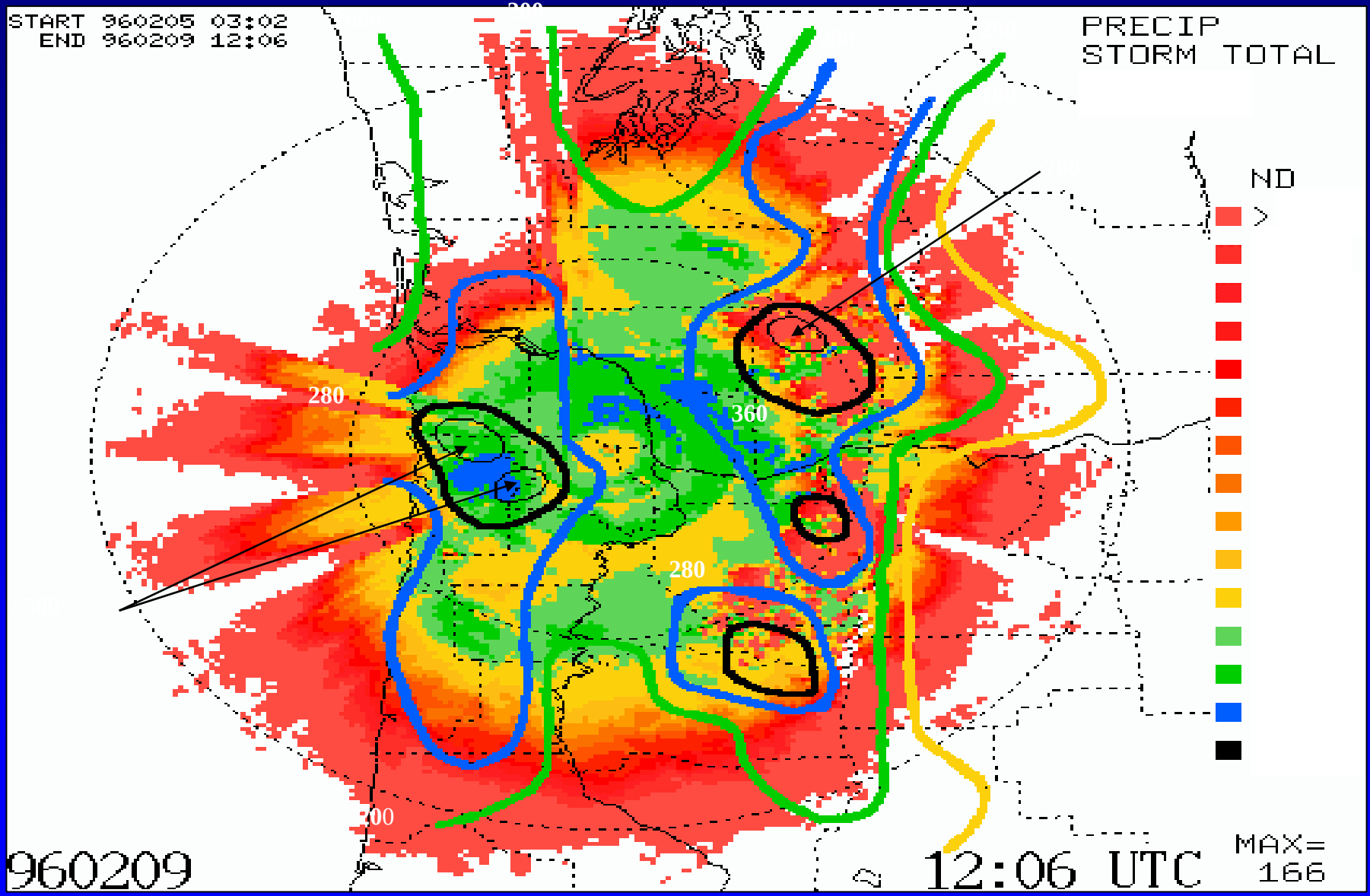
http://www.atmos.washington.edu/~cliff/coastalradar.html

