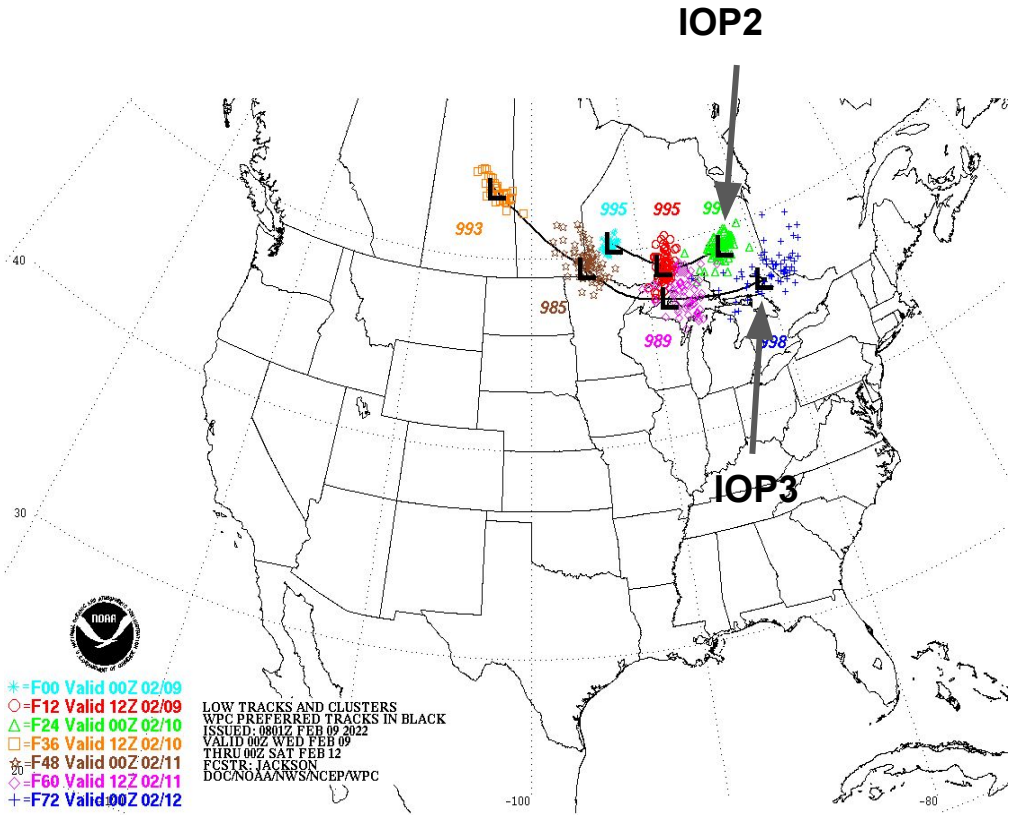
Synoptic-Scale Characteristics and Predictability Cold-Season Precipitation Events Affecting the SLV

Andrew Winters
WINTRE-MIX Project Meeting
13 January 2023

Motivation

WINTRE-MIX observed a diversity of cyclone tracks across our study domain

Clippers (e.g., IOPs 2 and 3)

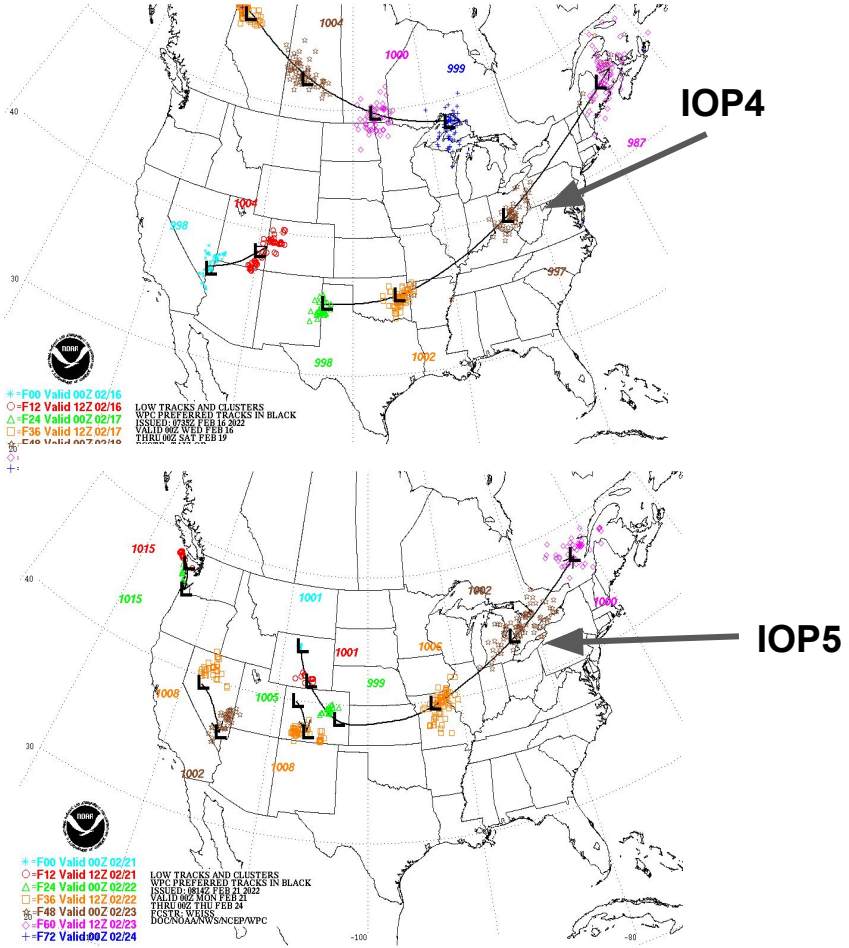


Motivation

WINTRE-MIX observed a diversity of cyclone tracks across our study domain

Clippers (e.g., IOPs 2 and 3)

Colorado Lows (e.g., IOP 4)



