



**ACCAP**

Alaska Center for Climate  
Assessment and Preparedness

A NOAA CAP/RISA team

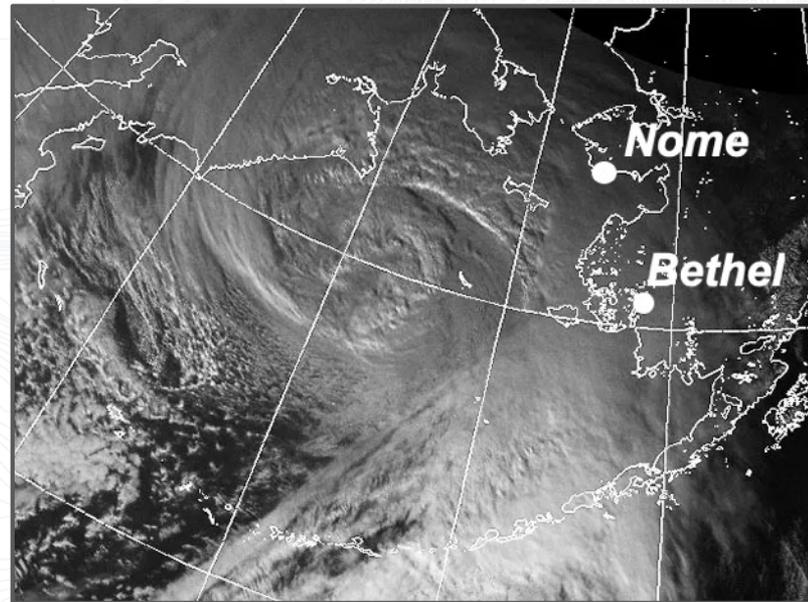
# Alaska storminess in a changing environment

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# Today's Agenda

- What is storminess?
  - Simple question, complex answer(s)
- Perspectives on storminess
  - Different perspectives, different answers
- What's changing, what's not
- Future prospects of storms



Bering Sea superstorm  
November 8, 2011

# What is a storm or storminess?

- Does a “storm” require any/some/lots of precipitation?
  - Is a clear sky ground blizzard a “storm”?
- Does a “storm” require strong winds?
- Does a “storm” require strong winds from a particular direction?
- Does a “storm” need to last a minimum length of time?

Are answers to these questions

regionally dependent?

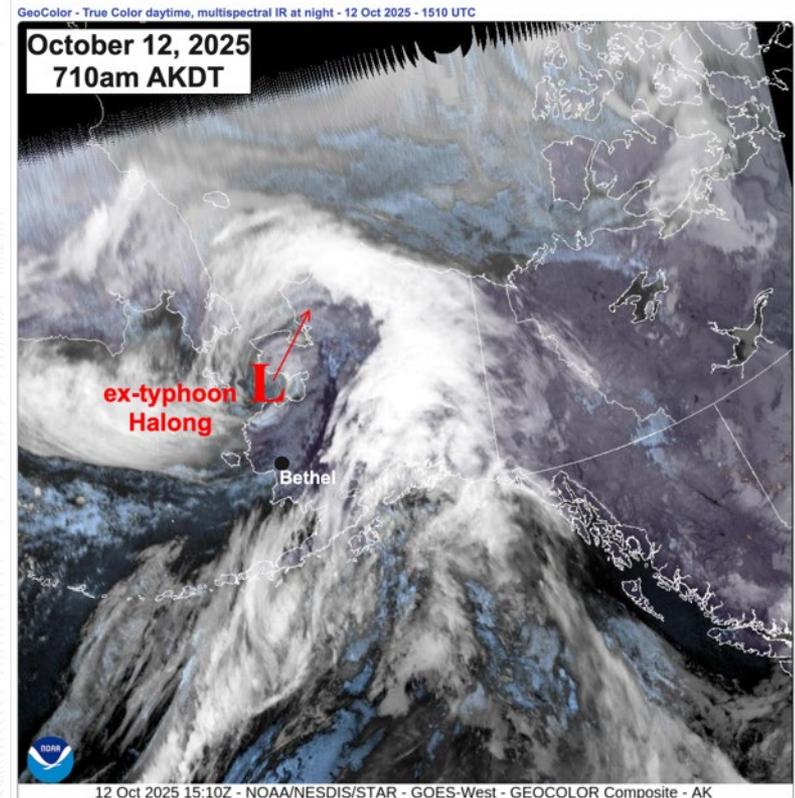
Some definitions

- storm (n): a **violent disturbance** of the atmosphere with strong winds and **usually** rain, thunder, lightning, or snow (New Oxford dictionary)
- storm: a **disturbed** state of the natural environment or the atmosphere (Wiki)
- a storm is a **transient occurrence** identified by its most destructive or spectacular aspect (Glossary of Meteorology)



