How Much Do Tropical Cyclones Grow in Size During Extratropical Transition?

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6/21/17

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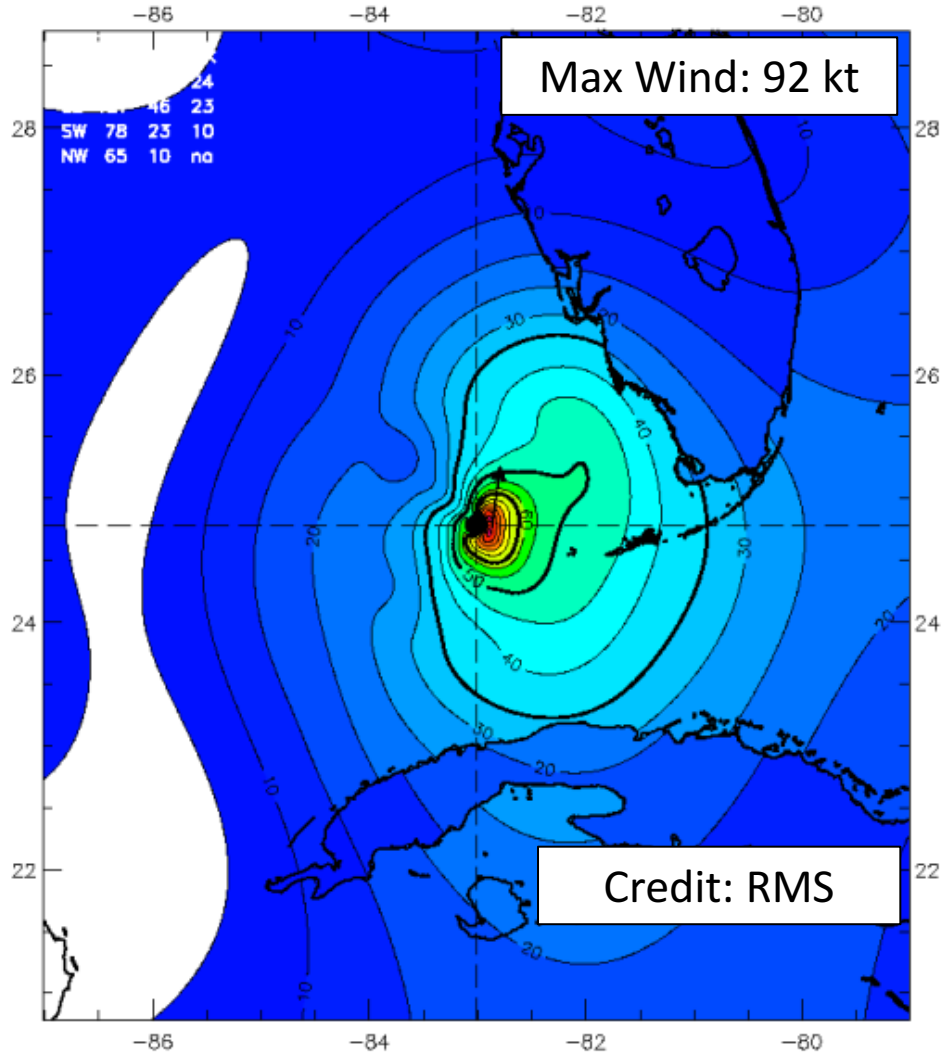
Extratropical Transition of Hurricanes Charley (2004) and Sandy (2012)

Hurricane Charley (2004)



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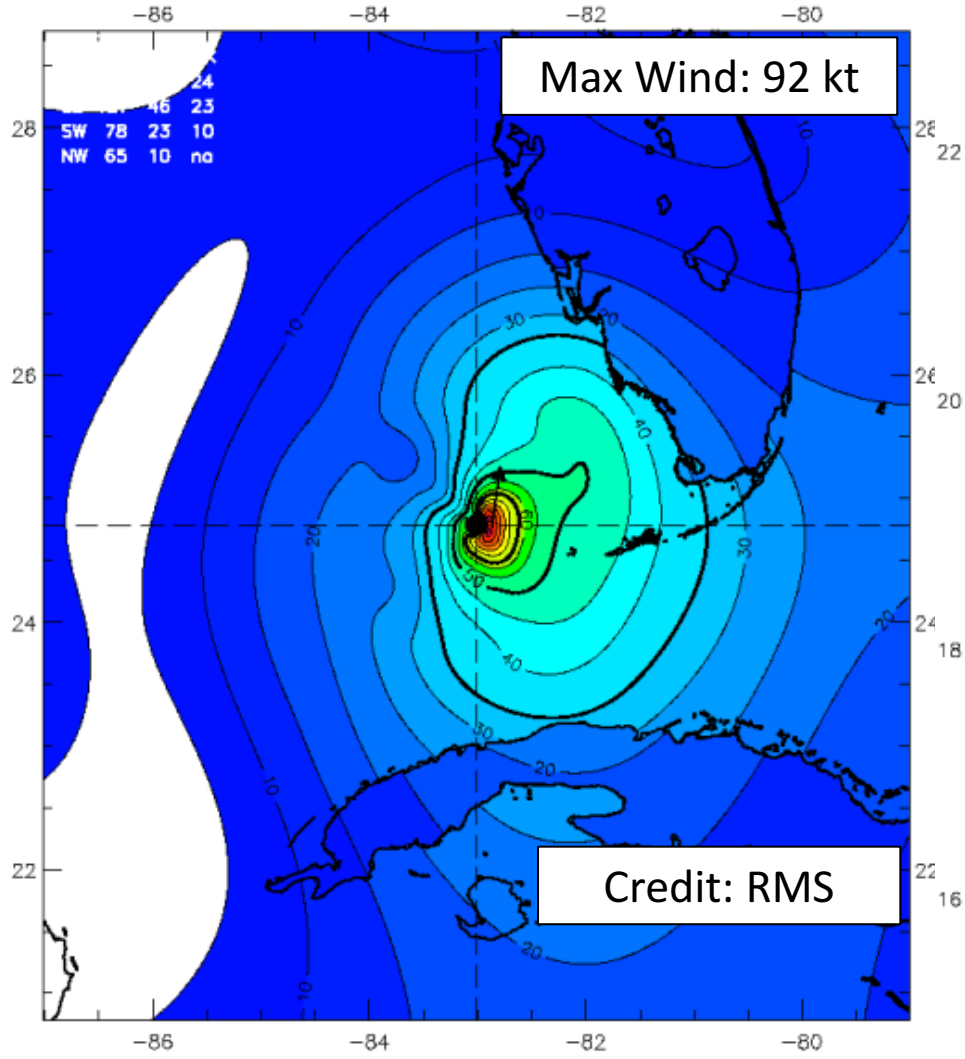

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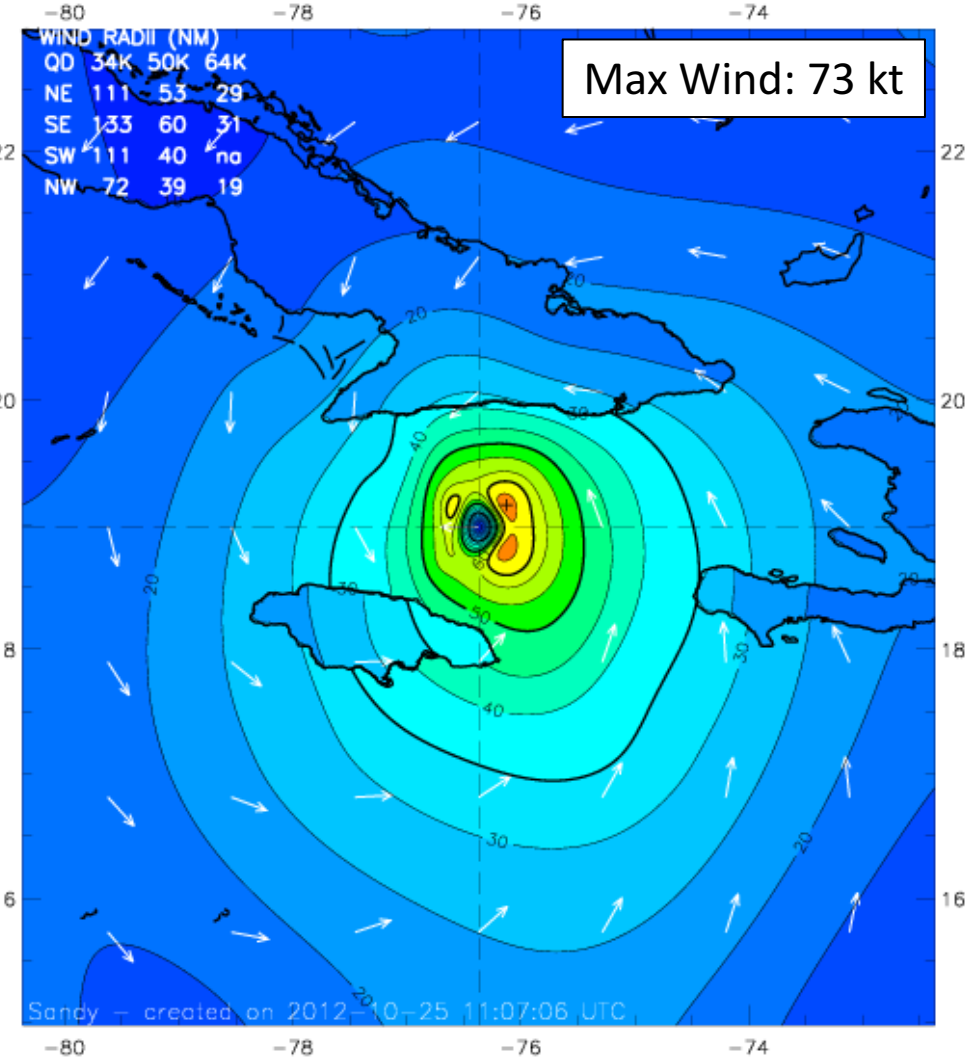