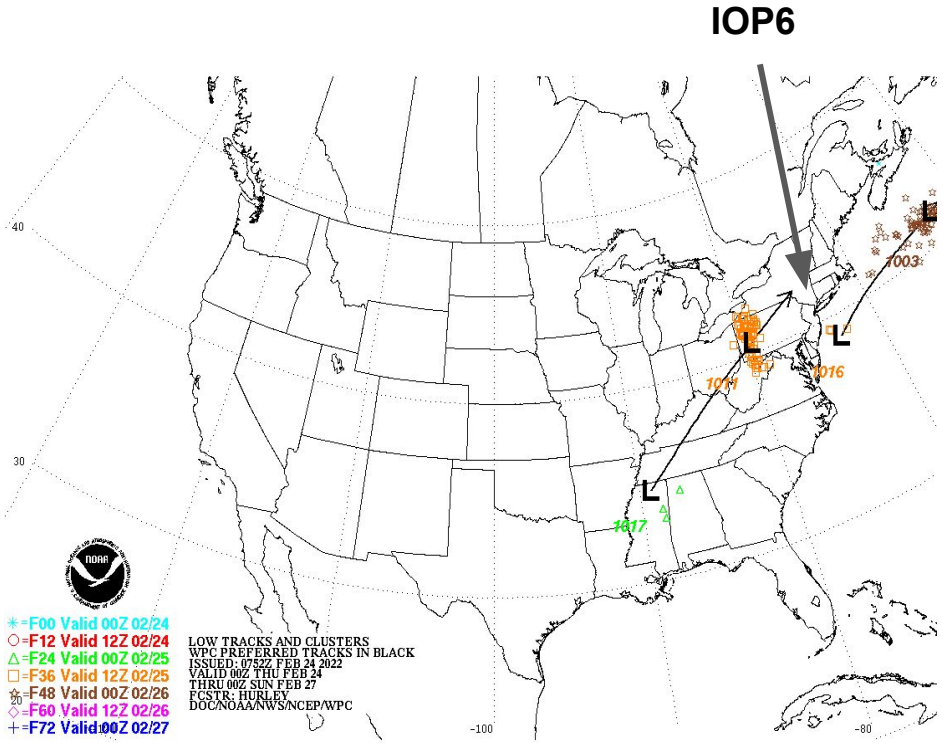
Motivation

WINTRE-MIX observed a diversity of cyclone tracks across our study domain

Clippers (e.g., IOPs 2 and 3)

Colorado Lows (e.g., IOP 4)

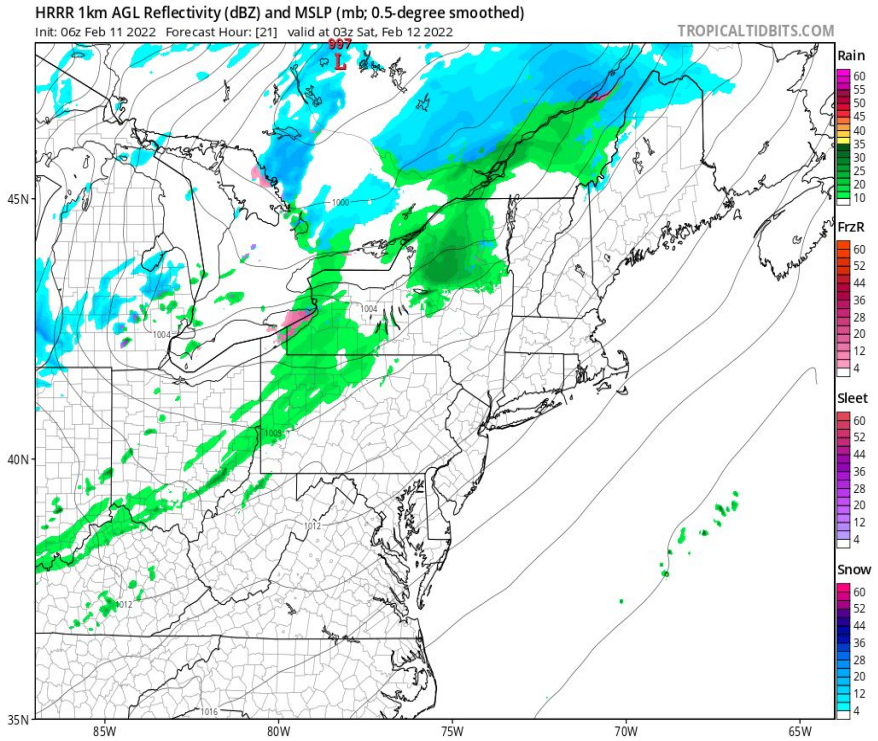
East Coast Track (e.g., IOP 6)



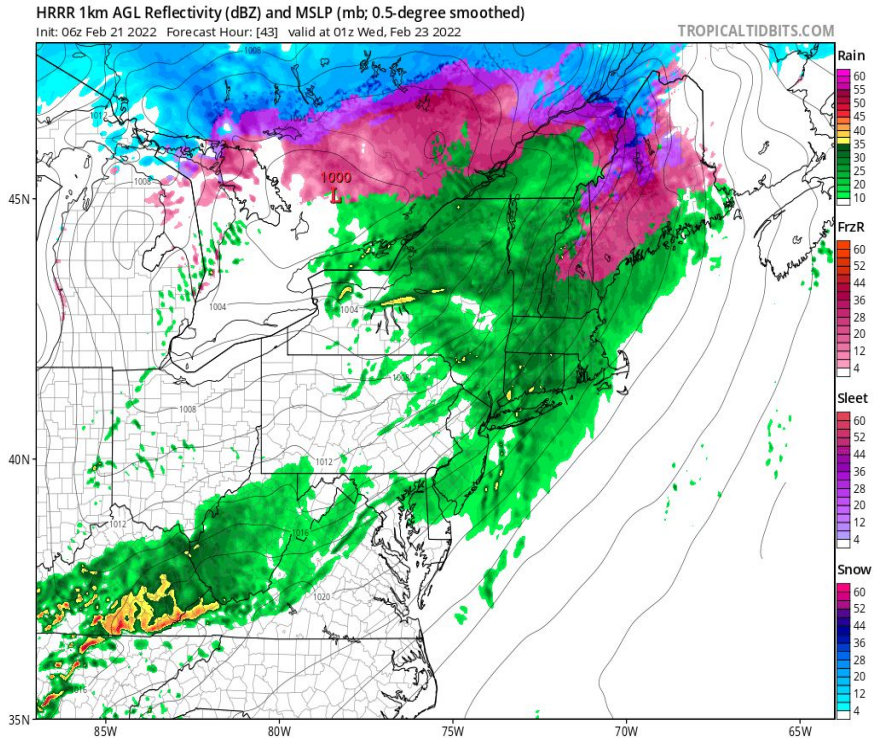
Motivation

Each IOP brought its own predictability challenges…

IOP 3 Forecast



IOP 5 Forecast



Group Research Objectives

(1) Can we objectively partition surface cyclones passing near the WINTRE-MIX domain based on their track?

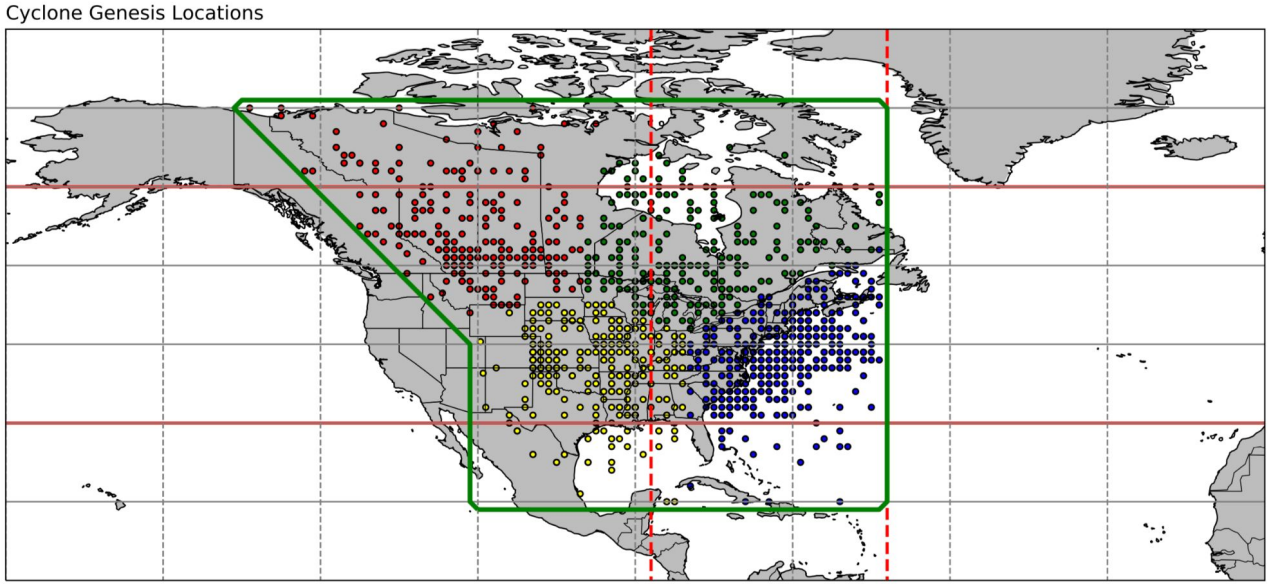
(2) What are the thermodynamic & dynamical characteristics of these surface cyclones, as well as their sensible weather impacts, as a function of their track?

