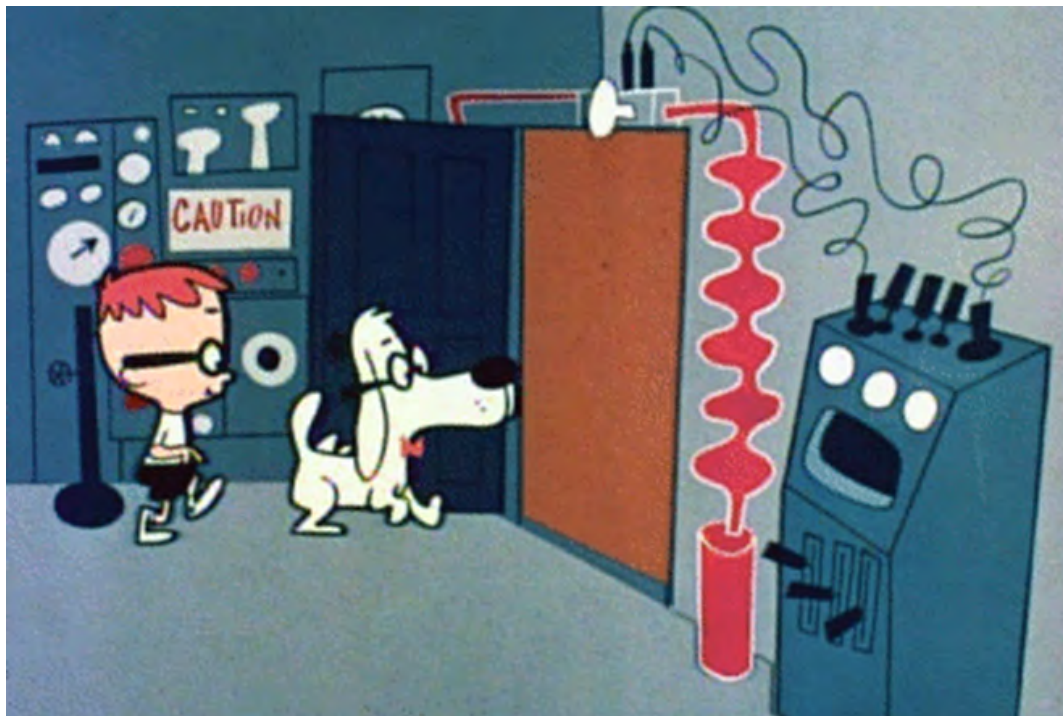


Weather Satellites and Alaska Weather



November 8, 2018

Previously at OLLI...





**"Mr. Osborne, may I be excused?
My brain is full."**

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3

All right men, we have to take Hill 505!

- Reading weather maps is similar to reading contour maps of terrain.
- A terrain map depicts the intersection of the surface of the earth with height above mean sea level.
- Let's go play in the sandbox!
<https://www.youtube.com/watch?v=UZ69gSinlPo>

Numerical Weather Prediction (NWP)

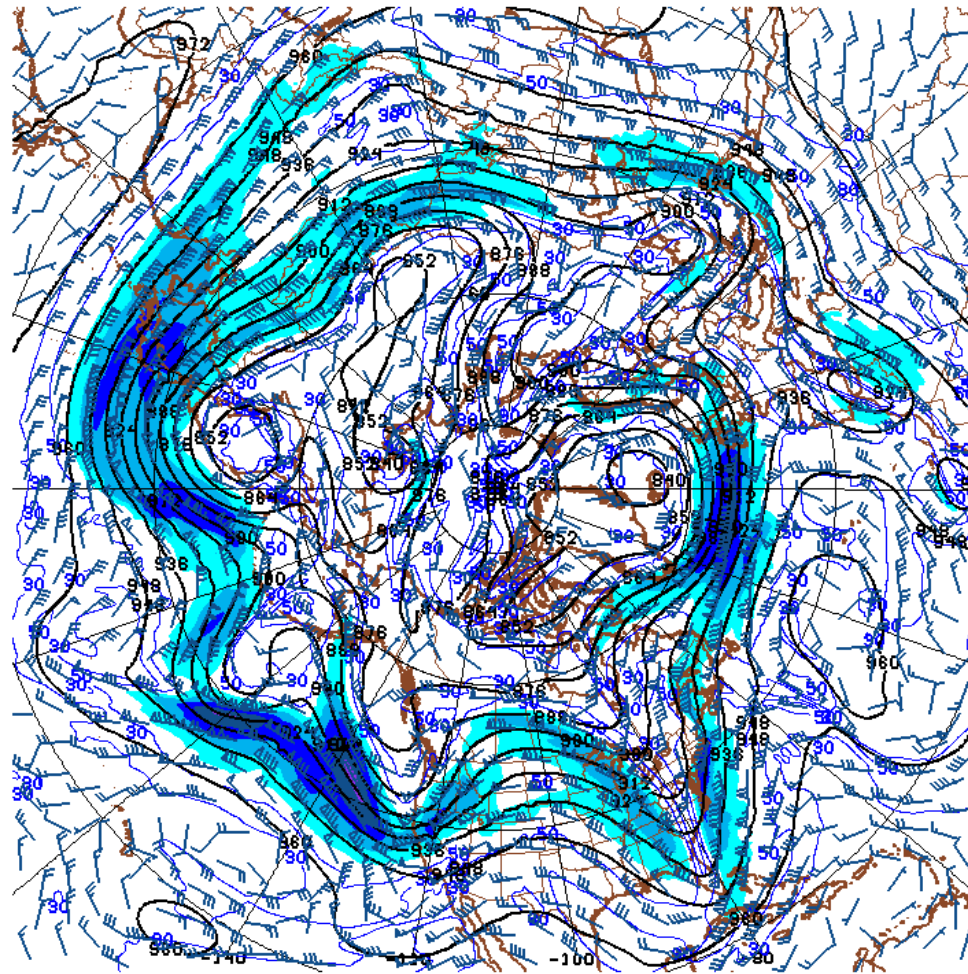
- Also known as “The Models” or “NWP Models”
- Computer simulations of future weather, using the most powerful computing resources available to humanity
 - Idea is to use computers to answer the question, “where is this storm going to go?” and etc
- Essential tools in the business of weather forecasting
 - What is the role of the human in the forecast process?
- Complicated as (insert your term of choice here)
- Nice article on Wikipedia
https://en.wikipedia.org/wiki/Numerical_weather_prediction
- US NWP output available at... <http://mag.ncep.noaa.gov/>



