Session C-3
Impact of circulation changes on extreme events

Zhuo Wang: Weather regimes and the variability and predictability of tornadoes

Hamish Ramsay: Poleward migration of the most damaging tropical cyclones

Marlene Kretschmer: Using machine learning to infer teleconnections of extreme events

WCRP EPESC/LEADER Workshop

17 July 2025

Context

Response of extremes to climate change typically assessed in terms of

- thermodynamic contribution and baseline changes
- dynamic contribution

Typically, less certainty around the dynamic contribution to extremes

$\rightarrow$ focus of EPESC/LEADER

Dynamical contribution components

1. relationships between large scale circulation and extreme events
   - ▶ summer large scale circulation and heatwaves
2. characterise changes in large scale circulation
   - ▶ role of forced response and internal variability
   - ▶ LESFMIP/LEADER
3. relate circulation changes to extremes

Complex relationships between flow and extremes

recent example: Hurricane Helene, September 2024

Helene
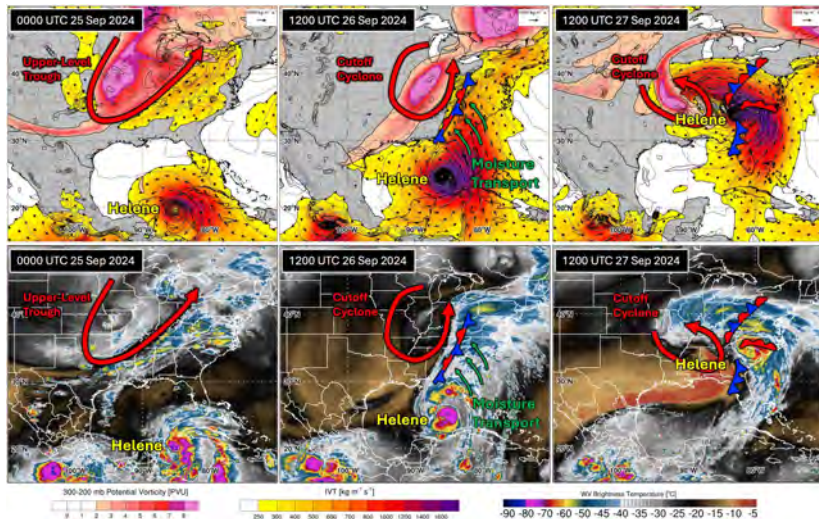
Circulation and background changes

- ▶ changes in SST fields and Hurricane extent/range
- ▶ changes in steering level fields and Hurricane tracks
- ▶ changes in intensification rates and power
- ▶ more tropical – extratropical transitions?
- ▶ more tropical – extratropical interactions?
- ▶ changes in atmospheric moisture and rainfall from cutoff lows
- ▶ changes in preferred subtropical jet locations, blocking and cutoff lows

Different approaches required

three different approaches in this session:

1. Zhuo | weather regime shifts and tornadoes |
2. Hamish | enhanced warming in subtropics and TCs |
3. Marlene | ML to relate predictable modes to extremes |