(3) How well are the tracks of these surface cyclones and their ambient thermodynamic environments predicted?

Surface Cyclone Categorization

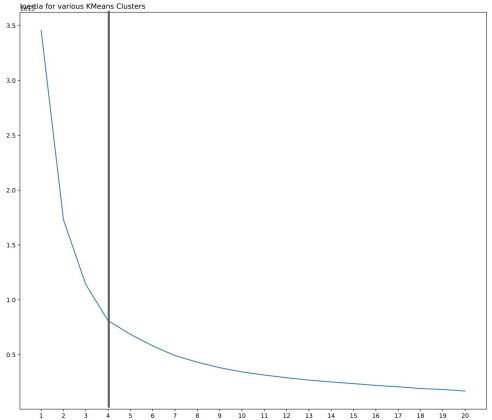
- Cyclones were required to pass through a lat-lon domain centered on the SLV and to originate within the region highlighted by the green box.
- Cyclones were required to be associated with precipitation at both KBTV and CYUL as they tracked near the WINTRE-MIX domain

Utilized a dataset of surface cyclones from Sprenger et al. (2017) between 2000–2018



Surface Cyclone Categorization

- K-means clustering was used to partition the genesis points for each cyclone into clusters.

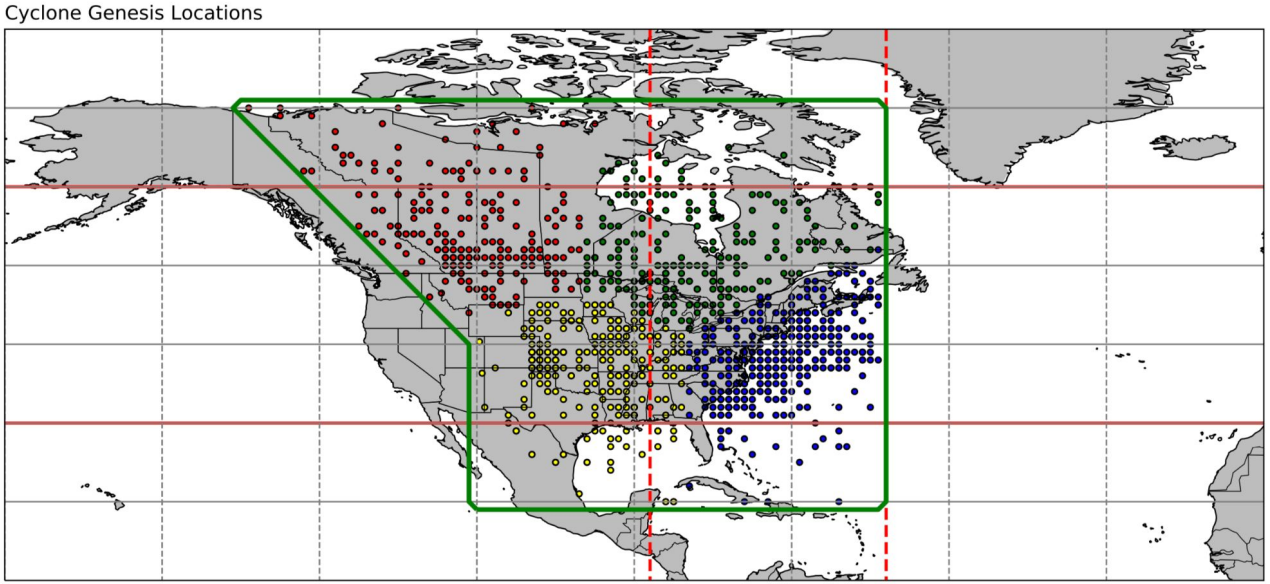