11/11/16 12UTC 120HR FCST VALID WED 11/16/16 12UTC NCEP/NWS/NOAA



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161116/1200V120 GFS 300MB HEIGHTS, ISOTACHS, AND WIND (KTS)

Who Dropped the Ball?

- Q: So if we're all so smart, and these computers are so powerful, how can an NWP forecast go wrong?
- A: Fundamentally, the atmosphere is a non-linear system
 - https://en.wikipedia.org/wiki/Nonlinear_system
- Consequence Number One: Imperfect initialization of the atmosphere will (eventually) ruin any NWP forecast
 - Due to the non-linearity of the atmosphere, these imperfections “upscale” over time and take over the model
- Consequence Number Two: Some atmospheric processes operate at spatial and temporal scales too fine to explicitly model; thus these processes are “parameterized” and will (eventually) ruin any NWP forecast
 - Due to the non-linearity of the atmosphere, the particulars of these fine-scale processes “upscale” over time and take over the model

Time for The Chaos Machine!



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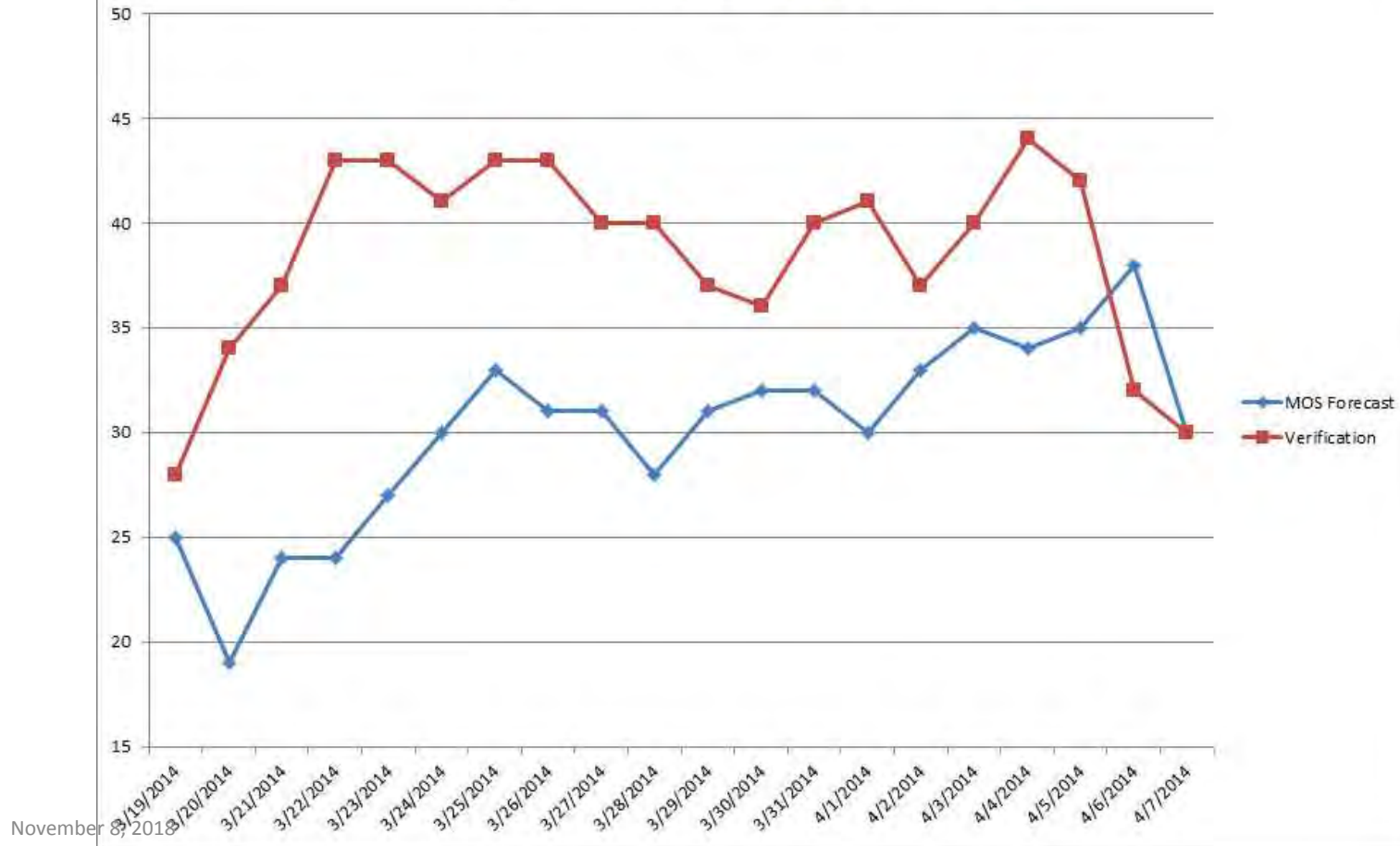
Is NWP Modeling Useless?