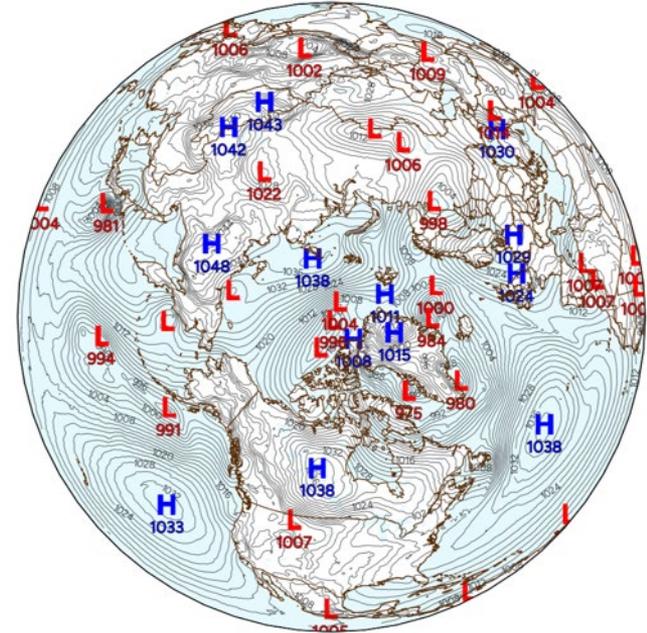
# Alaska perspectives

- “Storm” usually associated with low pressure systems
  - Nearly all coastal floods
  - Heavy rain/snow (except sometimes Interior)
  - Some strong wind events (see below)
- Exceptions can include:
  - Interior rain/snowstorms
  - Mountain modulated wind storms, e.g. Taku winds, Matanuska wind
  - Clear sky ground blizzards



# Western science perspective (1)

- “Storm” = area where air flow is counter-clockwise in the northern hemisphere
  - Facing into the wind, lower pressure is to your right, higher pressure to your left
  - Land greatly disturbs this simple pattern
- Pressure is lower toward the center of the wind circulation
  - “L” on a weather map
  - Does not imply anything about intensity or impacts



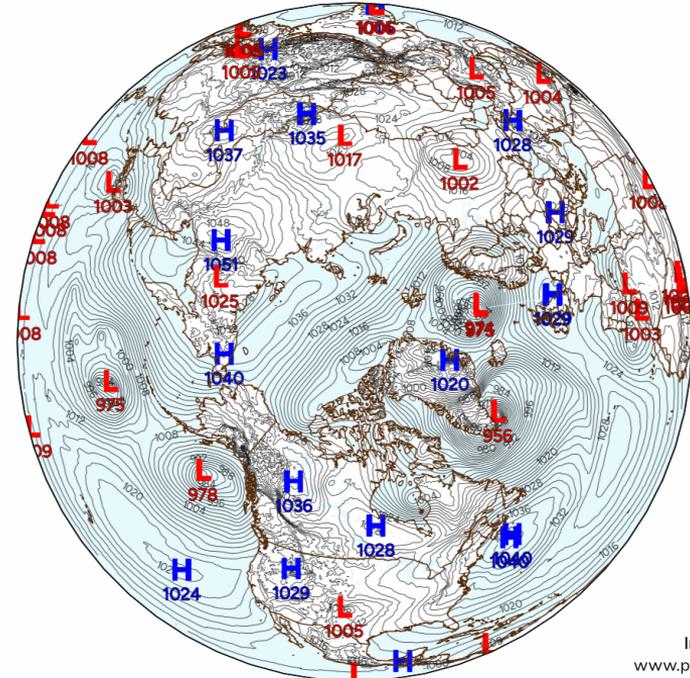
# Western science perspective (2)