East Coast

Clipper 1

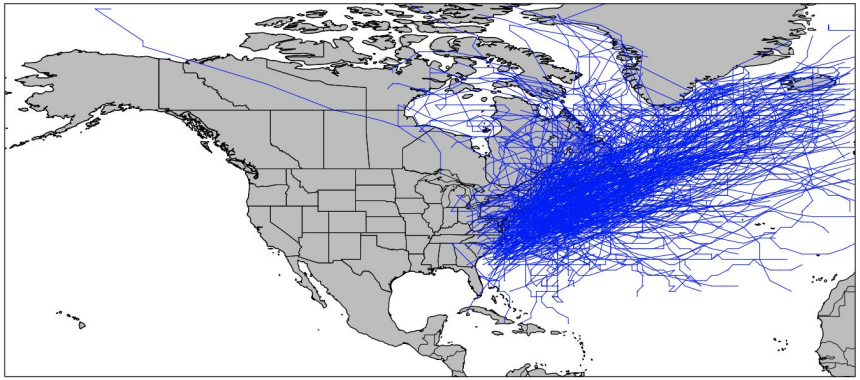
Clipper 2

Central US

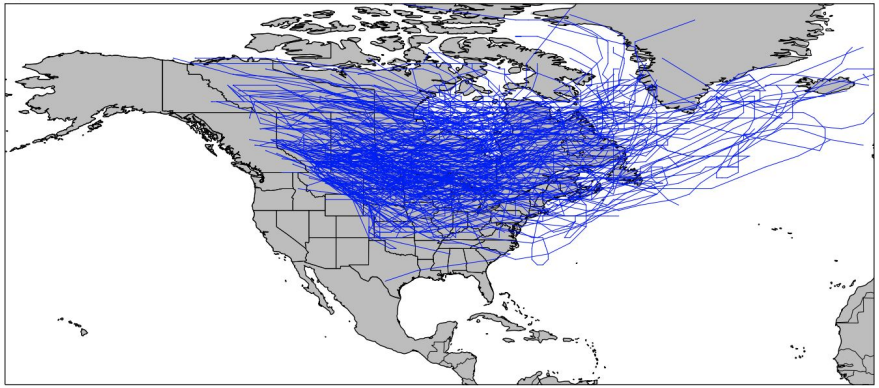


Cyclone Characteristics

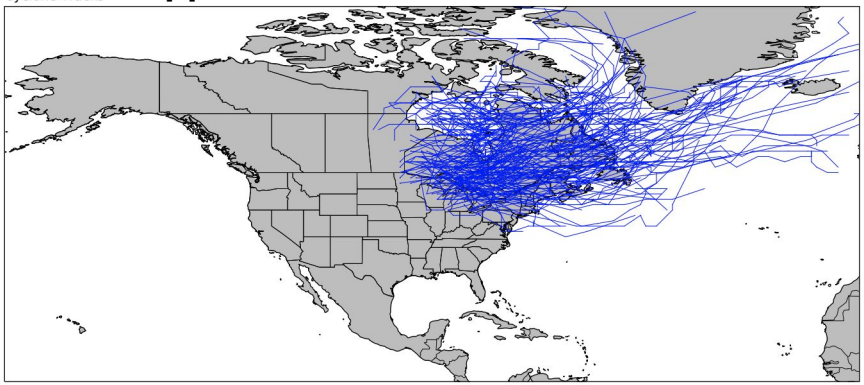
East Coast



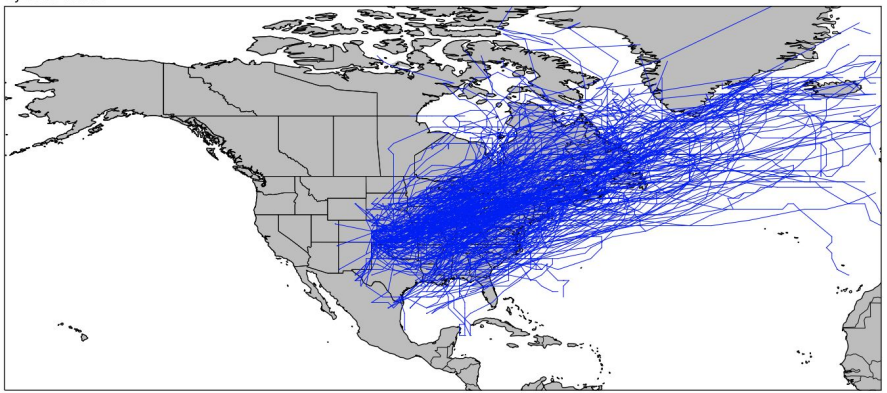
Clipper 1



Clipper 2

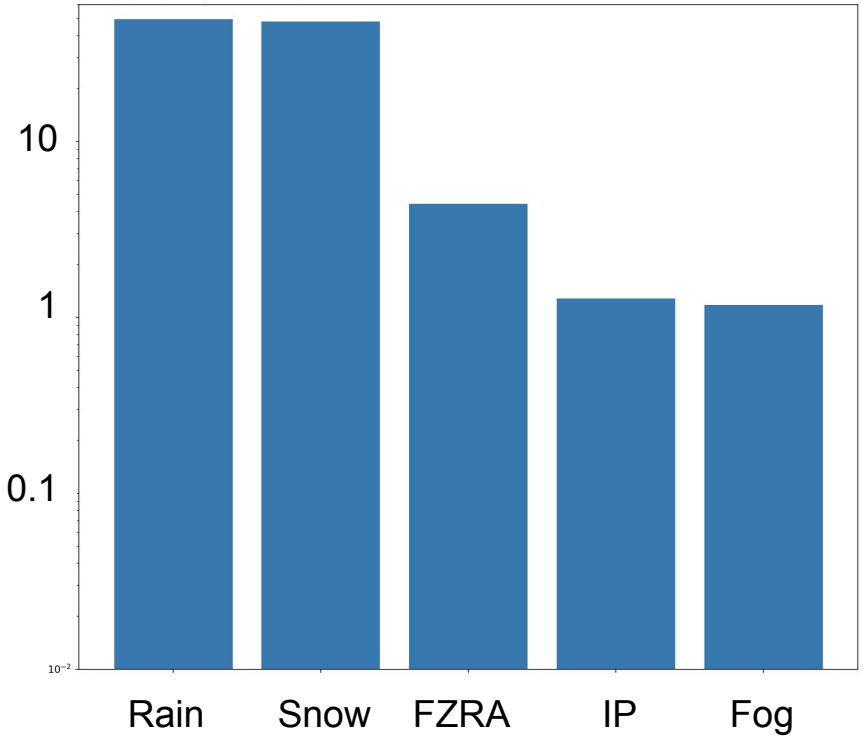


Central US

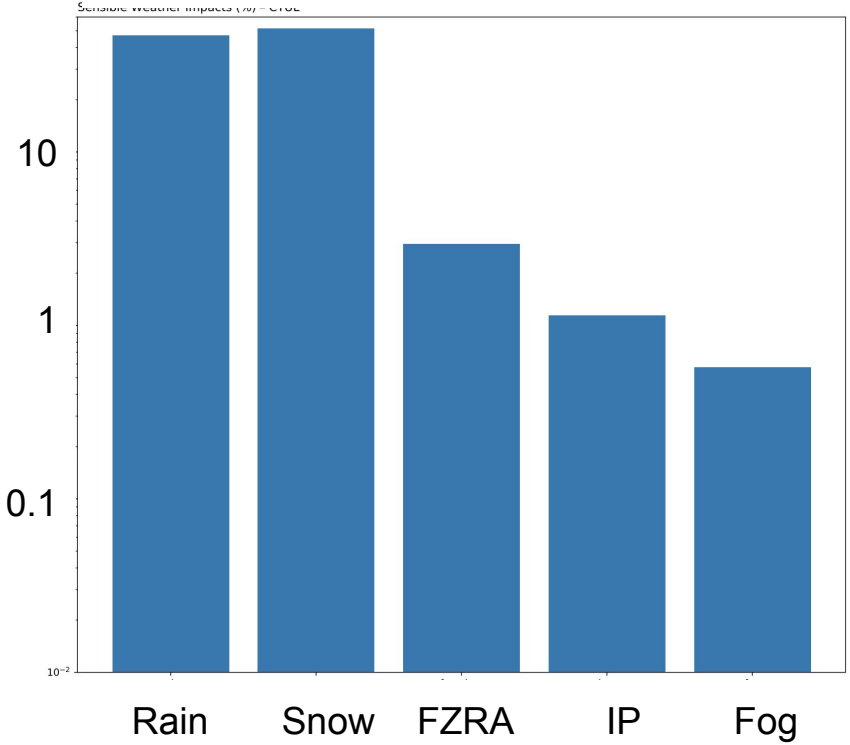


Cyclone Characteristics

Sensible Weather Impacts (%) – KBTV



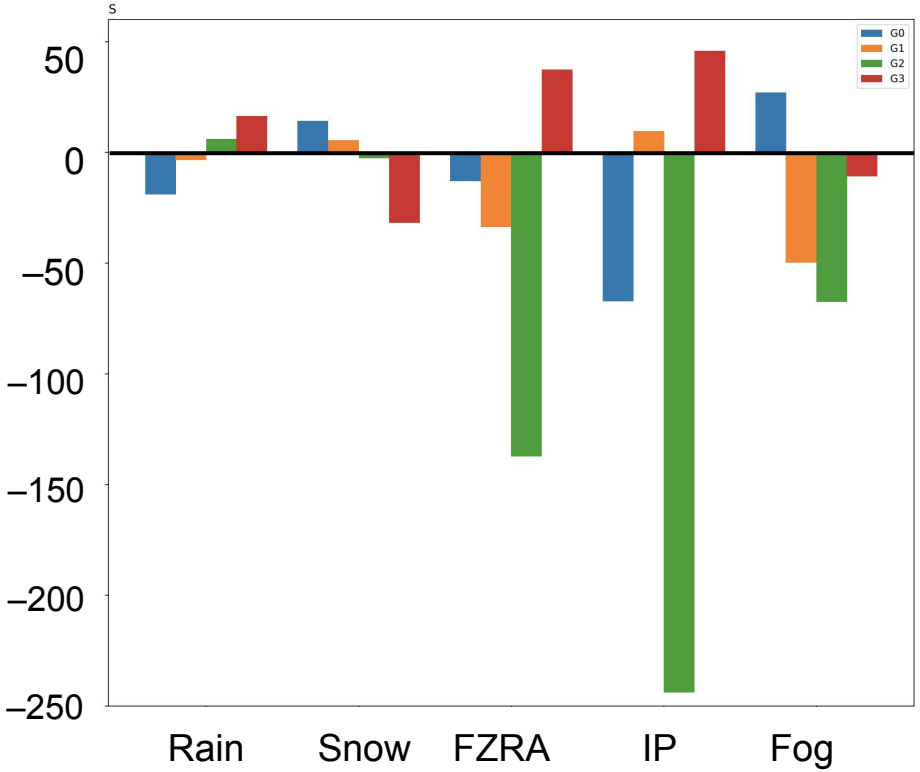
Sensible Weather Impacts (%) – CYUL



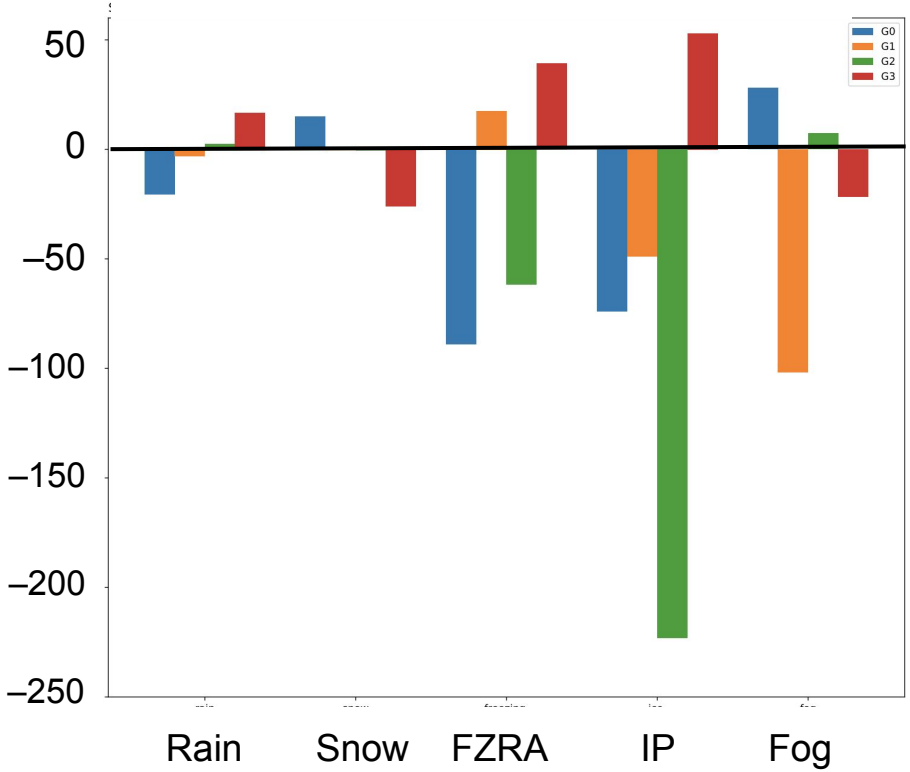
Cyclone Characteristics

Clipper 2
East Coast
Central US
Clipper 1

Sensible Weather Impacts (%) – KBTV



Sensible Weather Impacts (%) – CYUL