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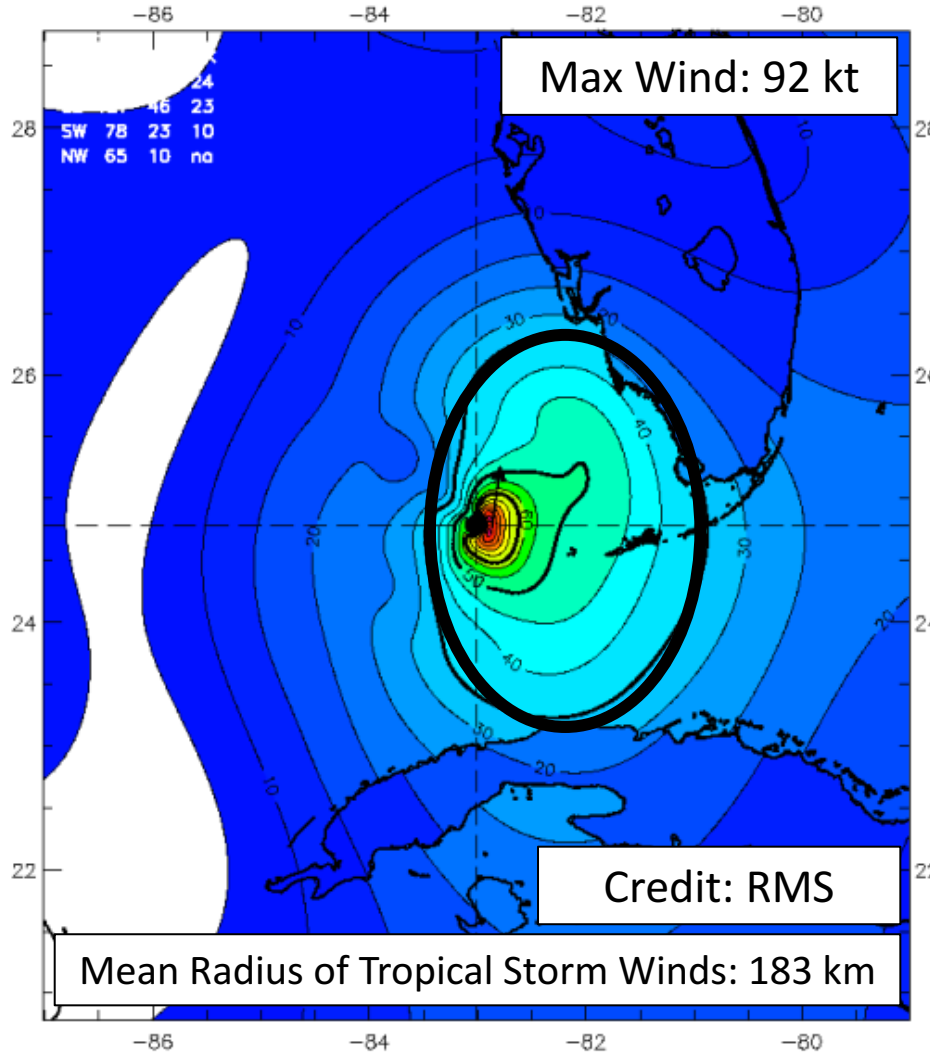

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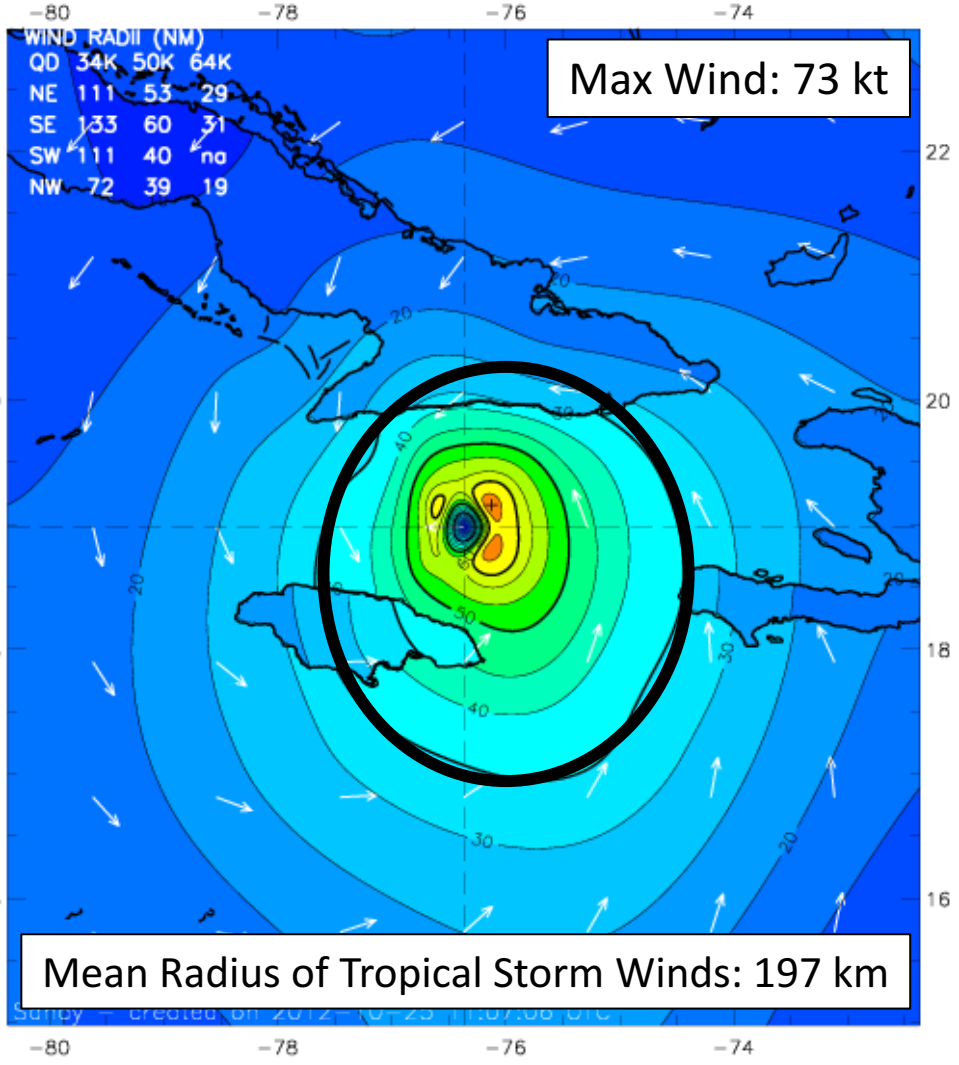

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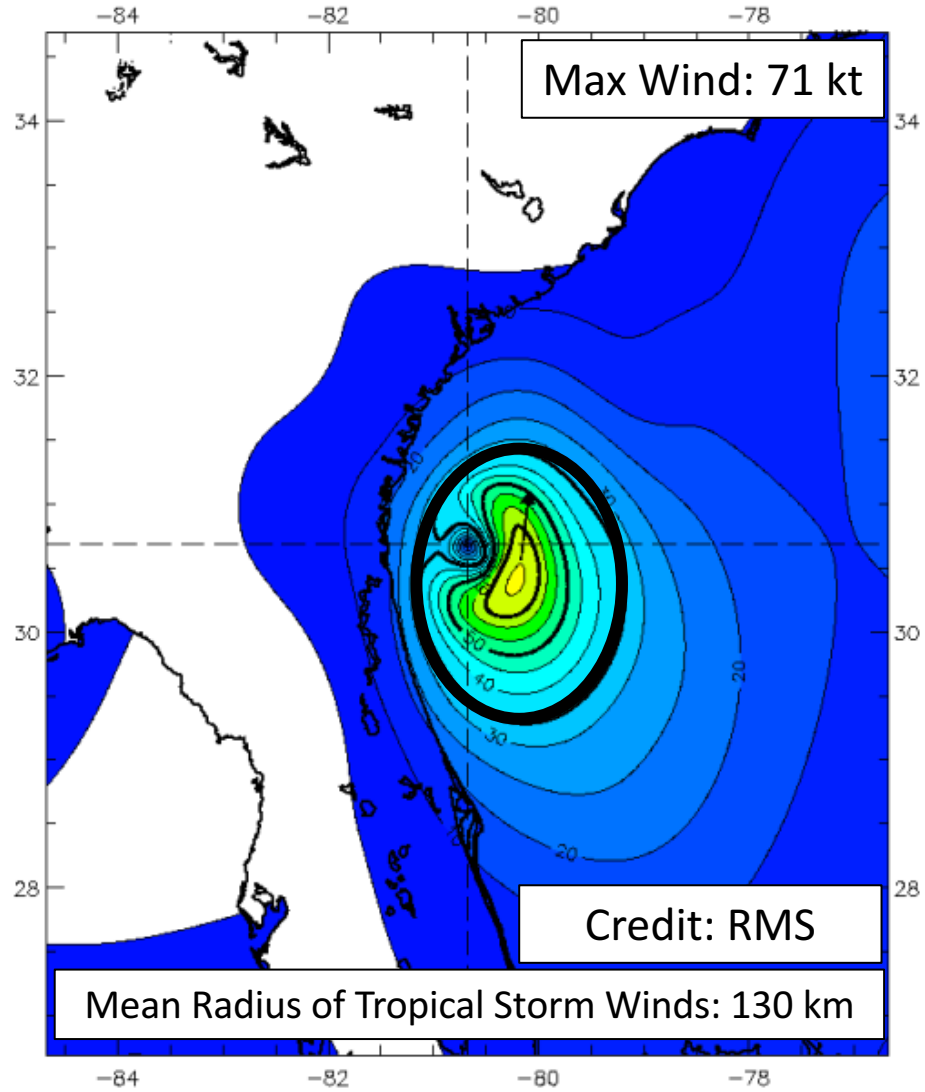

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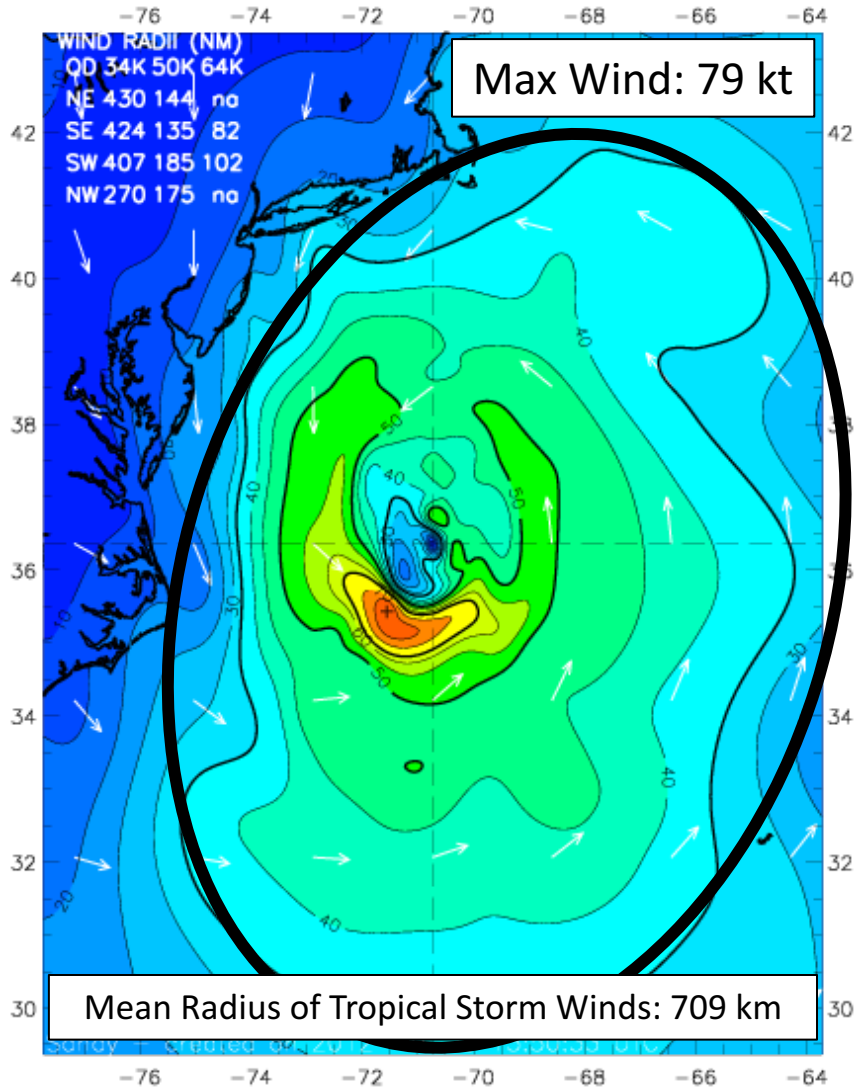