- Intensity (wind strength) related to lowest pressure
  - Measured in “millibars” or “inches of mercury”
- Lifecycle: development, intensification and decay
  - Time scales from hours to weeks, typically 4 to 8 days
- Movement controlled by
  - Winds aloft (“steering flow”)
  - Interaction with land (especially mountains)

0.25° ECMWF • MSLP (hPa)

Init: 1200 UTC Mon 2 Mar 2026 | Hour: [24] | Valid: 1200 UTC Tue 3 Mar 2026

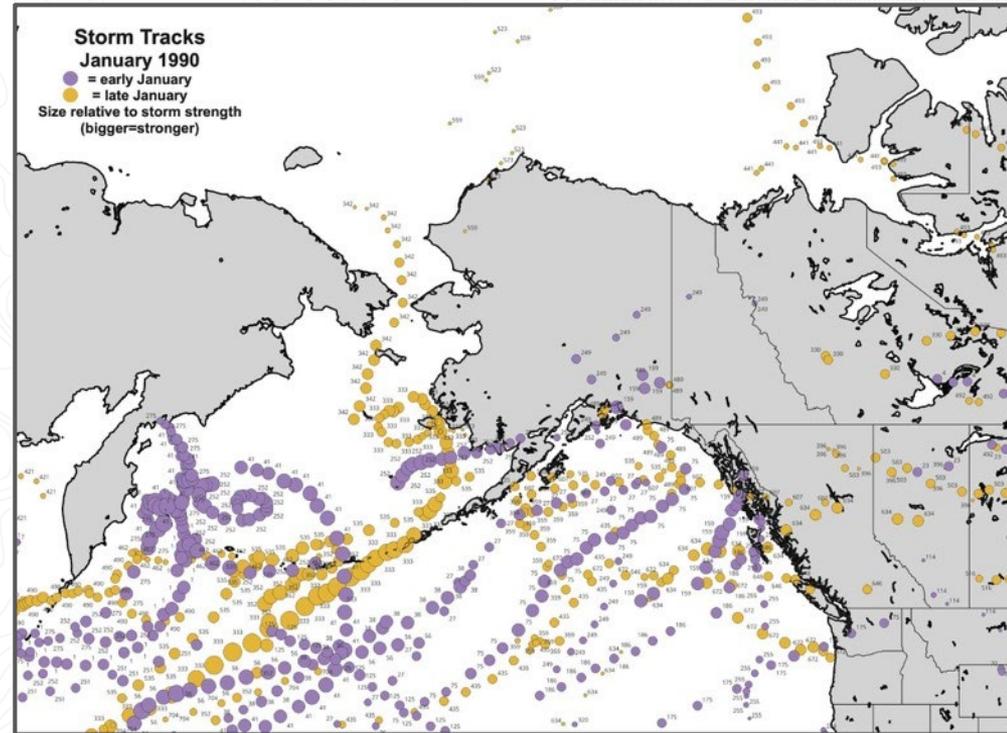
Label: MSLP Lows / Highs  
Contour: MSLP (every 2 hPa)



# Where storms move=storm tracks

## Critical to coastal impacts

- Coastal aspect determines threat direction
- Track determines wind direction and timing of changes for specific places
- Track determines region with maximum rise of ocean levels (storm surge)



# Storm impacts: geography

## Critical to coastal impacts

- Coastline aspect and orientation
  - North vs. south facing
  - Bay vs. open ocean
- Nearby terrain
  - Nearby mountains or offshore islands
- Near shore water depth