- Nope
- NWP is not perfect, but still useful
- NWP is getting better all the time (a double-edged sword)
- Other tricks up the NWP sleeve:
 - Model Output Statistics (MOS)
 - NWP Ensembles

Model Output Statistics: MOS

- Correlations between aspects of the atmosphere can be identified if you have a big (enough) archive of past NWP forecasts and weather observations to sift through
- You don't need to model or even know the underlying mechanisms that produce the correlation
- The Good: easterly winds at Unalakleet
- The Bad: MOS can get stuck in a rut (see next slide), and can be out of its depth during unprecedented events
- The Ugly: Forecasters can be tempted to just “load and go” with MOS

**PAFA GFS MOS Max Temp
Forecast 12Z Day Prior to Verification**



NWP Ensembles

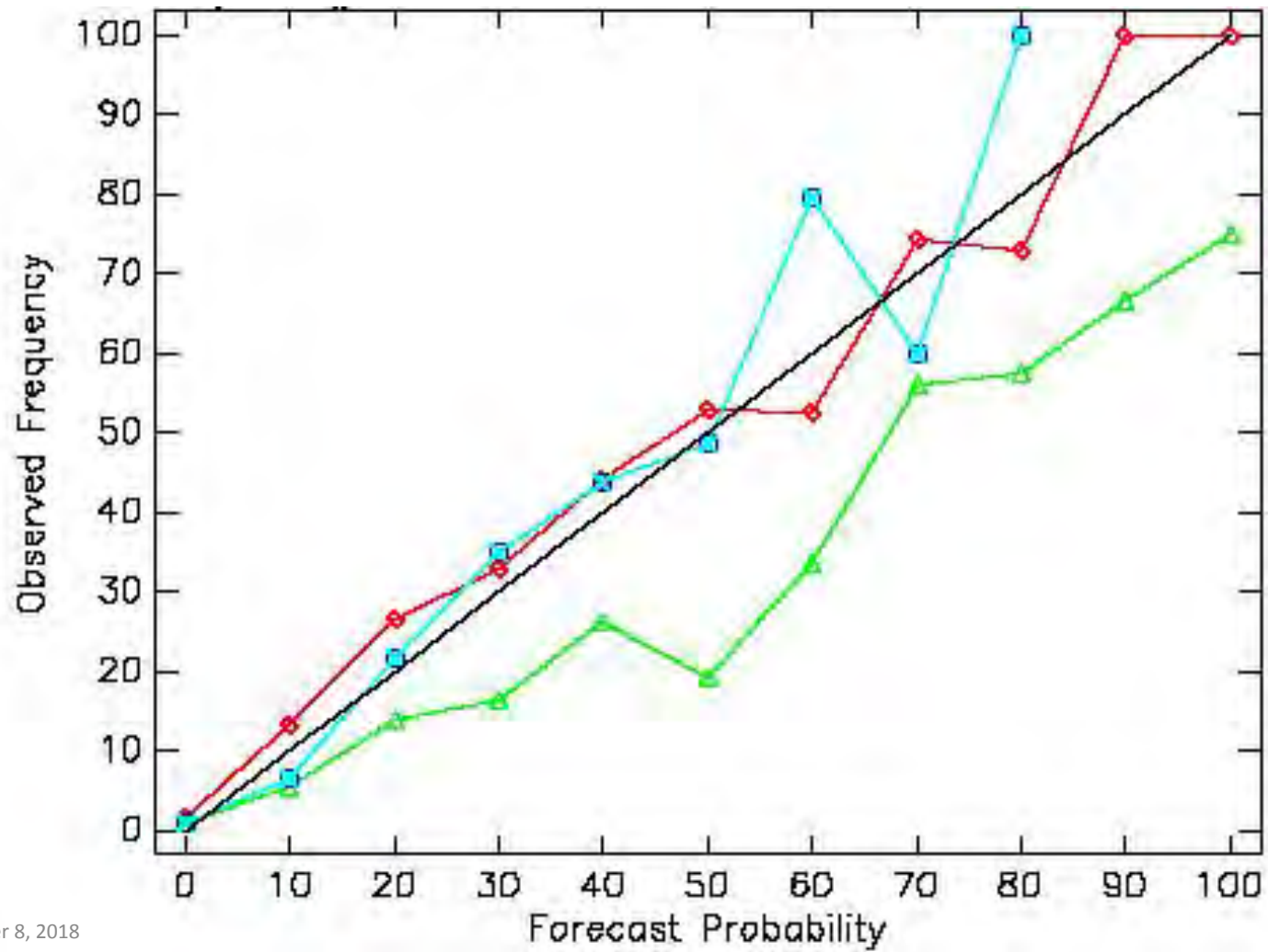
- Accept that, with current technology, “The Impenetrable Horizon of Deterministic Predictability” cannot be overcome by NWP models
- Instead of investing all effort into building one perfect NWP model, run an ensemble of slightly different NWP models
 - The result will be a cloud of solutions (probabilistic approach) rather than a single solution (deterministic approach)
 - Let’s take a look, courtesy of our good pals at Penn State:
<http://cms.met.psu.edu/sref/ensembles/>