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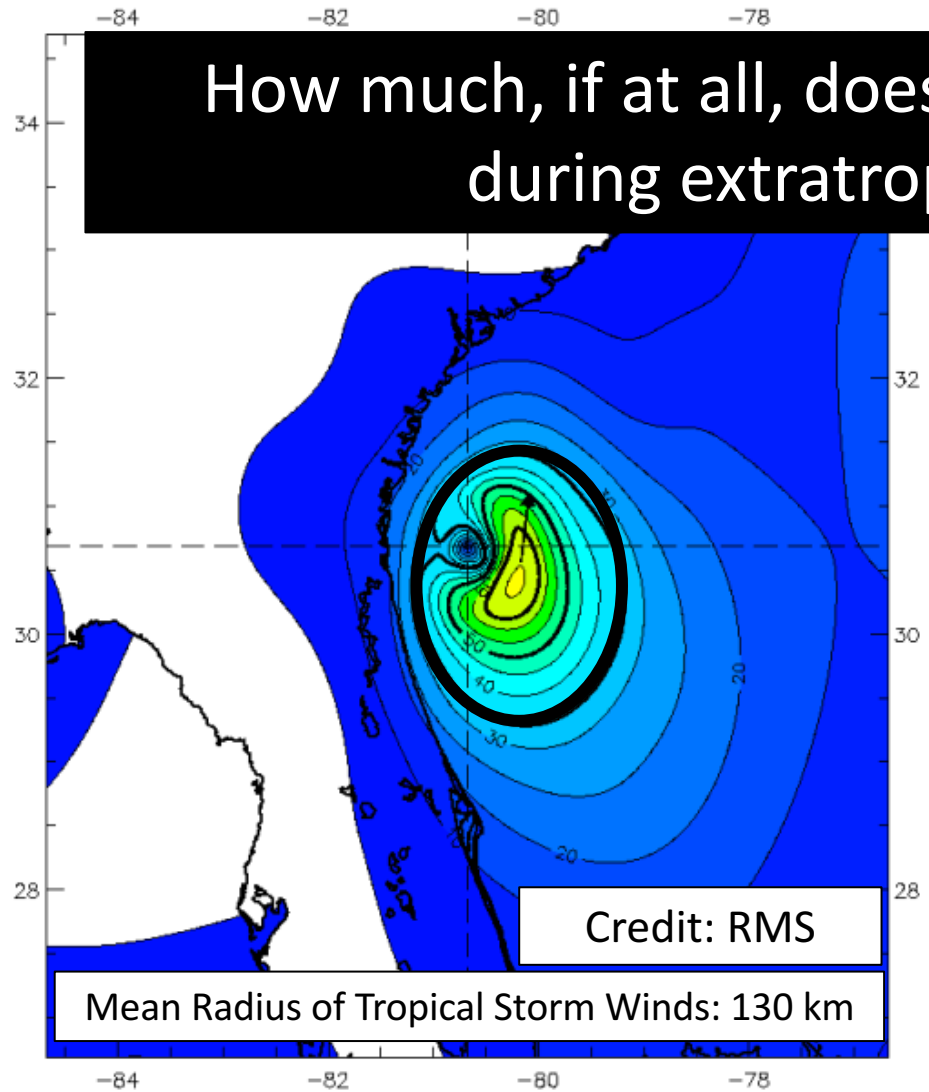
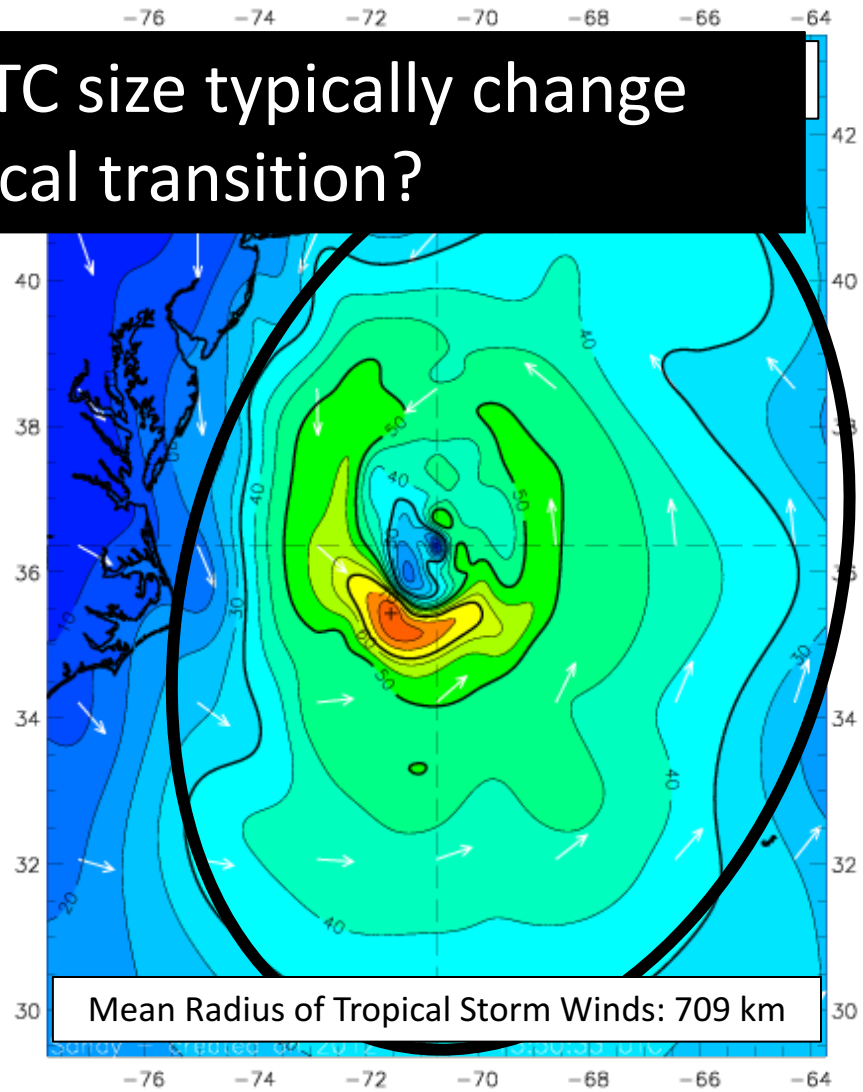
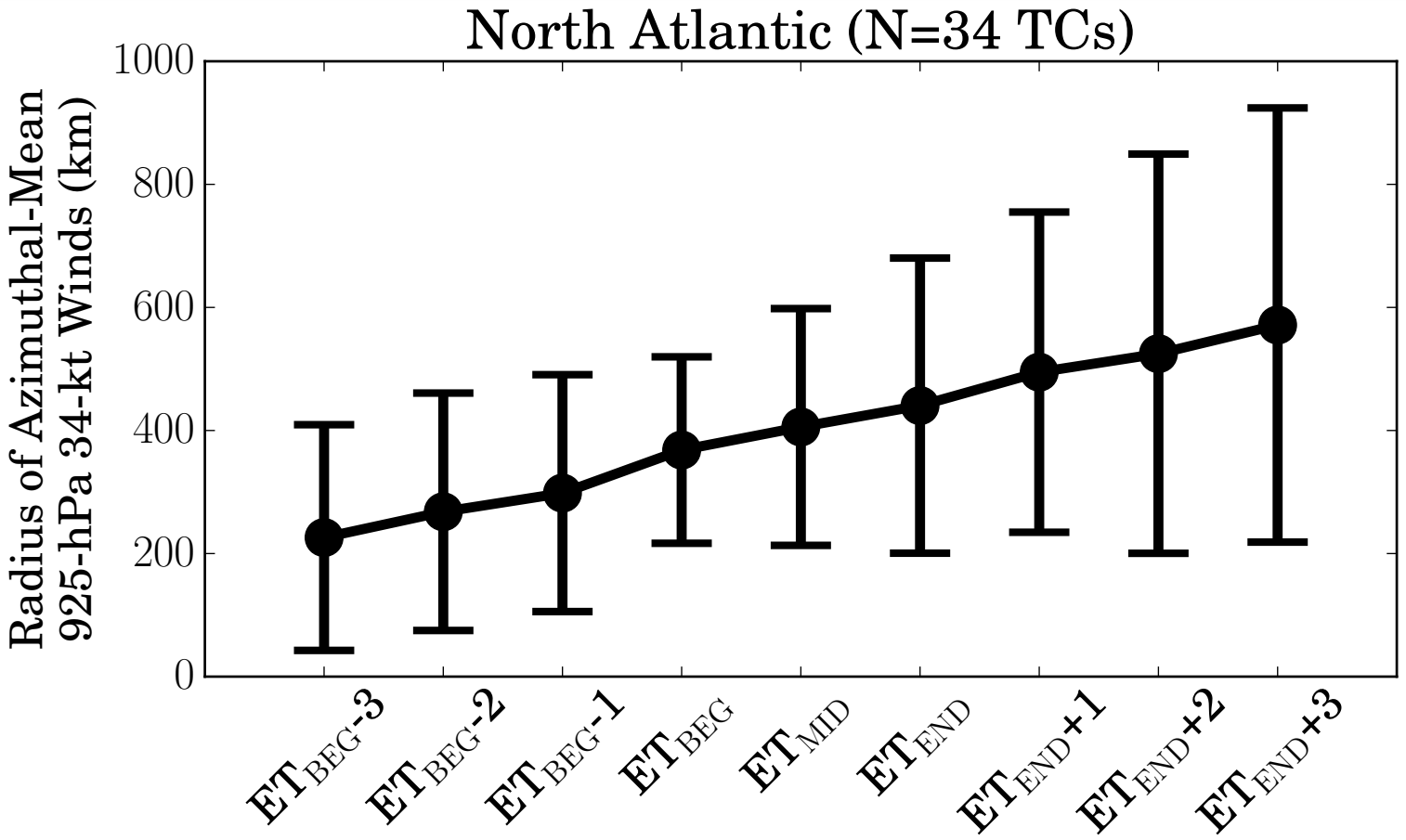
How much, if at all, does TC size typically change during extratropical transition?