Next Steps…

(1) Composite analyses for each group centered on closest approach of each cyclone to YUL/BTV is ongoing

(2) Evaluating the variability in thermodynamic profile across SLV during evolution of events from each group is ongoing

(3) Currently downloading GEFS Reforecast dataset to explore forecast errors in cyclone track and local thermodynamic profile for each cyclone group

(4) Examining synoptic/mesoscale processes that contribute to forecast errors during each cyclone group & WINTRE-MIX IOPs (Clairy)

Next Steps…

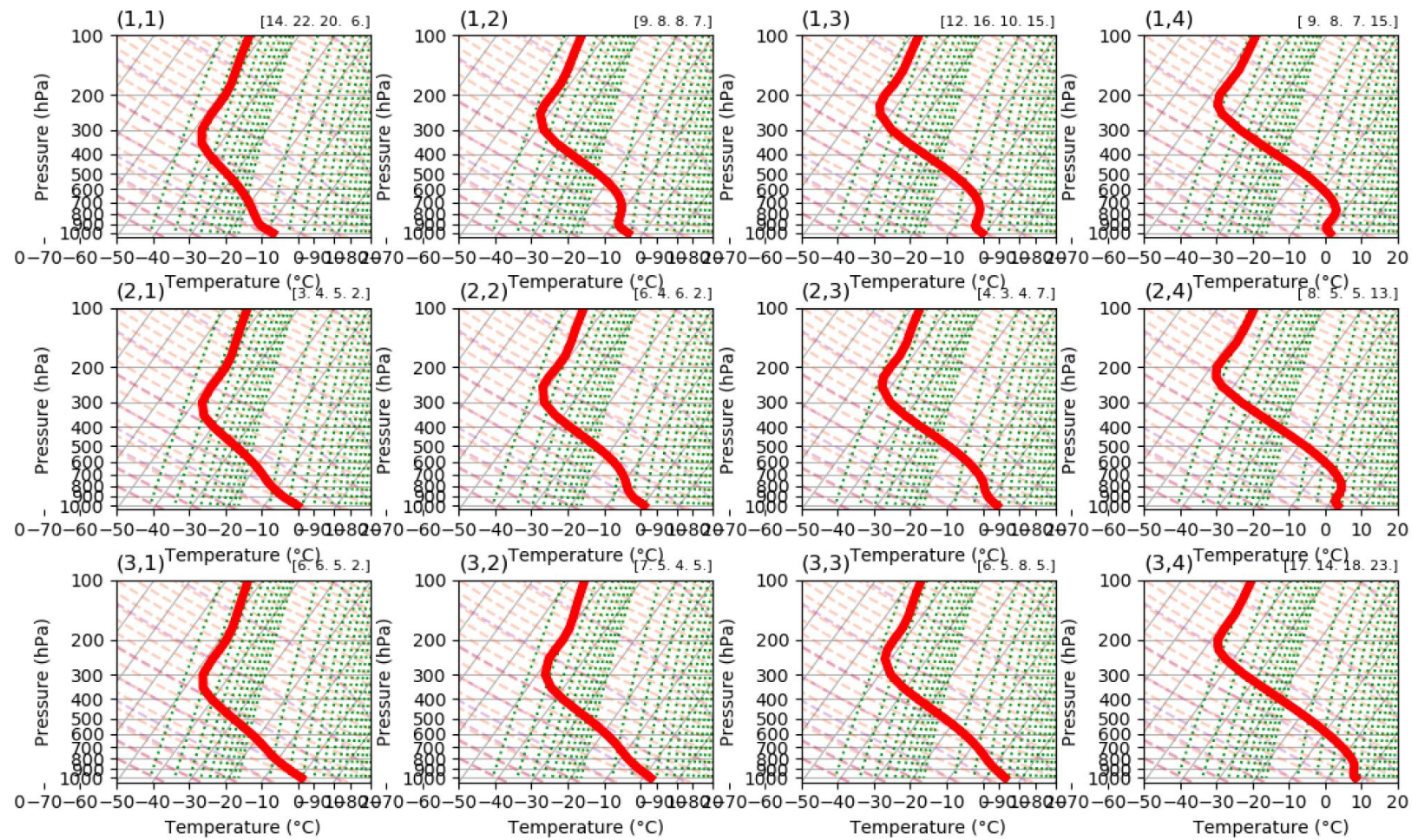
(1) Composite analyses for each group centered on closest approach of each cyclone to YUL/BTV is ongoing