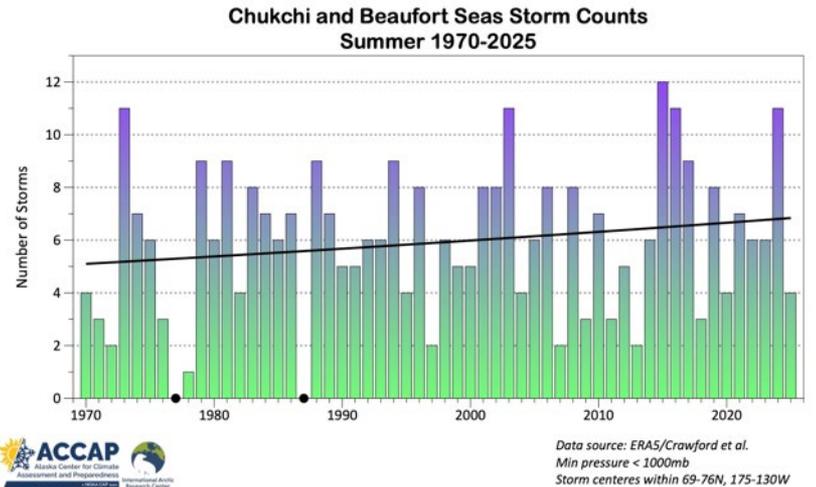
Aerial view of Utqiagvik  
pre-2011

# Assessing changes in storminess

## From the *meteorology* perspective

- Are the number of storms changing?
- Are the intensities of storms changing?
- Is the seasonality of storms changing?

Changing over what time scale(s), recognizing that there are year-to-year differences?

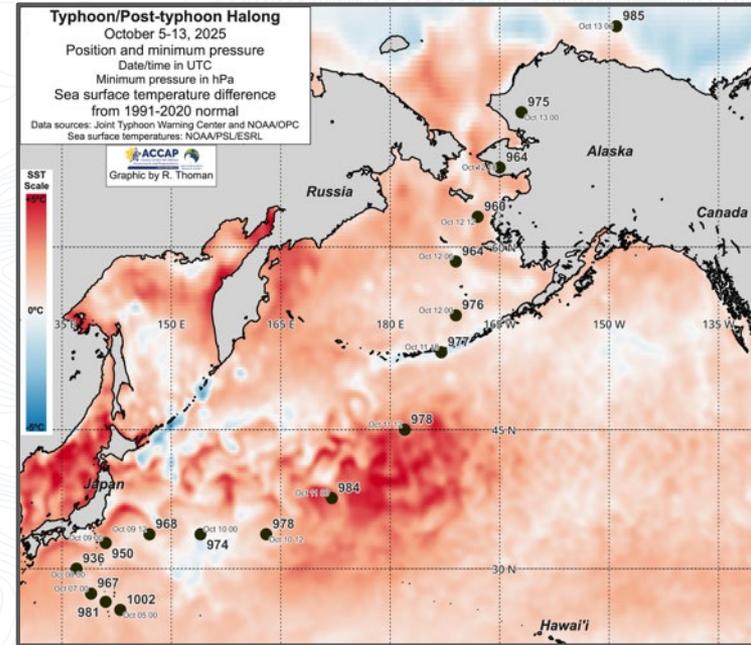


Answer: mostly (not entirely) **NO**



# Environmental impact factors (1)

- Ocean surface temperatures
  - Warmer → more evaporation into the atmosphere
  - Can increase storm intensity
  - Can increase overall precipitation amounts
- Moisture source
  - atmospheric rivers bring subtropical warm and moisture to Alaska
- Sea ice presence or lack thereof
- Wind fetch (distance) over open ocean (coastal flood)



# Environmental impact factors (2)

- Pre-existing conditions
  - Surface land state (frozen or thawed, dry or wet, snow cover or not, etc)
  - River levels (already high vs. unusually low)
- Relative to the recent past
  - Land surface changes, e.g. subsidence in the Kukso delta partly due to permafrost thaw
  - Infrastructure changes
  - Sea level rise
- Random
  - Timing of storm surge relative to tidal cycle (coastal flooding)