Prior Studies of TC Size Change During Extratropical Transition



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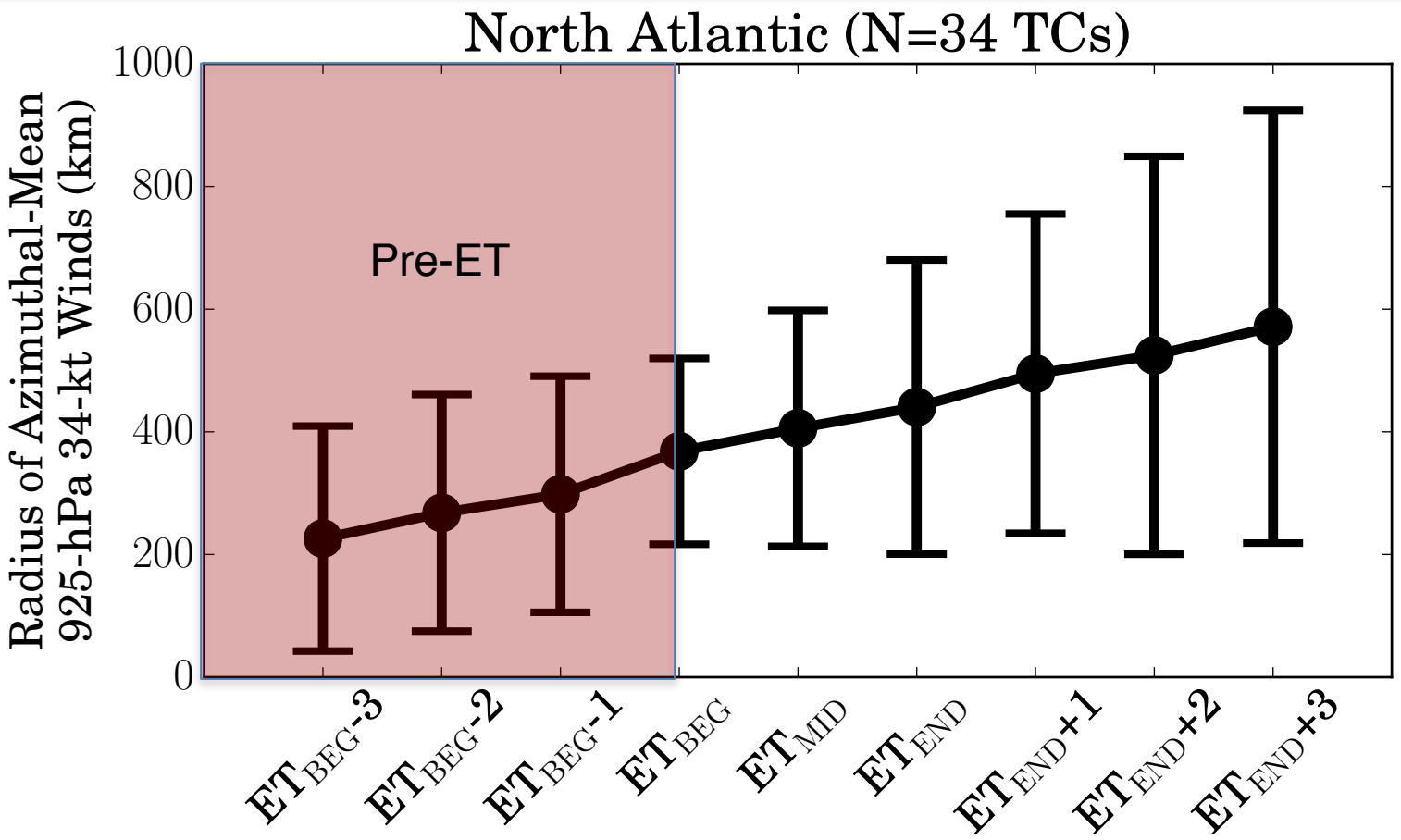

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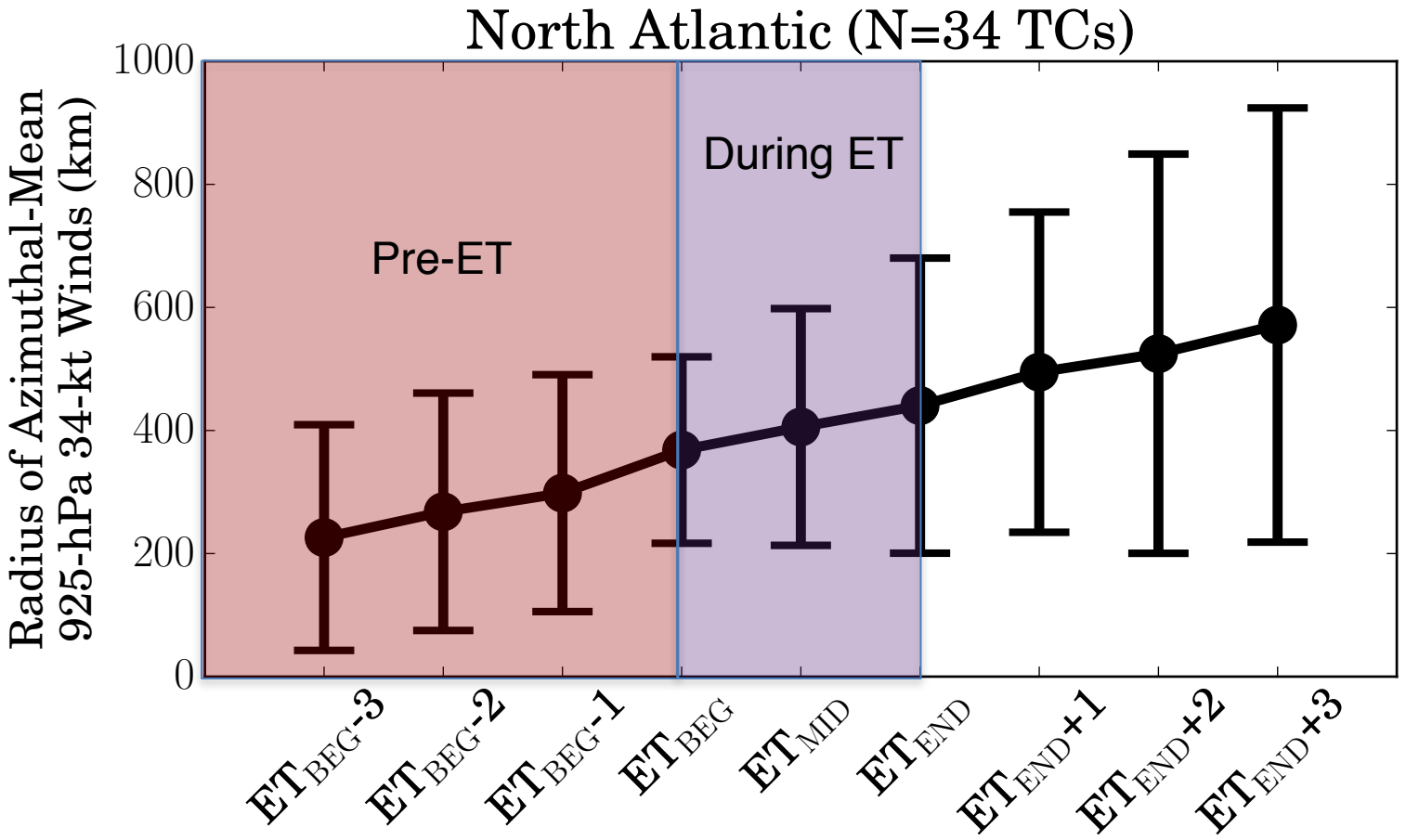

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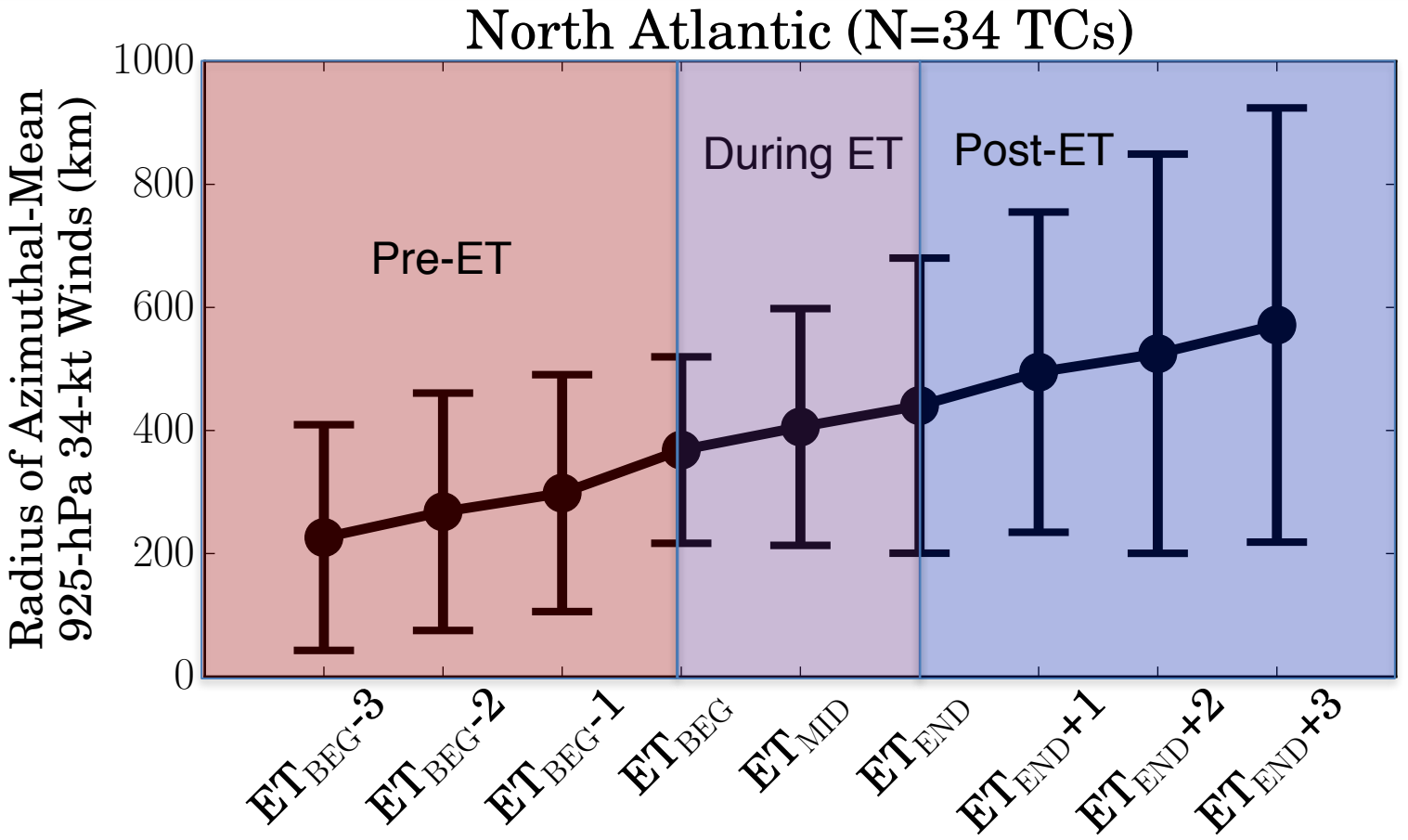