The Op/Ed Page

- “I’m sick of all this weasel-word pussy-footing around! Just give me a straight yes or no answer for once, is that too much to ask?”
- Yep
- The public needs to learn to properly handle probabilistic information. The very existence of Las Vegas and Powerball demonstrate the dire magnitude of this need. People tend to hear what they want to hear, rather than hear what the numbers say
- Examples that I like because they reinforce the way I already think:
 - Gordon Haber taught me to combine probabilities and confidence
 - A forecast of 50% is not a know-nothing forecast
 - The RAF’s pasty-skinned pencil-necked Boffins
 - Do not conflate probabilities of occurrence and intensity:
 - Precipitation in Fairbanks and the Global War on Terror

How do you verify ensemble forecasts?

- Deterministic forecasts are easy to verify
- Probabilistic forecasts are more of a challenge
 - A broad set of forecasts and events are required
 - Any single event means (almost) nothing when verifying probabilistic forecasts
 - Tuesday's election: were the polls wrong?
- The “reliability diagram” to the rescue
- <http://research.metoffice.gov.uk/research/nwp/ensemble/verify-example.html>



Speaking of Dave Snider and AK Weather...

- What do the symbols on weather maps depict?
- Ever spend a few hours looking at the floor on the C concourse at Seattle-Tacoma International Airport?
- Let's look at the web site for the TV show "Alaska Weather"
 - <https://www.weather.gov/afc/tv>

L Low Pressure Center in Millibars...typically brings clouds and precipitation

H High Pressure Center in Millibars...typically brings fair skies

•• Rain

••• Moderate Rain

••• Heavy Rain

•• Rain and Drizzle

••• Drizzle

••* Rain and Snow

* Flurries

** Snow

** Moderate Snow

** Heavy Snow

☃ Smoke

R Thunderstorms

≡≡≡ Fog

≡≡≡ Dense Fog

••• Rain and Fog

••• Drizzle and Fog

••• Rain, Drizzle, & Fog

≡≡≡ Snow and Fog

••• Rain, Snow, & Fog

~ Freezing Rain

~ Freezing Drizzle

☃ Blowing Snow

R Thunderstorms w/ Hail

Unshaded areas indicate cloud-free or fair skies

Black lines are lines of constant pressure or isobars



Grey shaded areas indicate cloudy areas

Green shaded areas indicate areas that have the best chance for rain. Blue shaded areas indicate snow. Pink indicates a rain-snow mix, freezing rain or sleet.