Kipnuk on October 12, 2025

Photo credit: Alaska National Guard

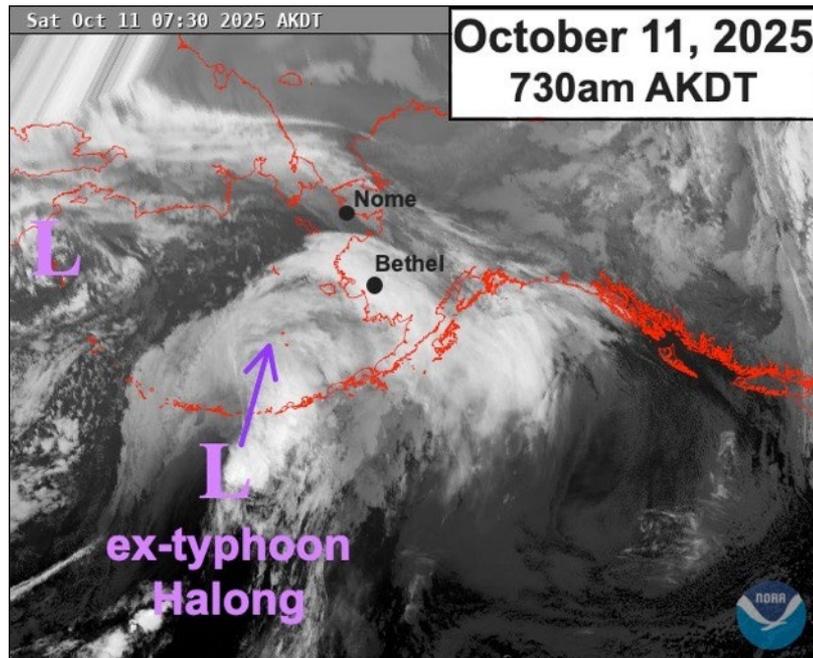
# Typhoons and Alaska

## What's this “ex-” thing about?

Storms that extract energy from warm (80F or higher) ocean water and have sustained winds at least 39 mph and are **named**

Storms that extract energy from horizontal air temperature differences are **not named**

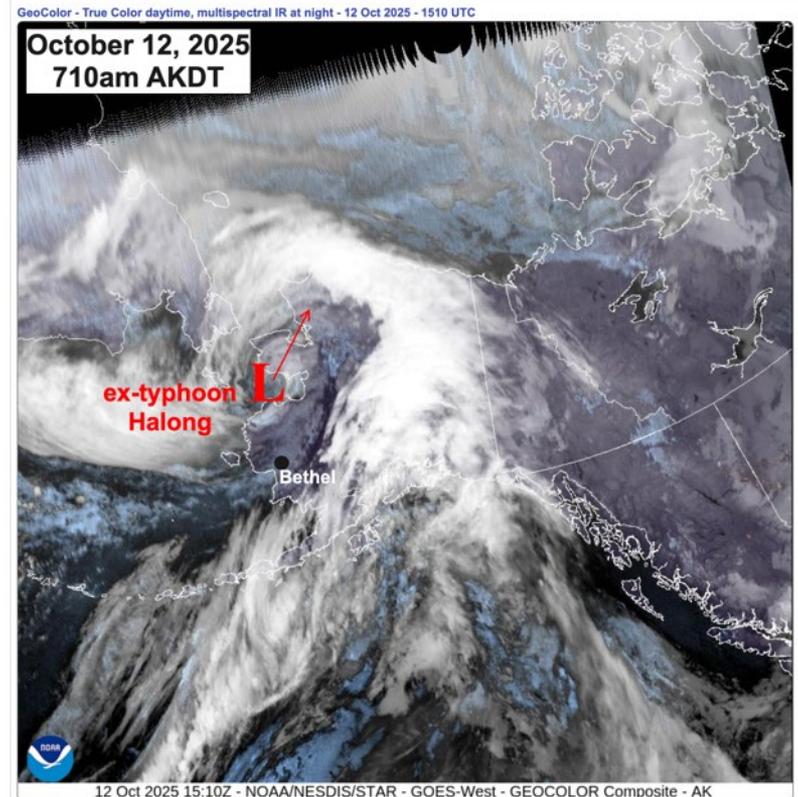
“Ex-” → a storm that began as a “warm water” storm and transitioned to a “air temperature difference” storm



# Why does this “ex-” thing matter?

Even if intensity (lowest pressure) of the storm stays the same...

- Area with moderate to strong winds expands...sometimes by 3 to 5 times
- Area of ocean water being pushed up by the winds expands





# Ex-typhoons and Alaska

Since 1970, more than 60 ex-typhoons have directly impacted some part of Alaska

1. Western/central Aleutians
2. Eastern Aleutians/Pribilof Islands
  - a. ex-Ivy 1977
3. Alaska Peninsula/Bristol Bay
  - a. ex-Soulik 2018
4. Gulf of Alaska
  - a. Ex-Oho 2015

Ex-typhoons also impact Alaska by bringing high moisture content air into the state

Only four ex-typhoons have moved into the Arctic after impacting northern Bering Sea coast