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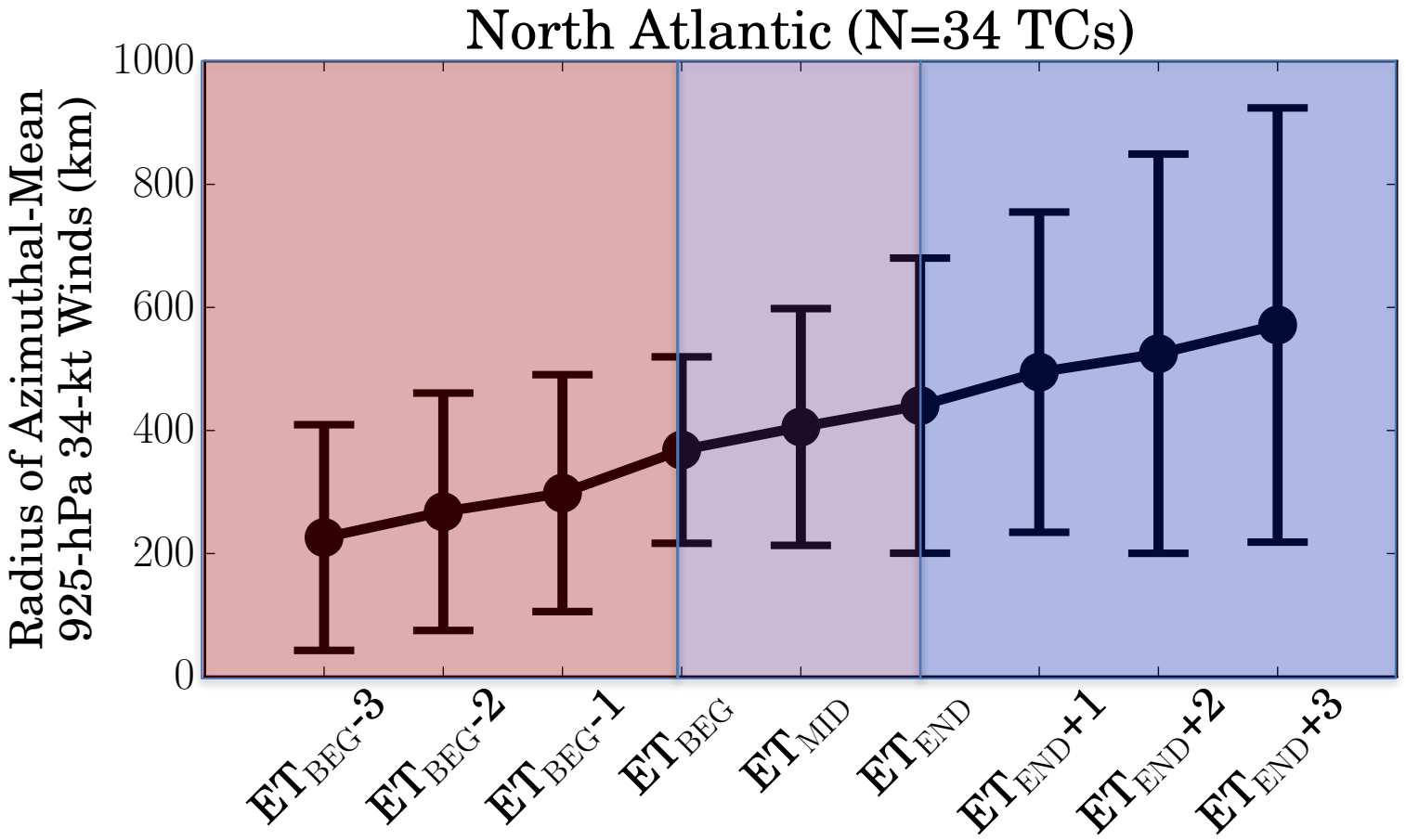

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- Mean tropical cyclone size increases before, during, and after ET

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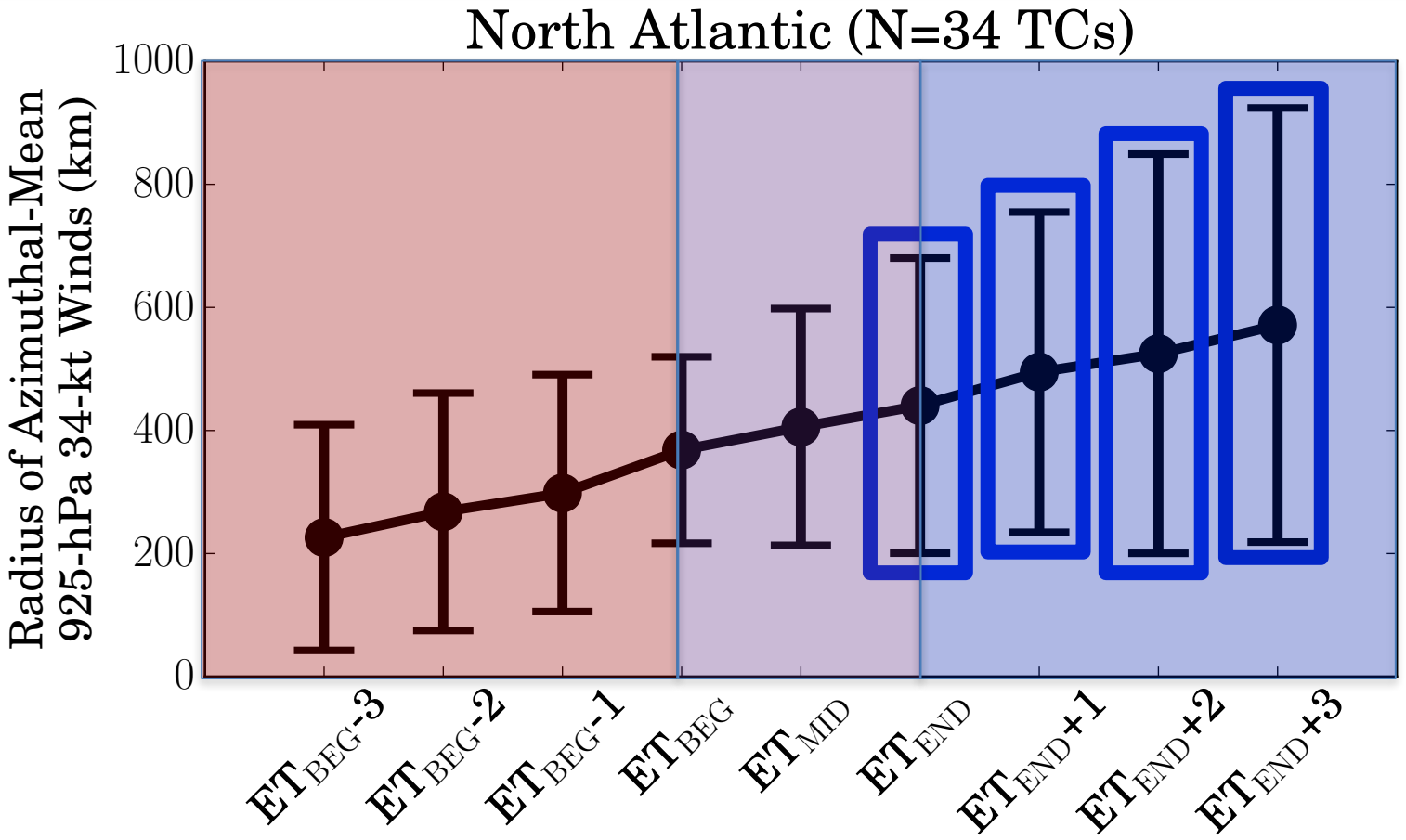

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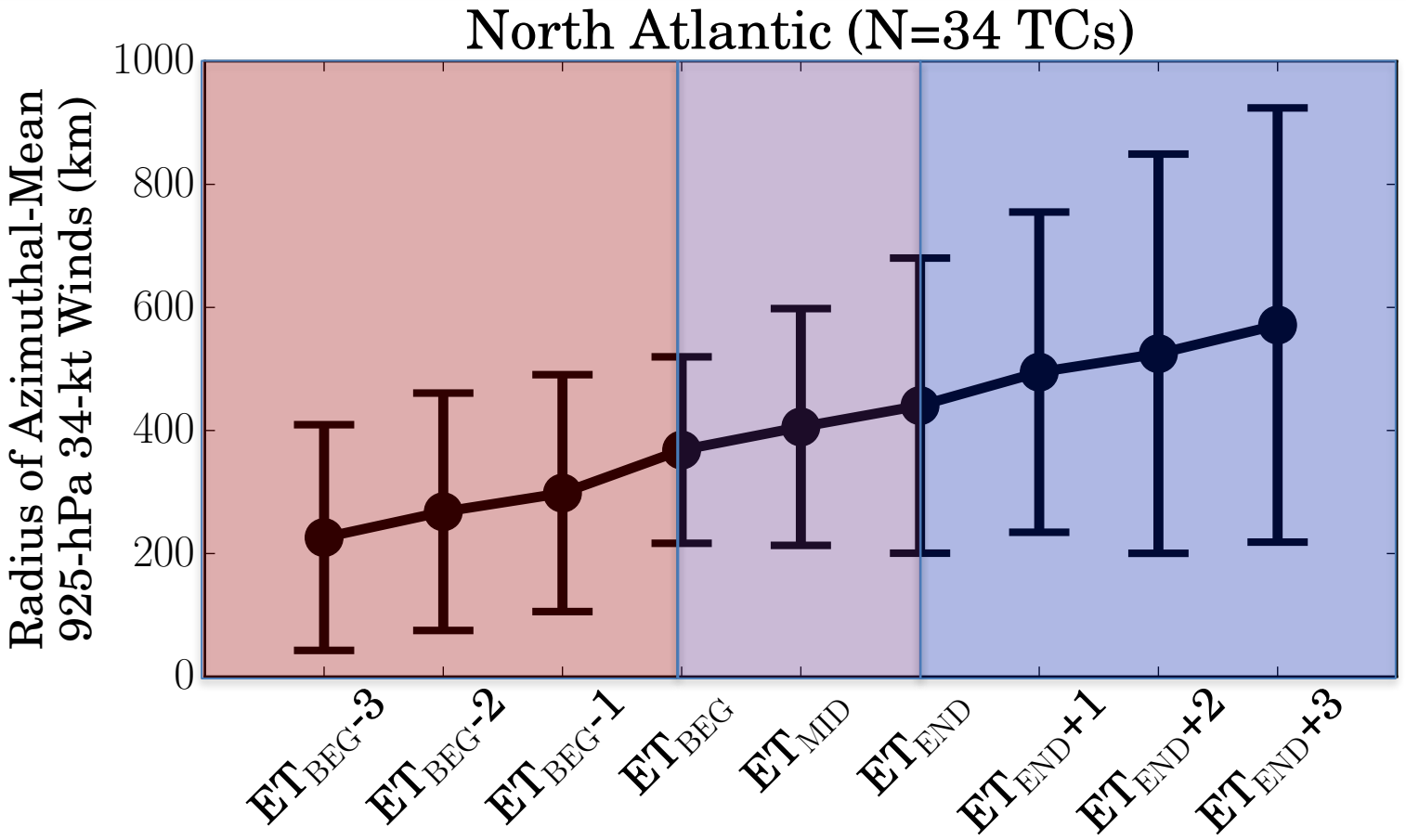