Cold Front...boundary between approaching cold air and warmer air

Warm Front... boundary between approaching warm air and cooler air

Occluded Front... cold air over takes warm air or vice versa

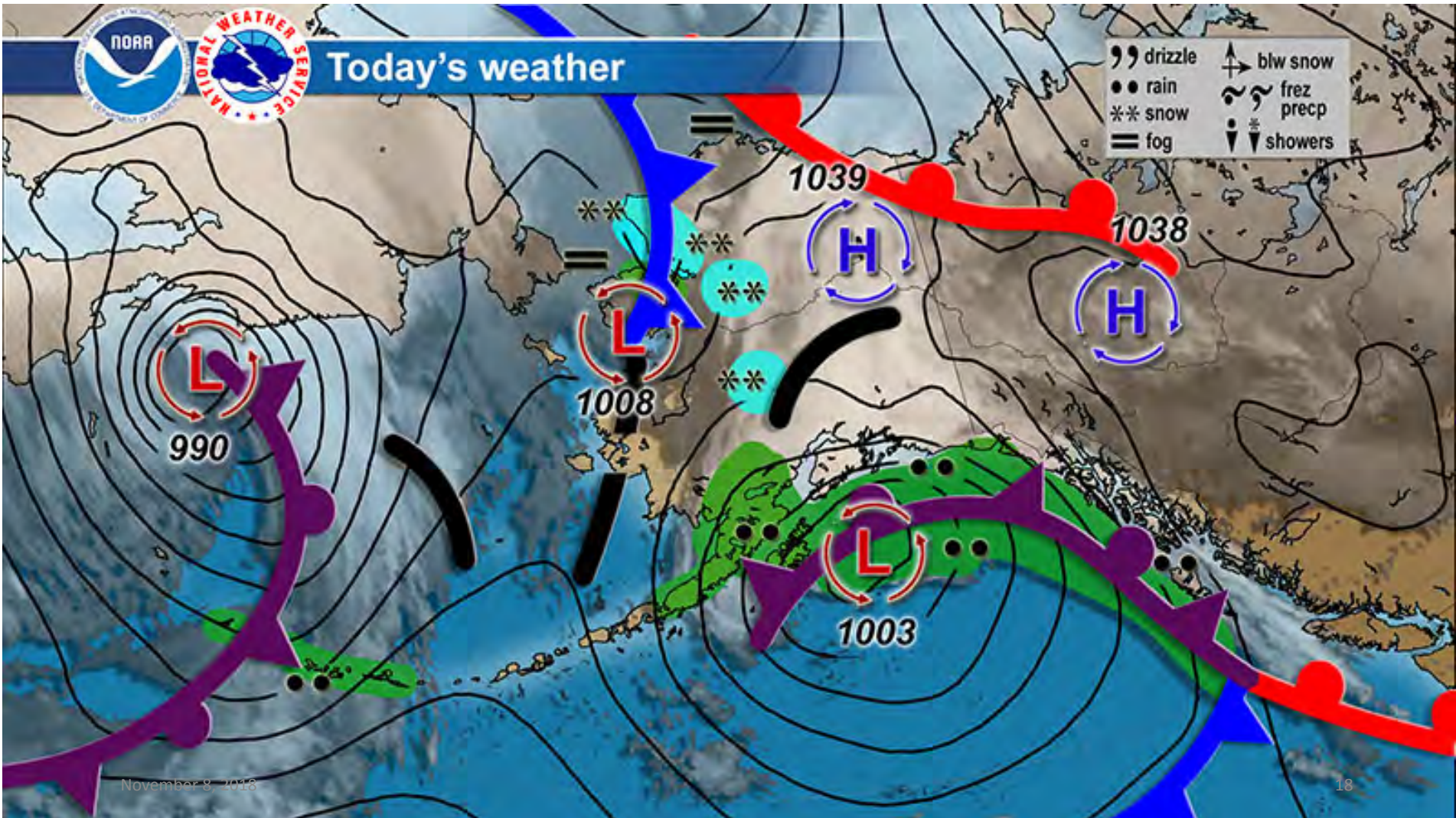
Trough...boundary of low pressure

Stationary Front...boundary between warm and cold air has little or no movement



Today's weather

- ☂ drizzle
- rain
- ** snow
- ☁ fog
- ↕ blw snow
- ❄️ frez precp
- ☔ showers

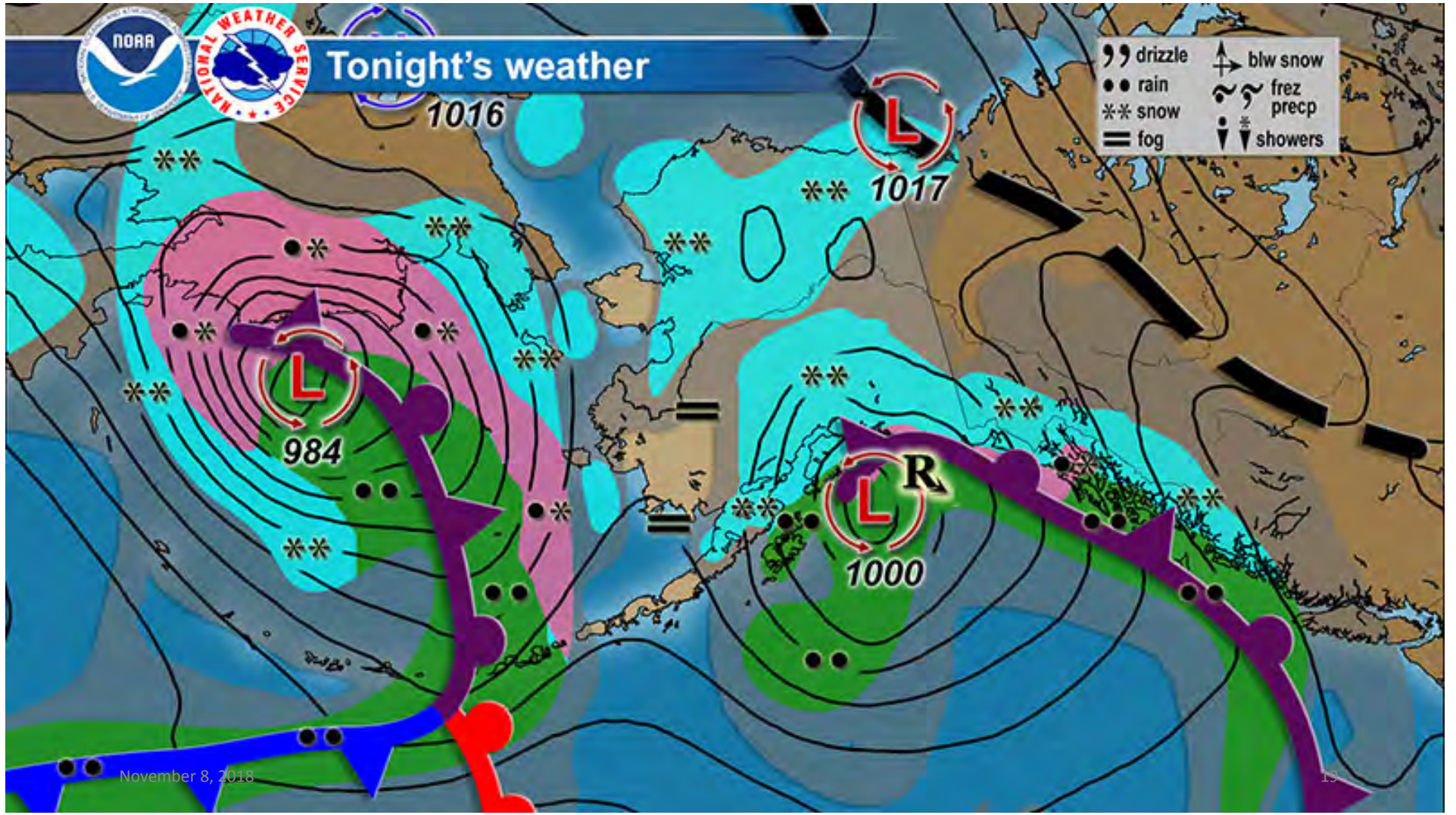


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Tonight's weather