1. Ex-Carlo (Oct 1996)
2. Ex-Merbok (Sep 2022)
3. Ex-Ampil (Aug 2024)
4. Ex-Halong (Oct 2025)

Since 1990 significant trend down in number of West Pacific typhoons

# Most western Alaska storms are NOT ex-typhoons

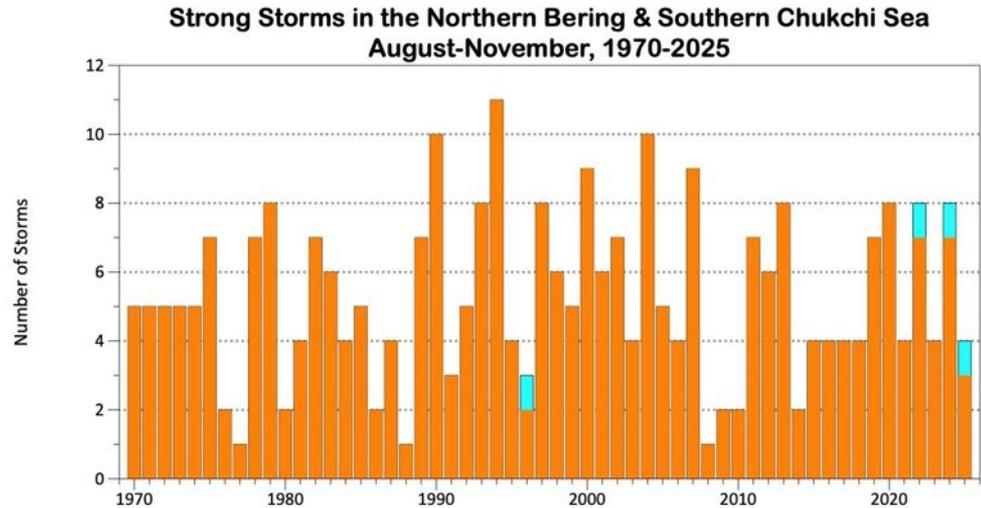
High impact coastal flood producing storms that were never typhoons

- Northern Bering Sea (Nov 1974)
- Eastern Norton Sound (Oct 1992)
- Kuskokwim delta (Nov 2000)
- Northern Bering Sea (Oct 2004)
- Bristol Bay (Aug 2005)
- Bering Sea Superstorm (Nov 2011)
- Eastern Norton Sound (Nov 2013)
- Kuskokwim delta (Aug 2024)
- Southern Chukchi Sea (Oct 2024 & Oct 2025)



# Strong storms in the Bering/Southern Chukchi Seas

- Already stormy region
- No long term trend in autumn
- Ex-typhoons not a major factor in the **number** of storms
- **But...** ex-typhoons are “predisposed” to become strong storms at higher latitudes
  - They bring a key ingredient with them: warm moist air



# Future storm prospects

Q. **Will there be more storms** (“Ls on weather maps”)?

A. Probably, but seasonally and regionally dependent

Q. **Will storms be more intense?**

A. Not always, but sometimes for sure

Q. **Will storms bring more extreme rain/snow?**

A. Already happening

Q. **Will there be greater/more frequent impacts from storms?**

A. Beyond all doubt, absolutely yes



Anchorage record snow

December 16, 2022

Photo credit: B. Brettschneider



# Summary and Resources

- What constitutes a “storm” varies
- However defined, storm impacts in Alaska are increasing
- The number of storms (lows on a weather map) are increasing only in some regions/seasons
- Ex-typhoons are an added source of potentially impactful storms

## **ACCAP Resources**

- Extreme events library
- Alaska’s Changing Environment series
- Climate graphics
- Webinars of interest

**ACCAP homepage**

**<https://uaf-accap.org/>**

# Upcoming ACCAP webinars

Upcoming ACCAP webinars [accap.uaf.edu/events](https://accap.uaf.edu/events)

- March 20 ▶ March NWS Alaska Climate Outlook Briefing
- March 26 ▶ When Every Second Counts: How Alaskans Get Emergency Alerts
- April 17 ▶ April NWS Alaska Climate Outlook Briefing
- April 21 ▶ Alaska Spring River Breakup Outlook

For more info email Ed Plumb [ewplumb@alaska.edu](mailto:ewplumb@alaska.edu)

**Chin'an • Quyana • Dogidinh • Gunalchéesh • Basi'**  
**• Thank You**