(2) Evaluating the variability in thermodynamic profile across SLV during evolution of events from each group is ongoing

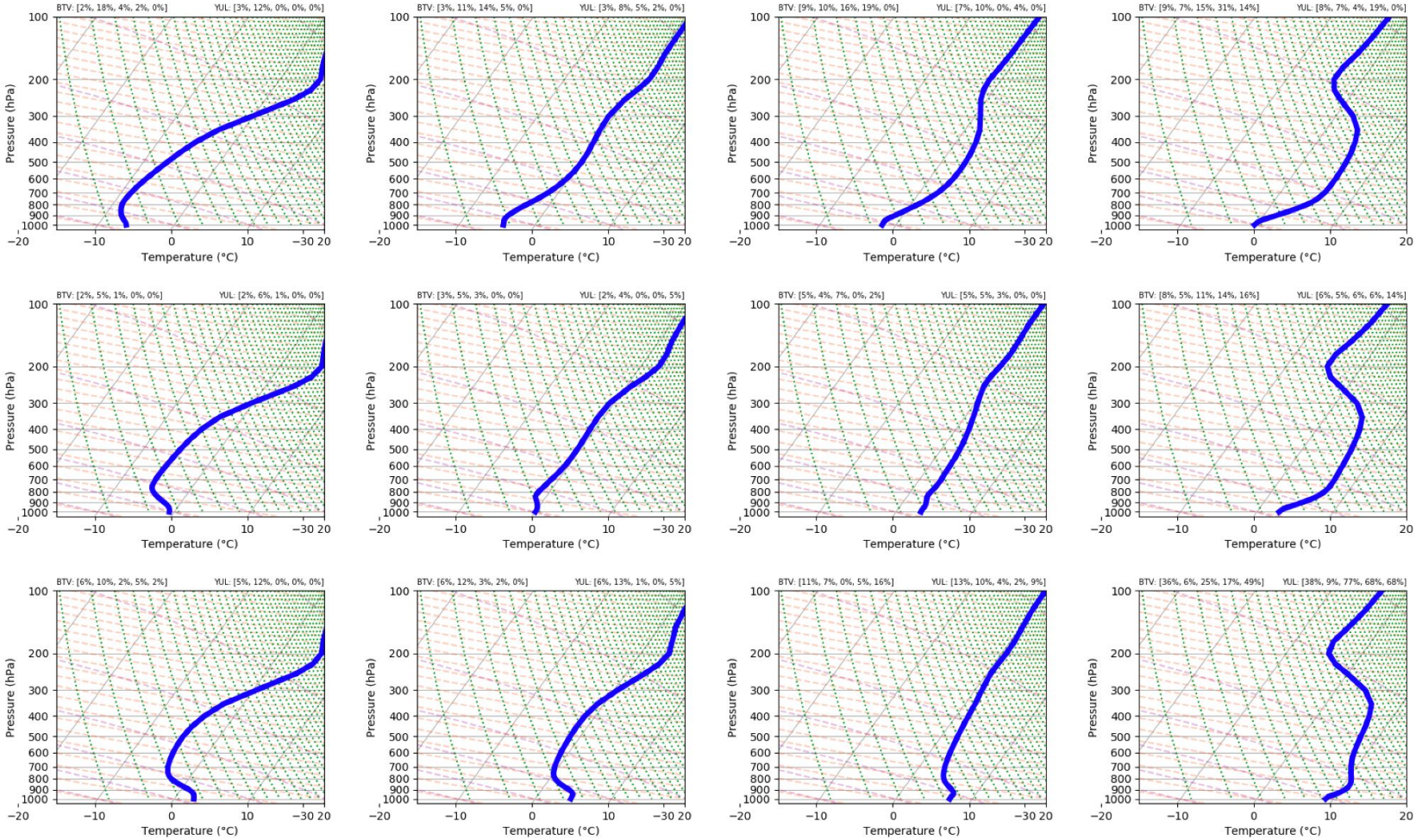
(3) Currently downloading GEFS Reforecast dataset to explore forecast errors in cyclone track and local thermodynamic profile for each cyclone group

(4) Examining synoptic/mesoscale processes that contribute to forecast errors during each cyclone group & WINTRE-MIX IOPs (Clairy)