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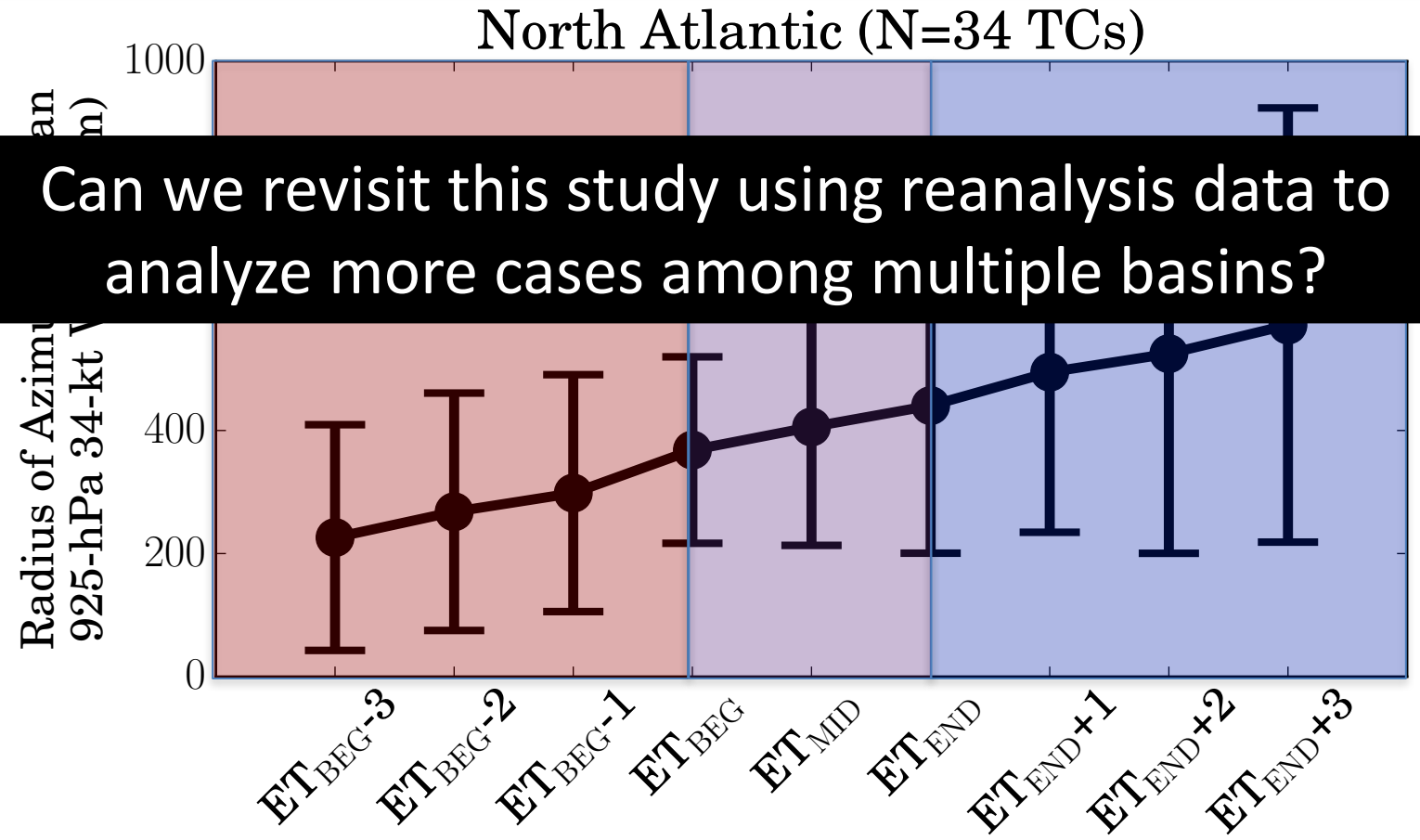

Can we revisit this study using reanalysis data to analyze more cases among multiple basins?

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- Examining North Atlantic and western North Pacific TCs from 1979–2010 in IBTrACS (Knapp et al. 2010) that underwent ET over ocean

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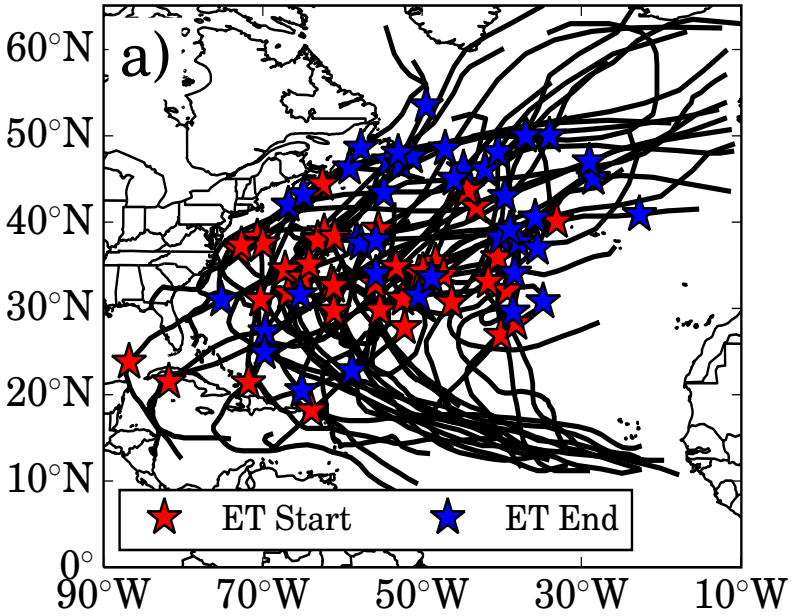
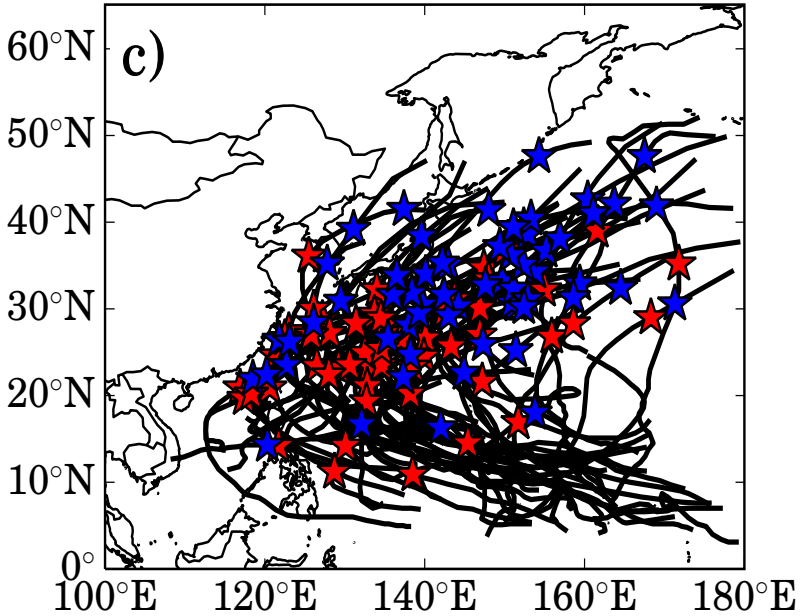
- NCEP Climate Forecast System Reanalysis (CFSR) is used to represent TC wind field (Saha et al. 2010)
- Only those TCs whose extratropical transition is “well-represented” in NCEP CFSR are examined

North Atlantic (N=41 TCs)



Western North Pacific (N=60 TCs)



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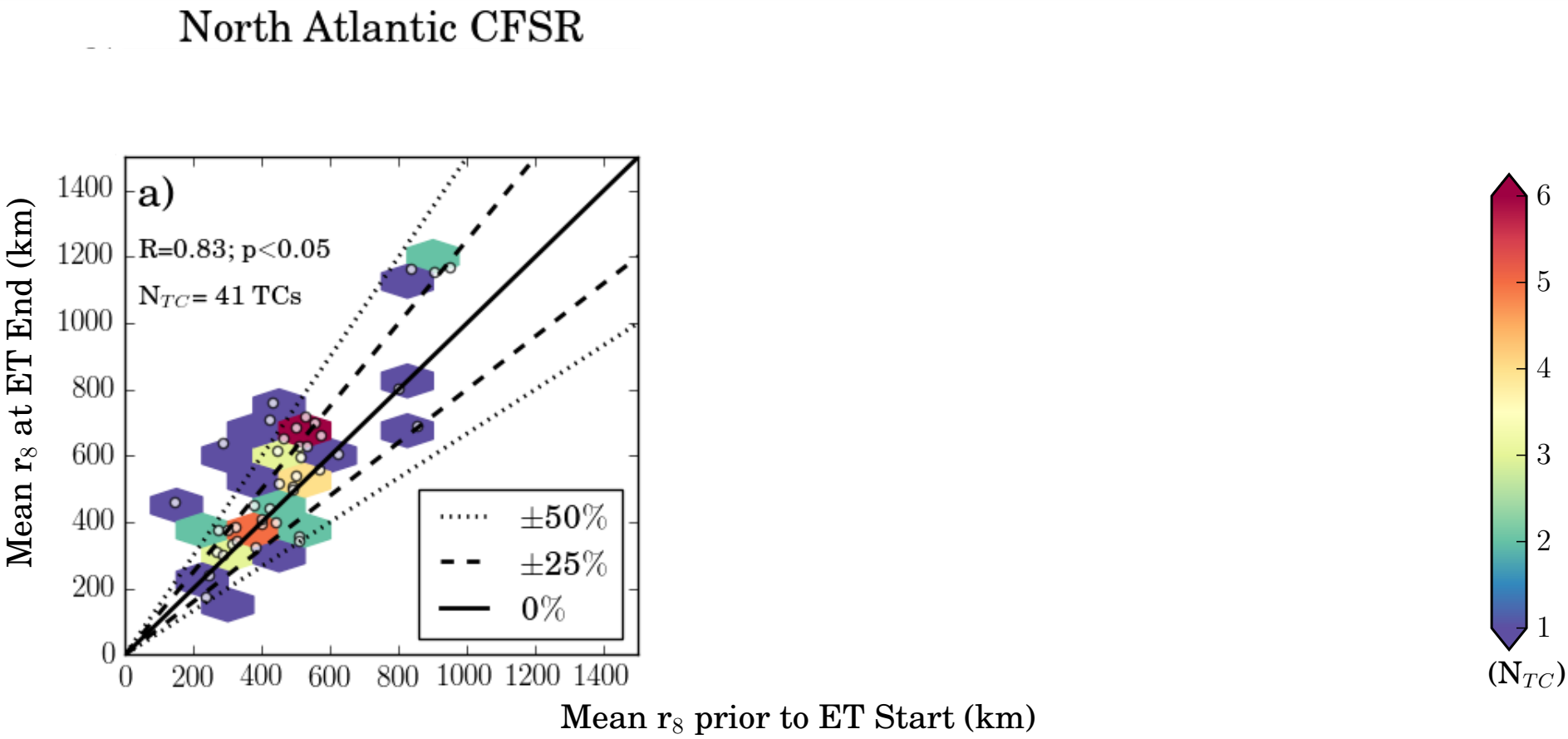
- **Extratropical Transition Definition:** cyclone phase space (Hart 2003) used to obtain objective definition of extratropical transition start and end time from reanalysis data