- ☁ drizzle
- rain
- ** snow
- ☰ fog
- ↕ blw snow
- ☃ frez precp
- ☂ showers

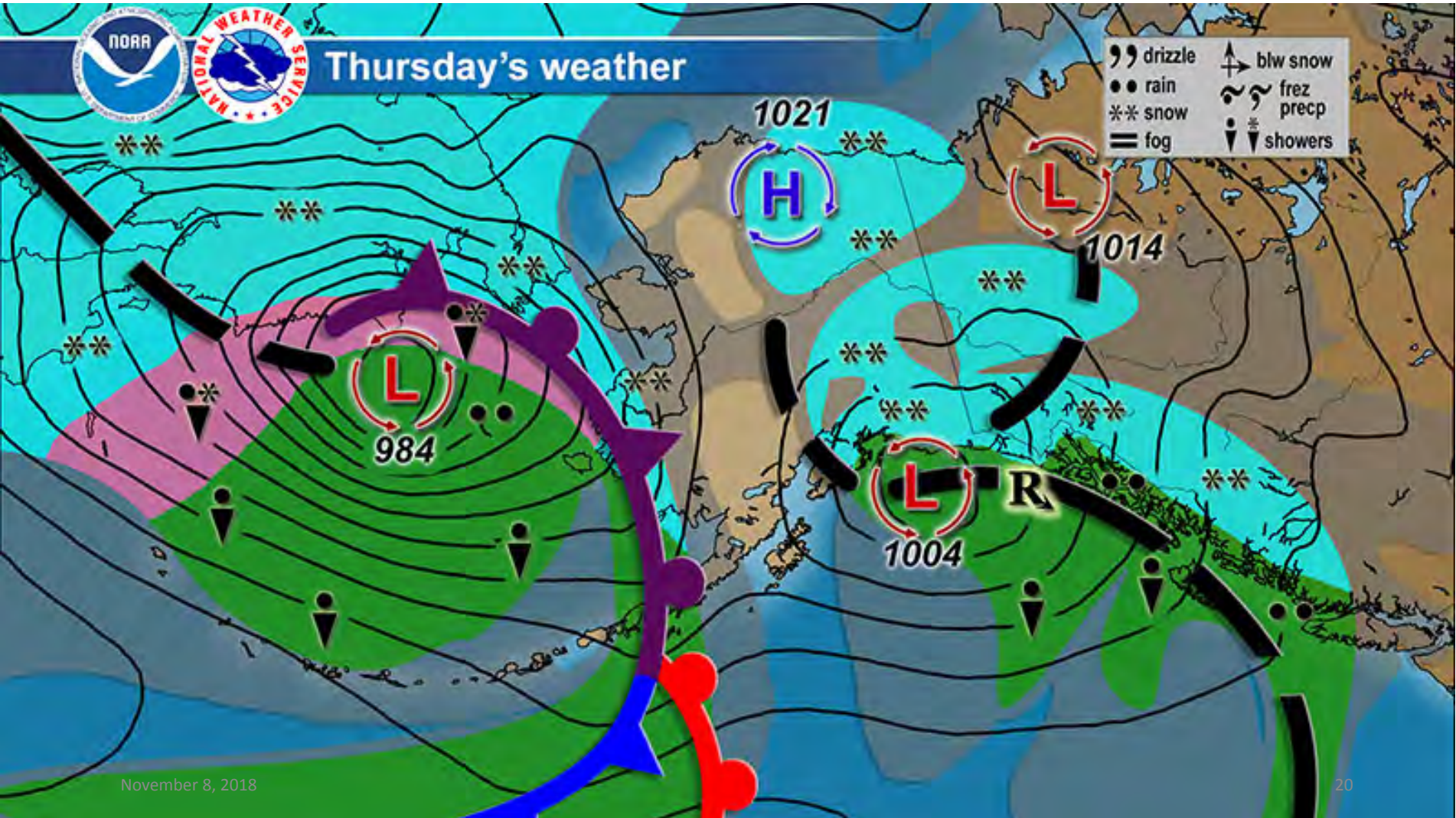


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Thursday's weather

- ☁ drizzle
- rain
- ** snow
- ☁ fog
- ↕ blw snow
- ☁ frez precp
- ☁ showers

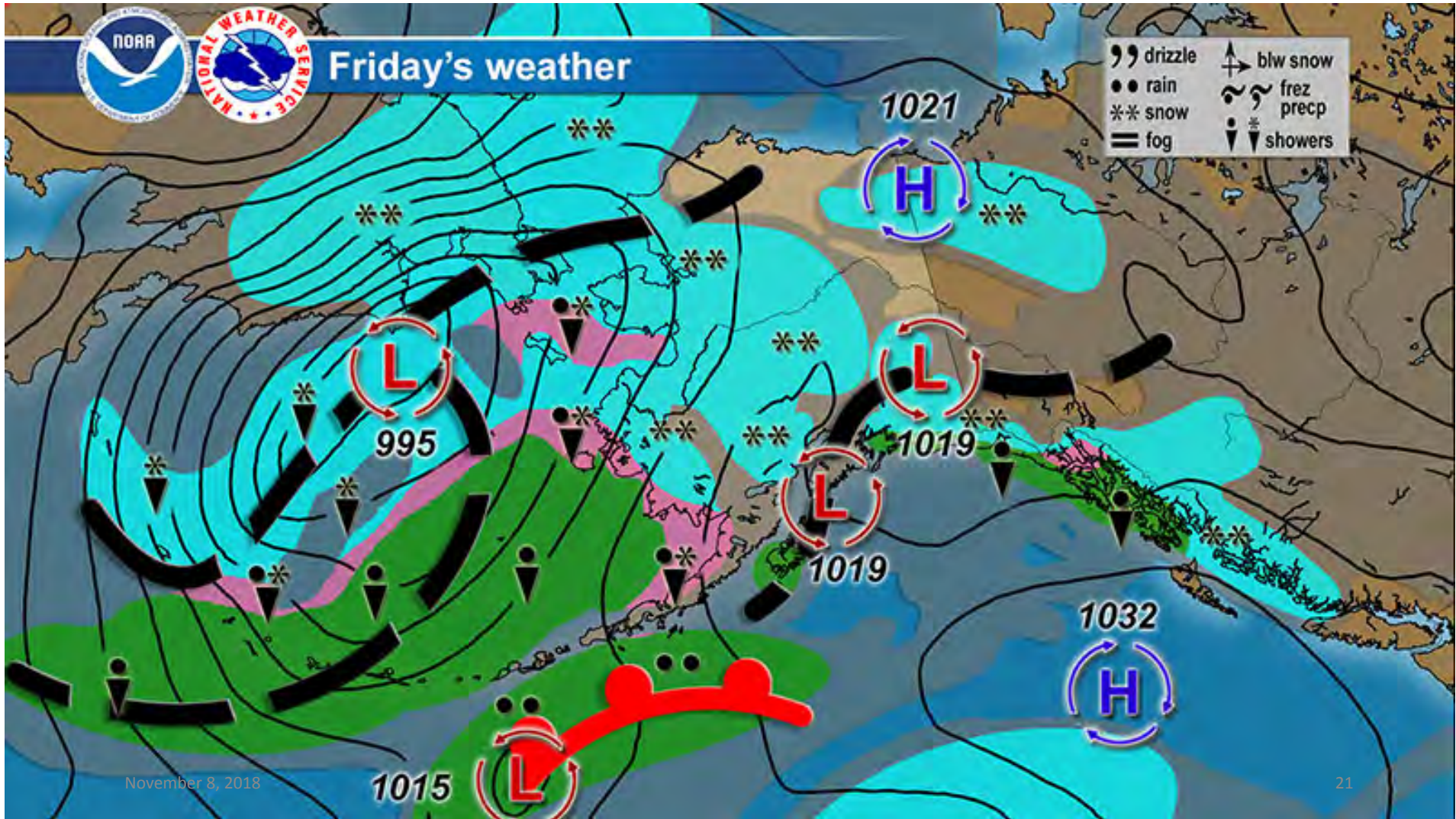


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Friday's weather

- ☁ drizzle
- rain
- ** snow
- ☁ fog
- ↕ blw snow
- ☁ prez precp
- ☁ showers



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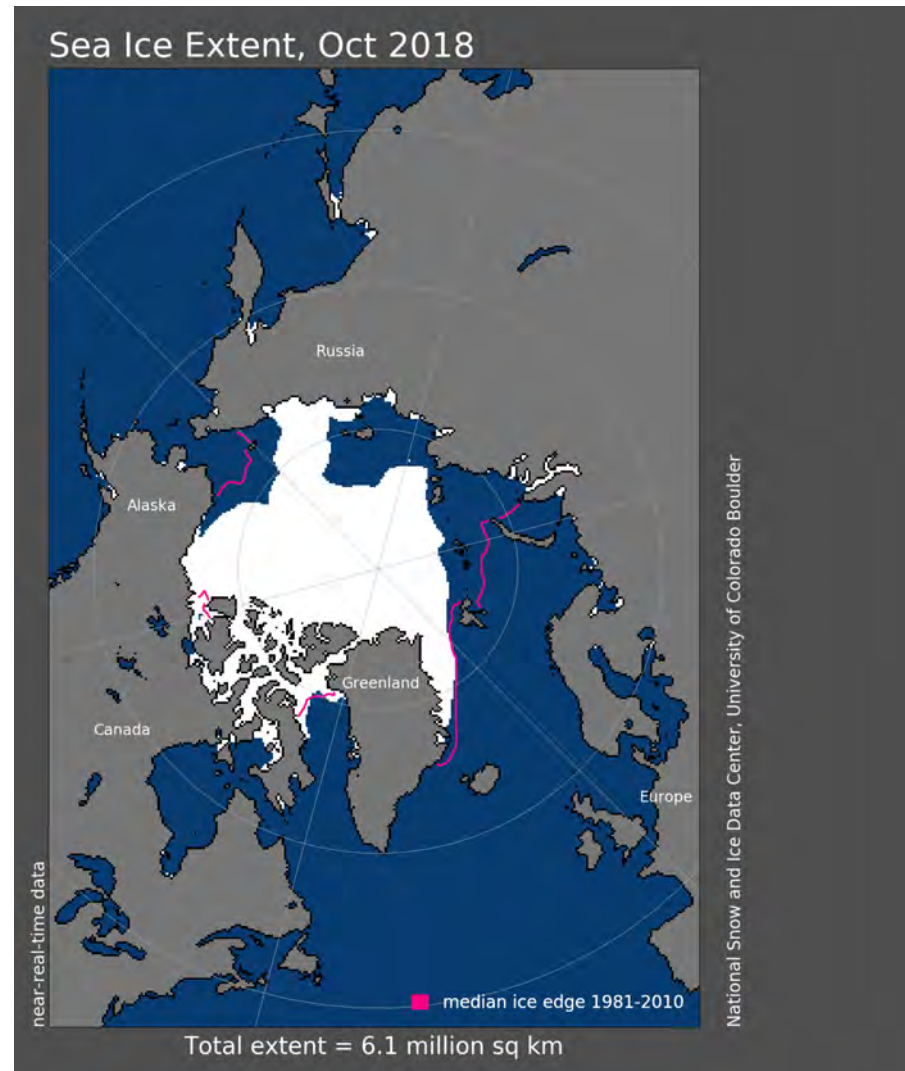
Ice is Nice

- The satellite era began in 1979
- The era of ships being trapped in ice began...a long time ago
- Nice web sites:
 - National Snow and Ice Data Center <https://nsidc.org/>
 - NWS Anchorage's "Ice Desk" <https://www.weather.gov/afc/ice>

October, 2018

- Note the “Median Ice Edge” in magenta.
- Alaska and Russia are missing some ice, while Canada has a small surplus
- Median Ice Edge based on data from 1981-2010...sound familiar?

November 8, 2018



Guess What Rick Thoman Talks About Next Week

- 10am next Tuesday, November 13.
- “Standing at the Brink: The upcoming winter and what it means for western Alaska sea ice”
- https://accap.uaf.edu/Sea_ice_webinar



Even More Ice

- “The Cold and The Dark: JPSS and the Cryosphere”
 - Where JPSS stands for Joint Polar Satellite System
 - ...and with apologies to Carl Sagan and friends
- A tad out of date, from December, 2014
- Find a recording of this presentation at https://www.jpss.noaa.gov/assets/pdfs/science_seminars/presentations/SSP26_JPSS_Cryosphere_15Dec2014.pdf