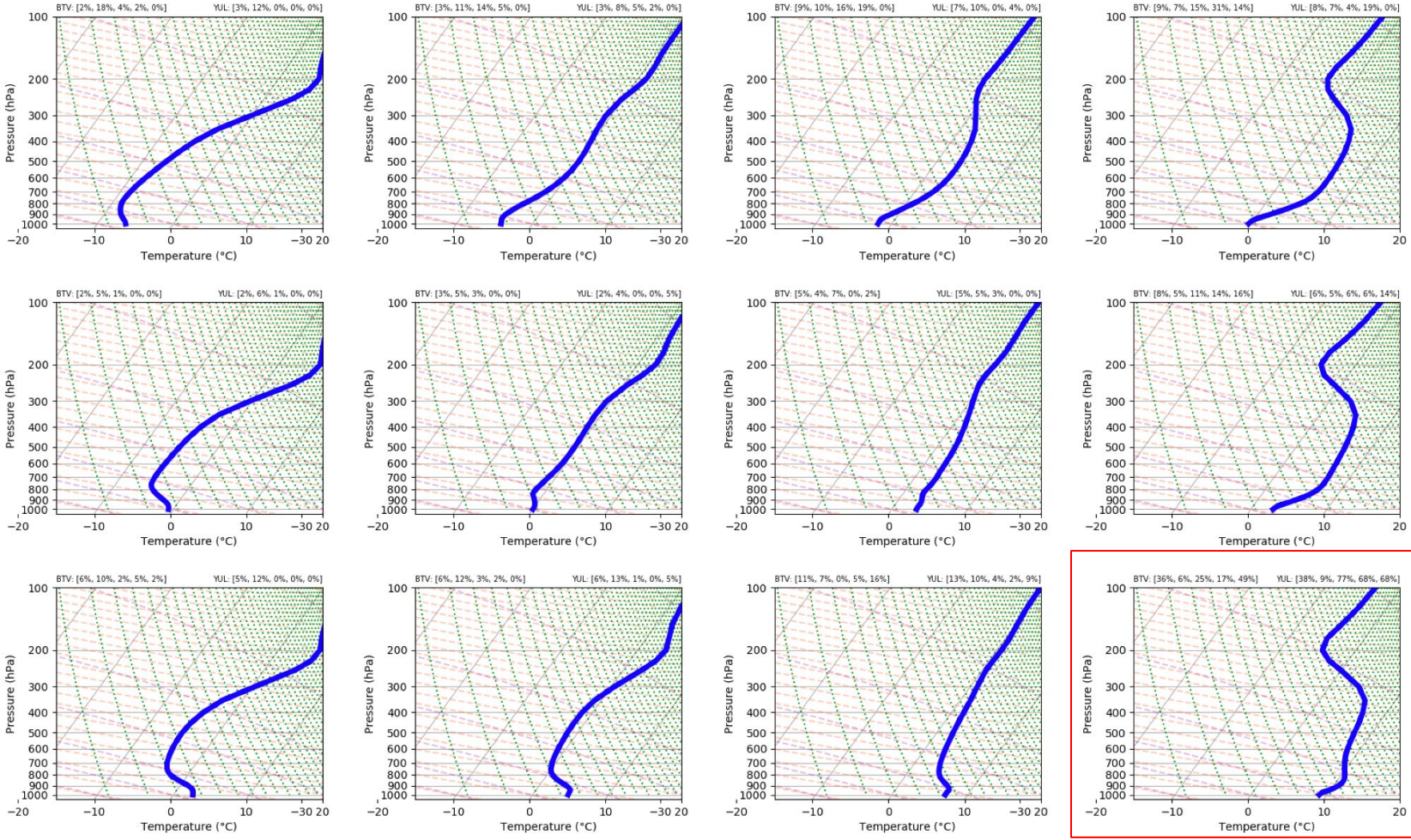
SOM trained on the thermodynamic profiles from ERA-Interim at a grid point centered in WINTRE-MIX domain



SOM trained on the thermodynamic profiles from ERA-Interim at a grid point centered in WINTRE-MIX domain

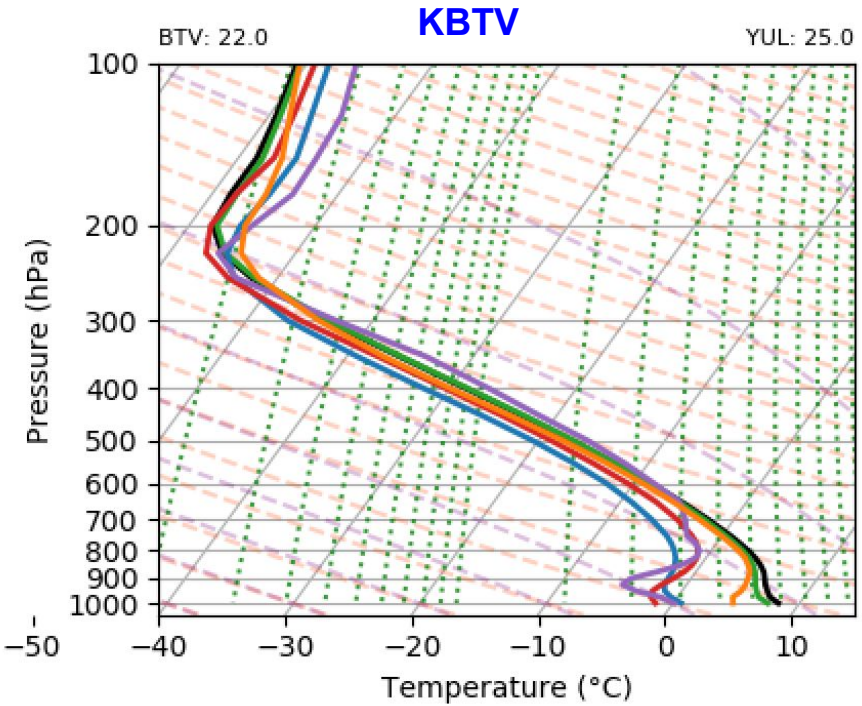


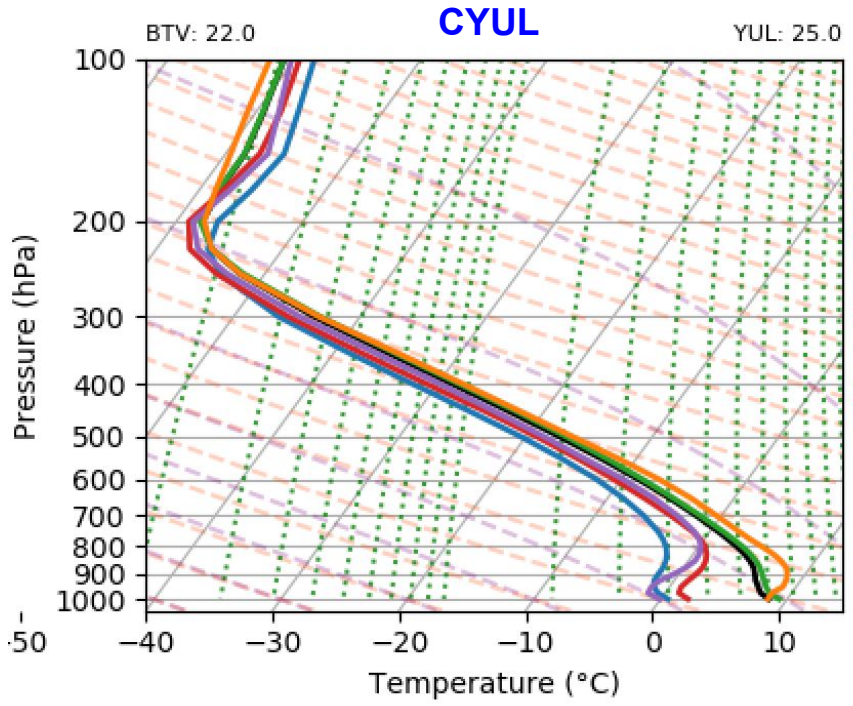
SOM trained on the thermodynamic profiles from ERA-Interim at a grid point centered in WINTRE-MIX domain



SOM trained on the thermodynamic profiles from ERA-Interim at a grid point centered in WINTRE-MIX domain