The End



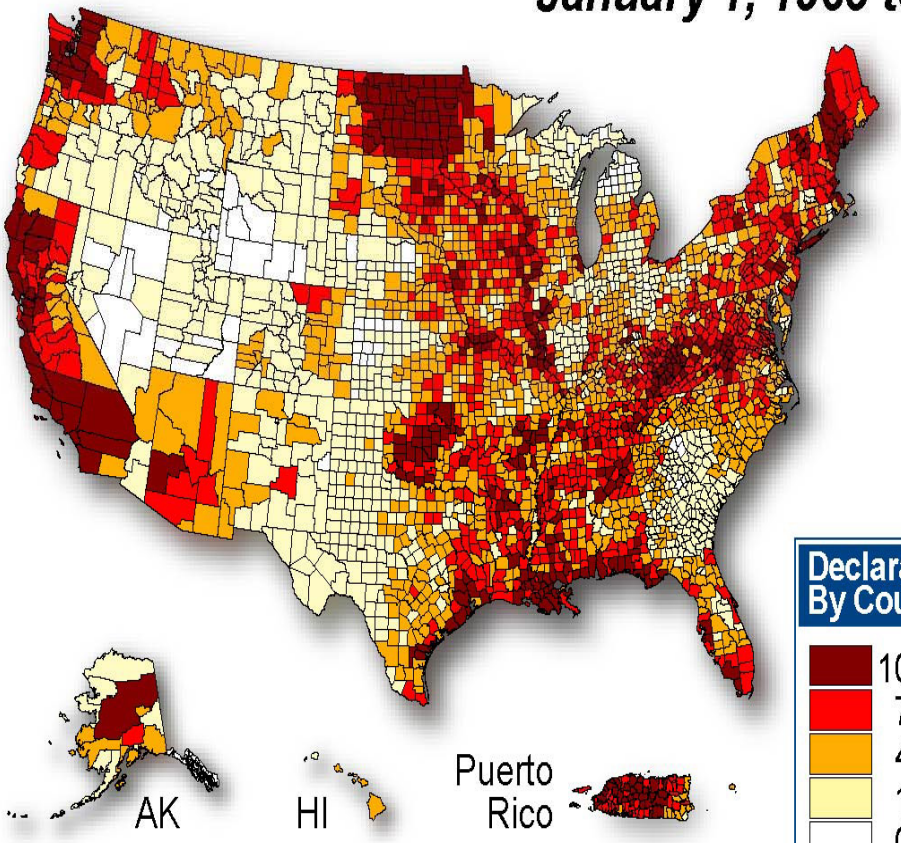
Coverage over the Pacific Northwest at or below 2-km

Storm total precipitation: 5-9 February 1996, 8 deaths, 300,000 people forced from homes, 500 million dollars damage



Presidential Disaster Declarations

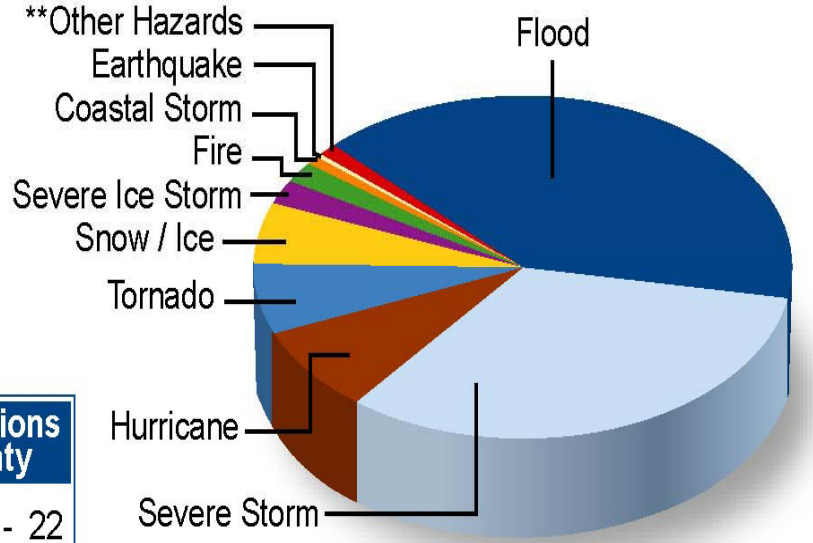
January 1, 1965 to June 1, 2003



Declarations By County

10 - 22
7 - 9
4 - 6
1 - 3
0

Disasters By Type



****Other Hazards include:** Drought, Volcano, Other, Freezing, Mud/Landslide, Typhoon, Human Cause, Terrorist, Dam/Levee Break, Toxic Substances

Mapped Total: 1,214*

* Prior to January 1, 1965, 185 declarations did not have county designations. Therefore, of the total declared disasters (1,399), only 1,214 are included in the Mapped Total.

***Source:** FEMA's National Emergency Management Information System*