Variability in TC Size Changes during Extratropical Transition



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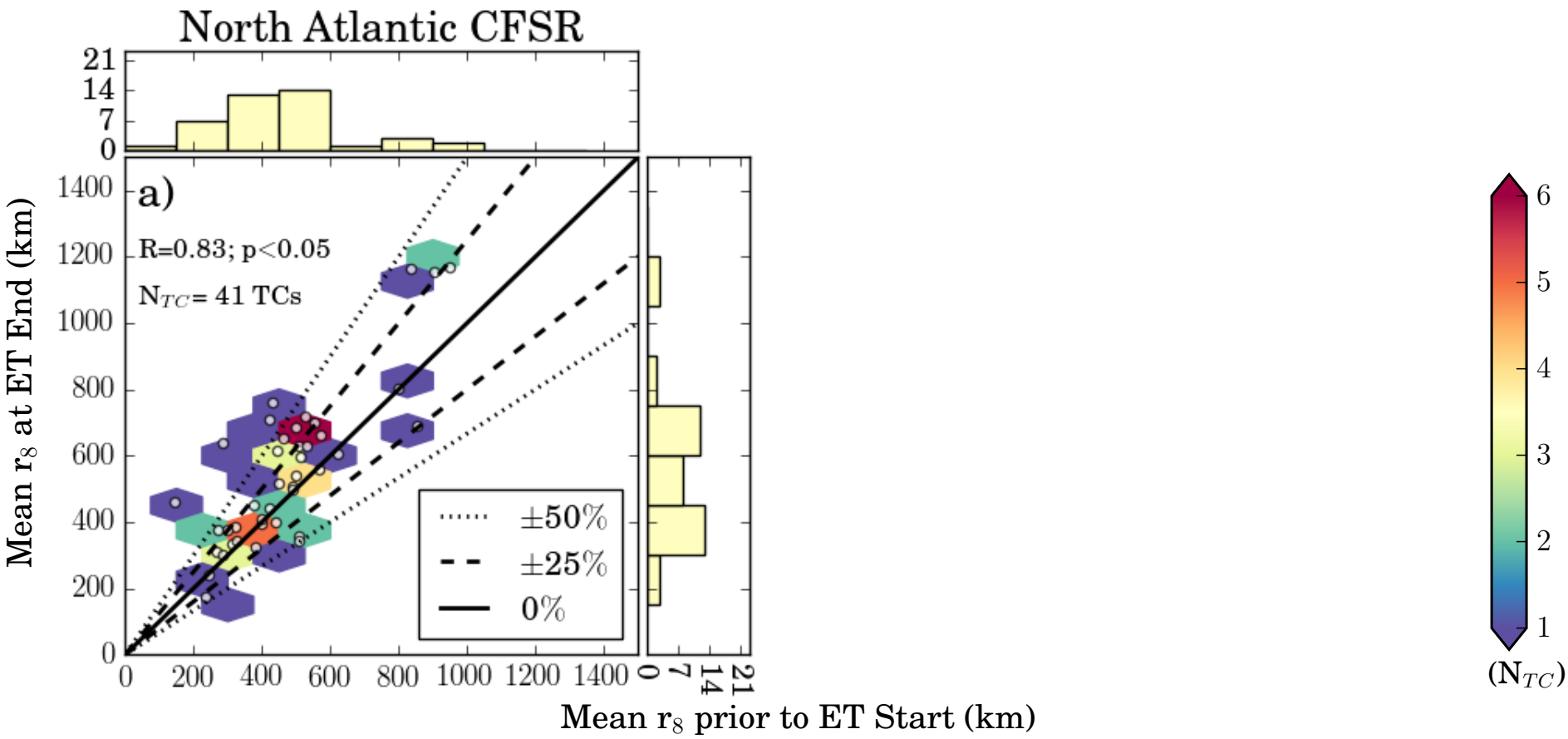

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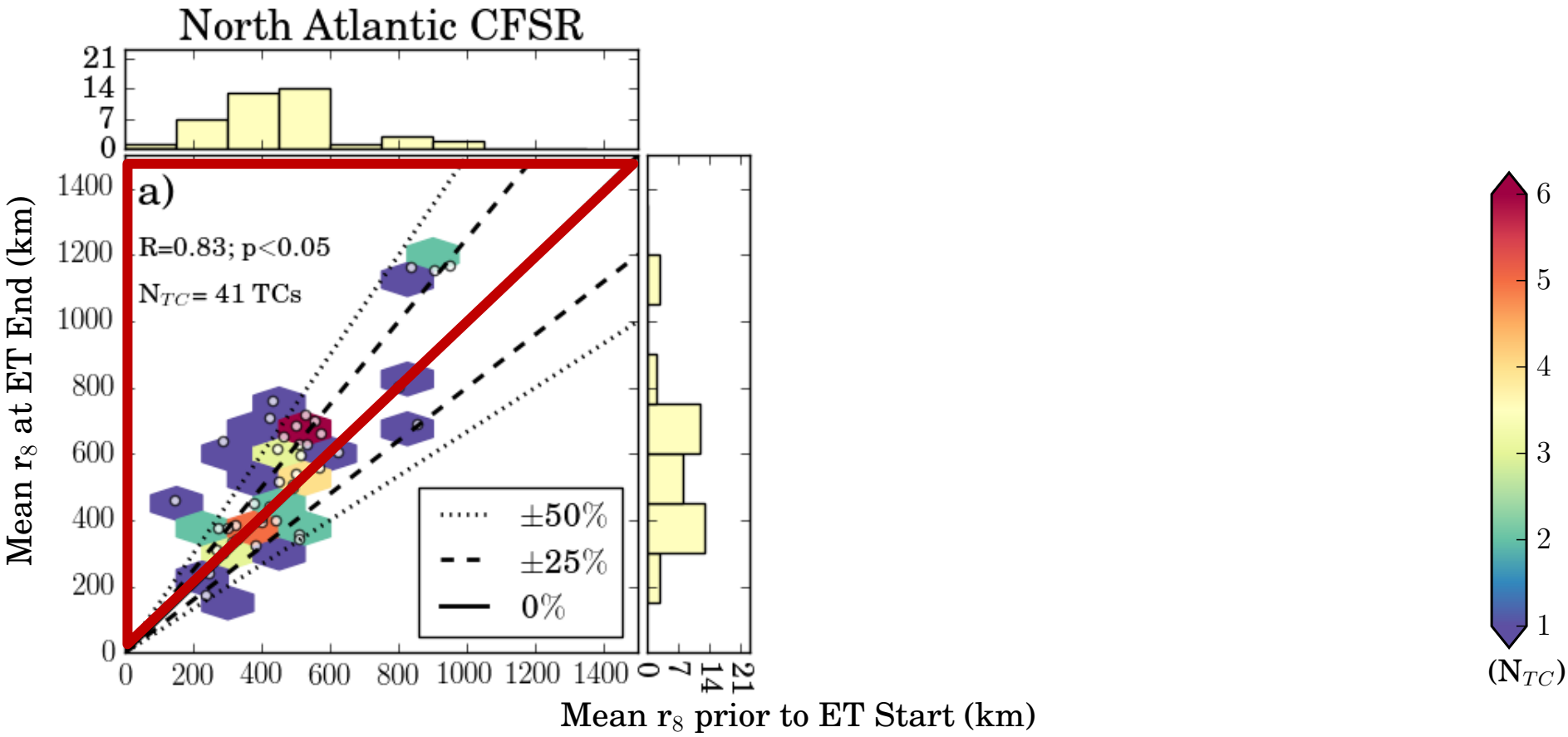

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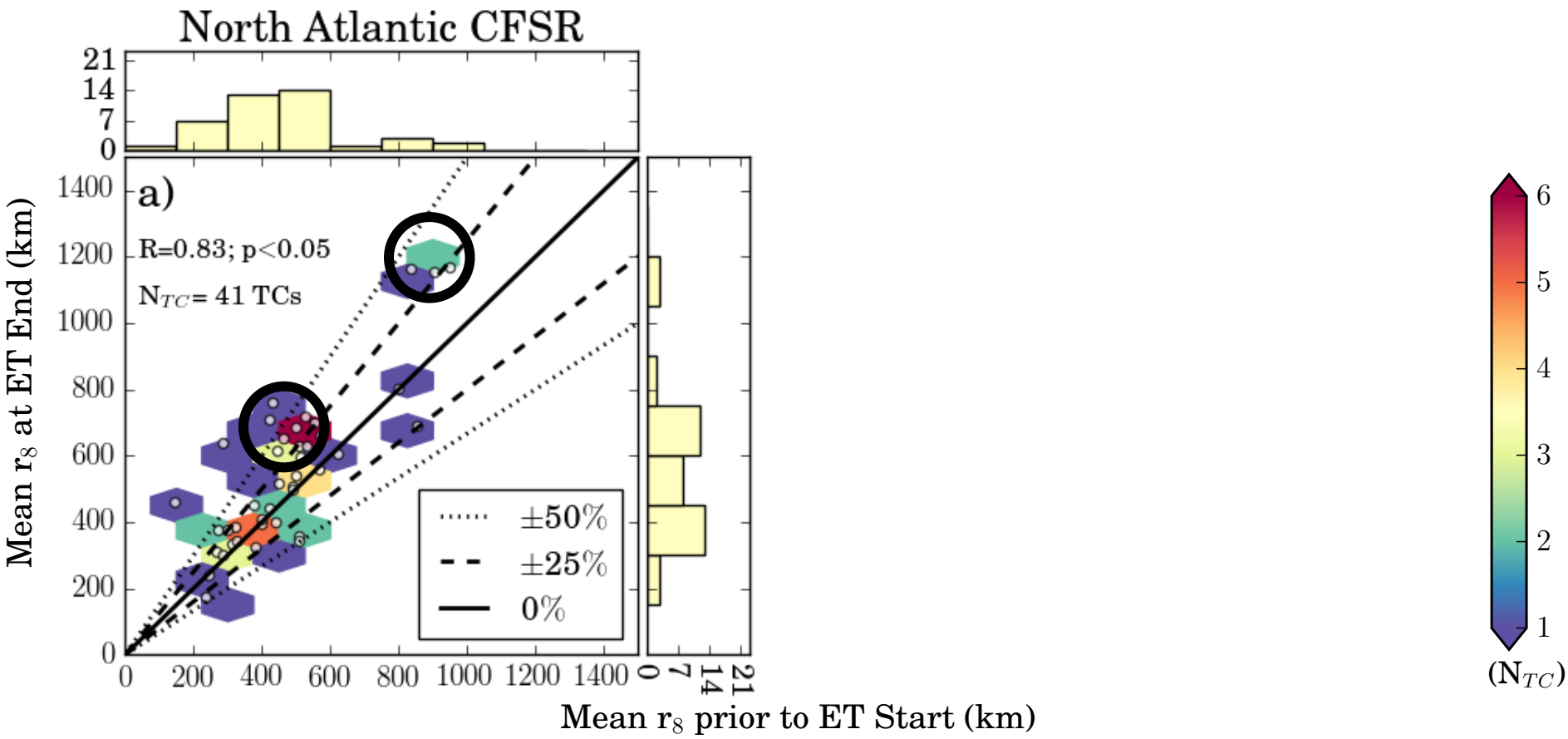

- 76% of North Atlantic TCs increase in size or remain unchanged in size during ET
- North Atlantic TCs with largest growth during ET have size greater than 400 km prior to ET