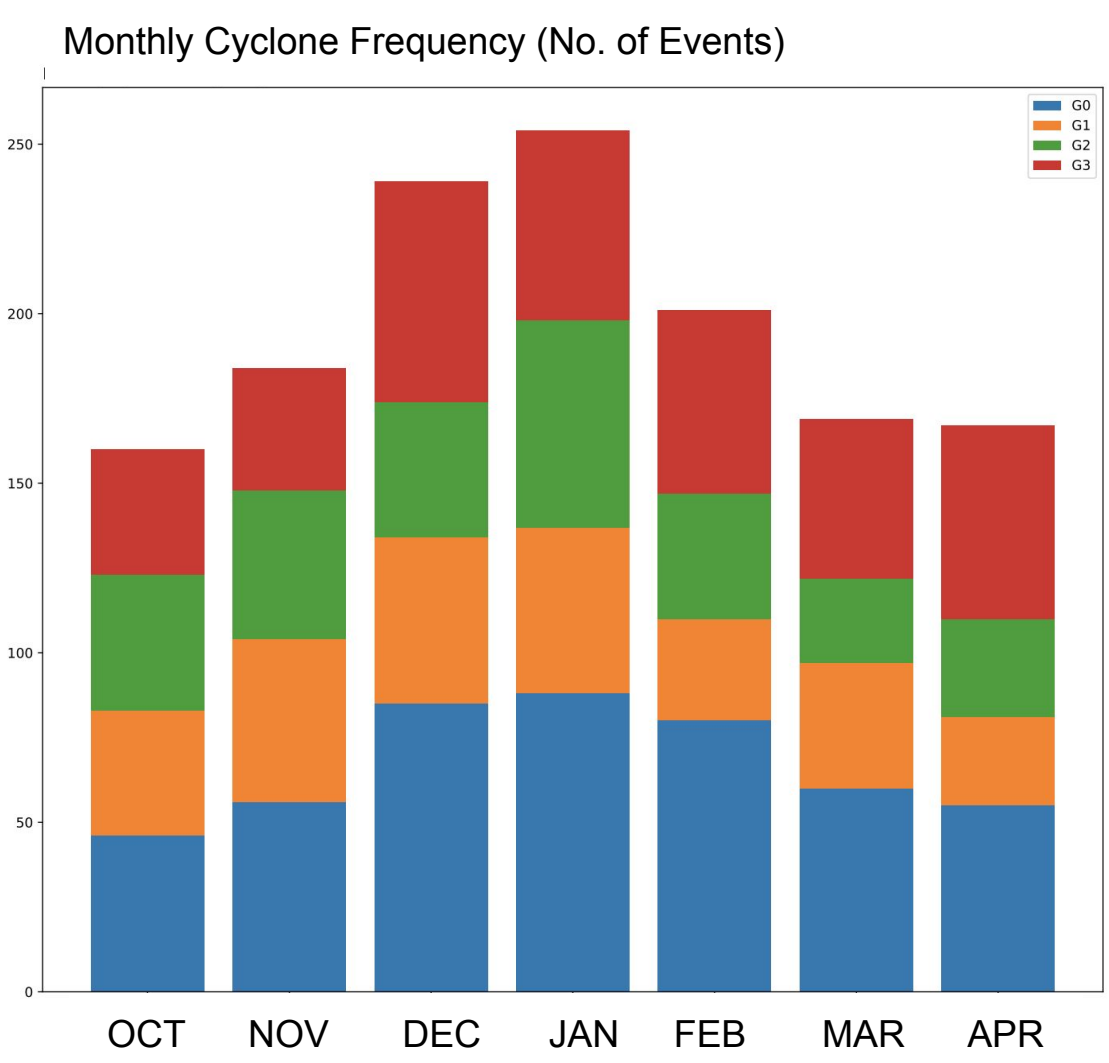
No active weather
Snow
Sleet
Rain
Freezing Rain
Fog





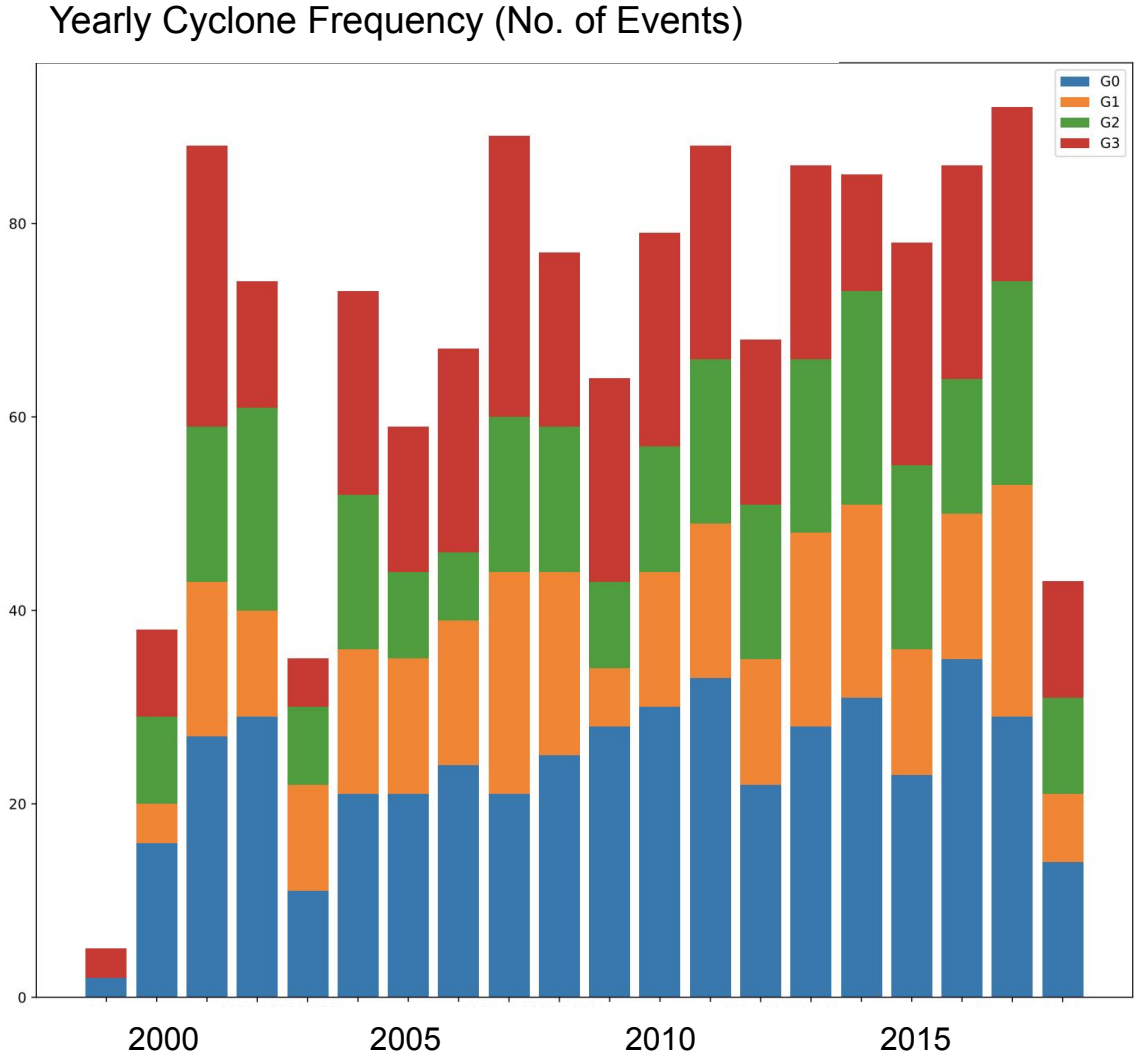
Cyclone Characteristics

East Coast
Clipper 1
Clipper 2
Central US



Cyclone Characteristics

- East Coast
- Clipper 1
- Clipper 2
- Central US



Cyclone Characteristics

First box: All cyclones

Second box: East Coast

Third Box: Clipper 1

Fourth Box: Clipper 2

Fifth Box: Central US