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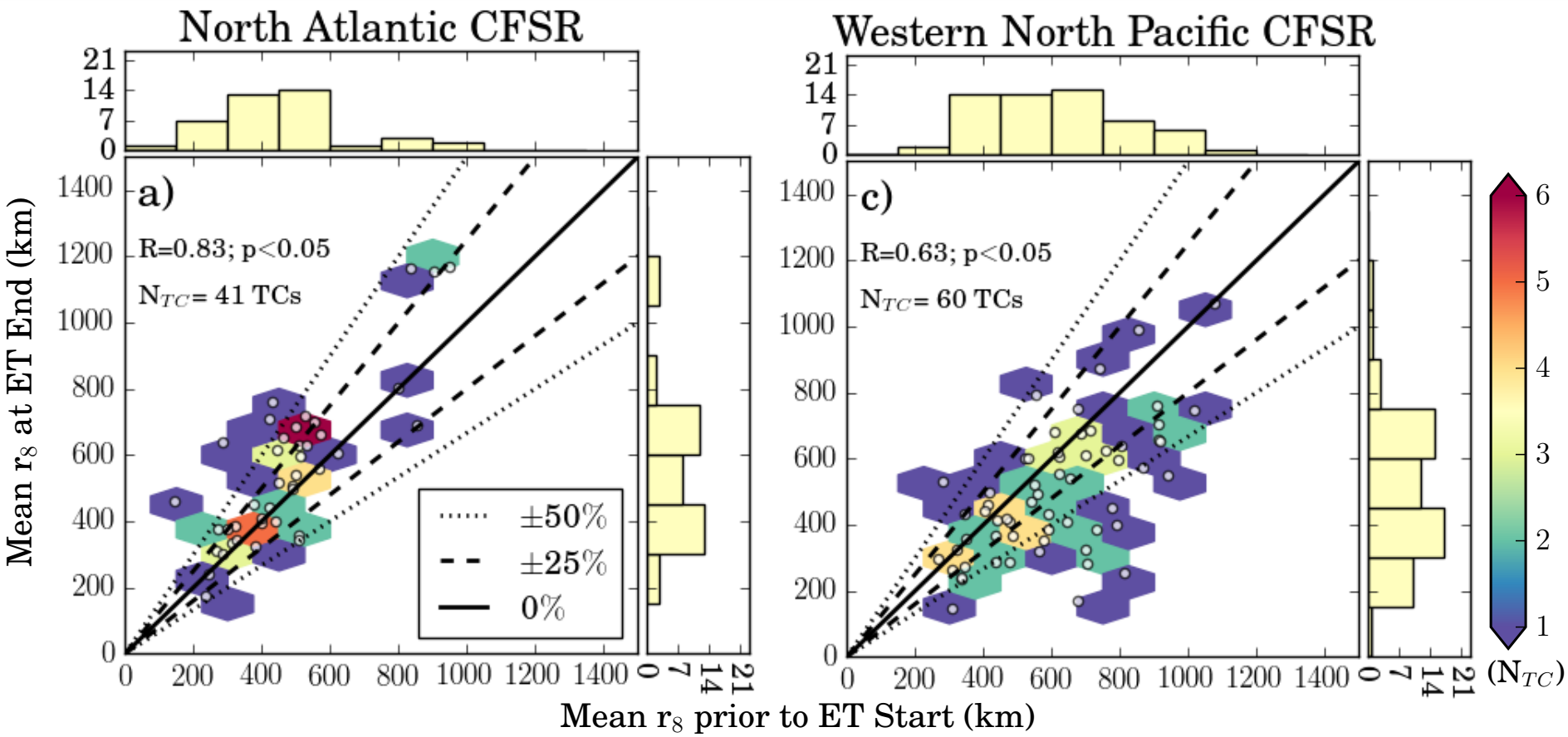

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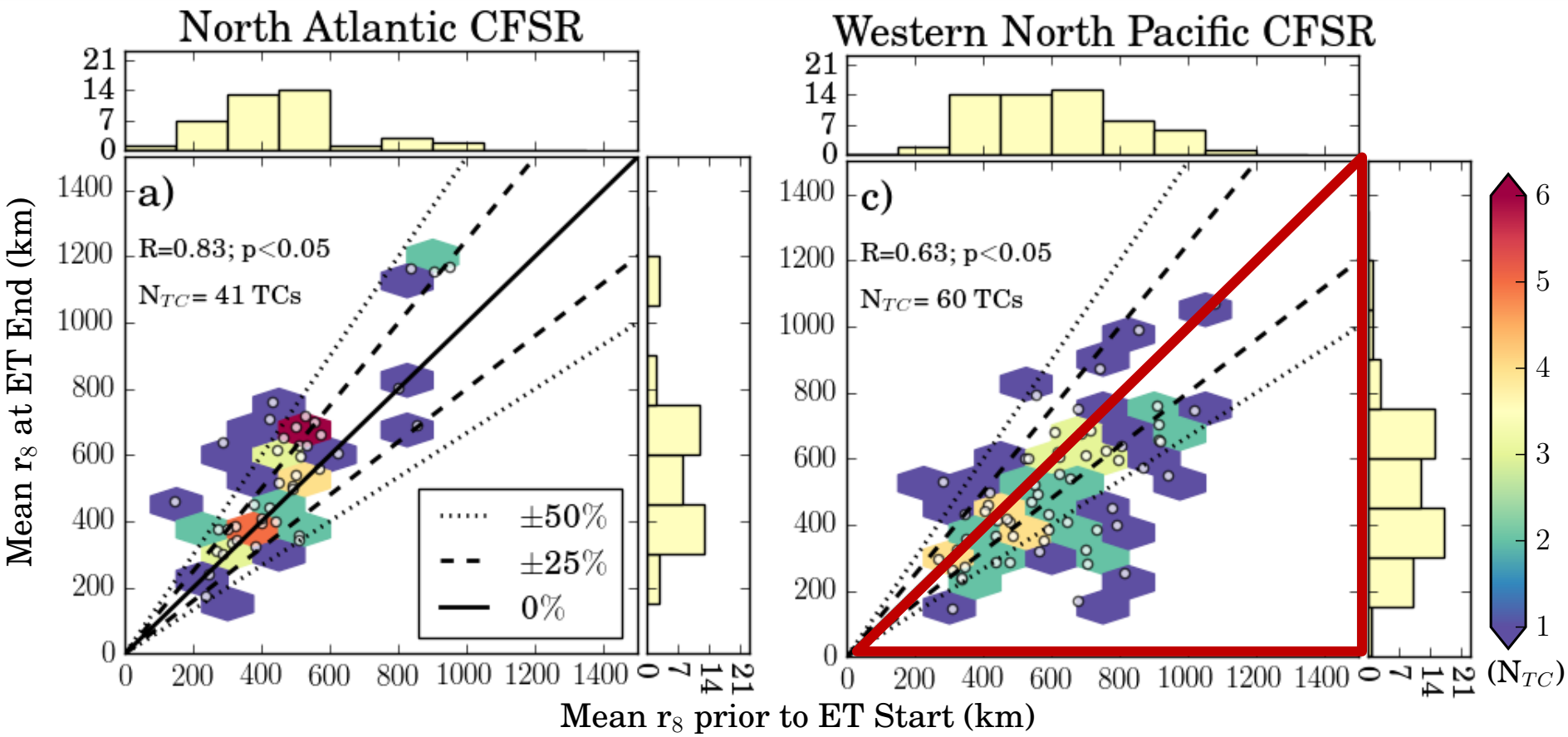

- 76% of North Atlantic TCs increase in size or remain unchanged in size during ET
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- 75% of western North Pacific TCs decrease in size or remain unchanged in size during ET

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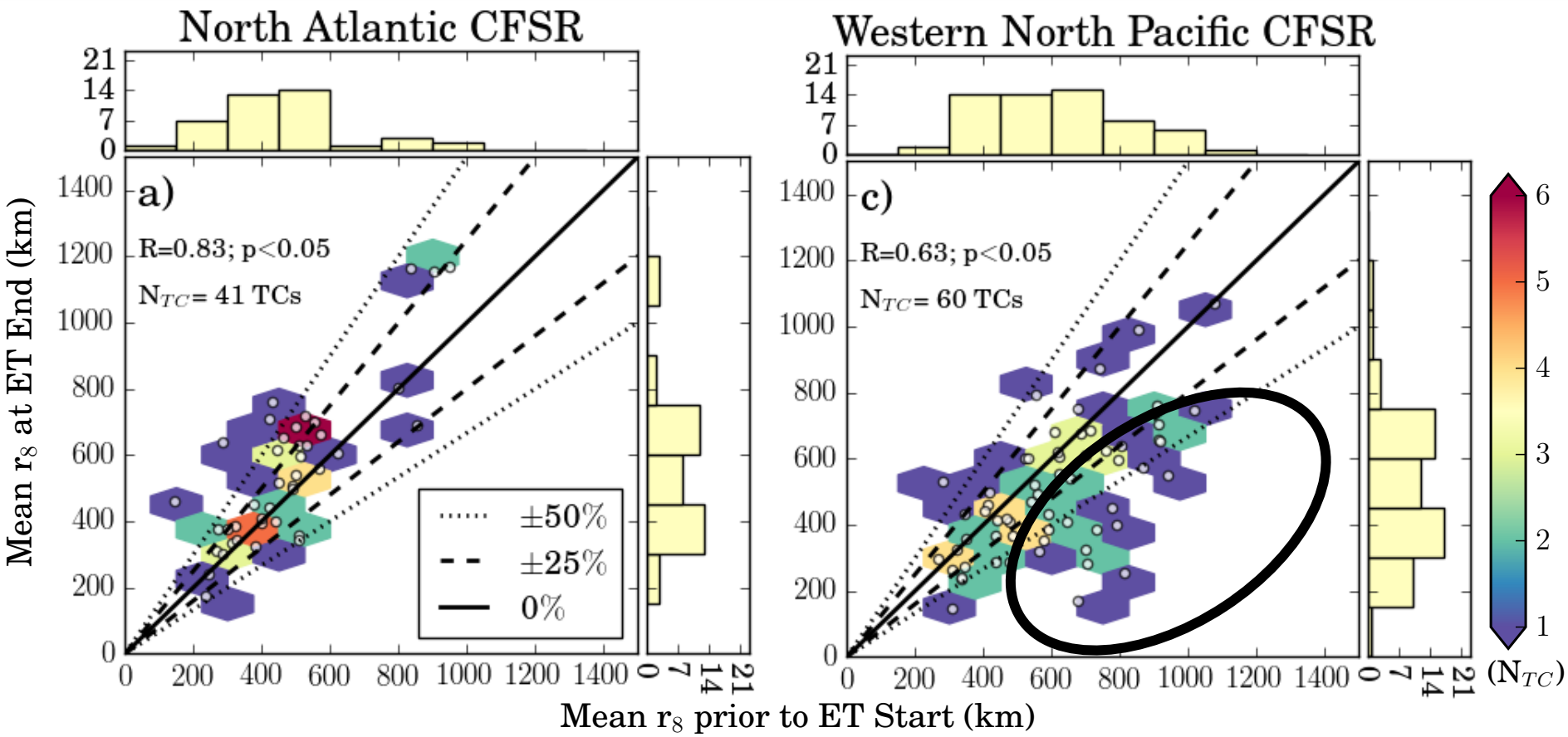

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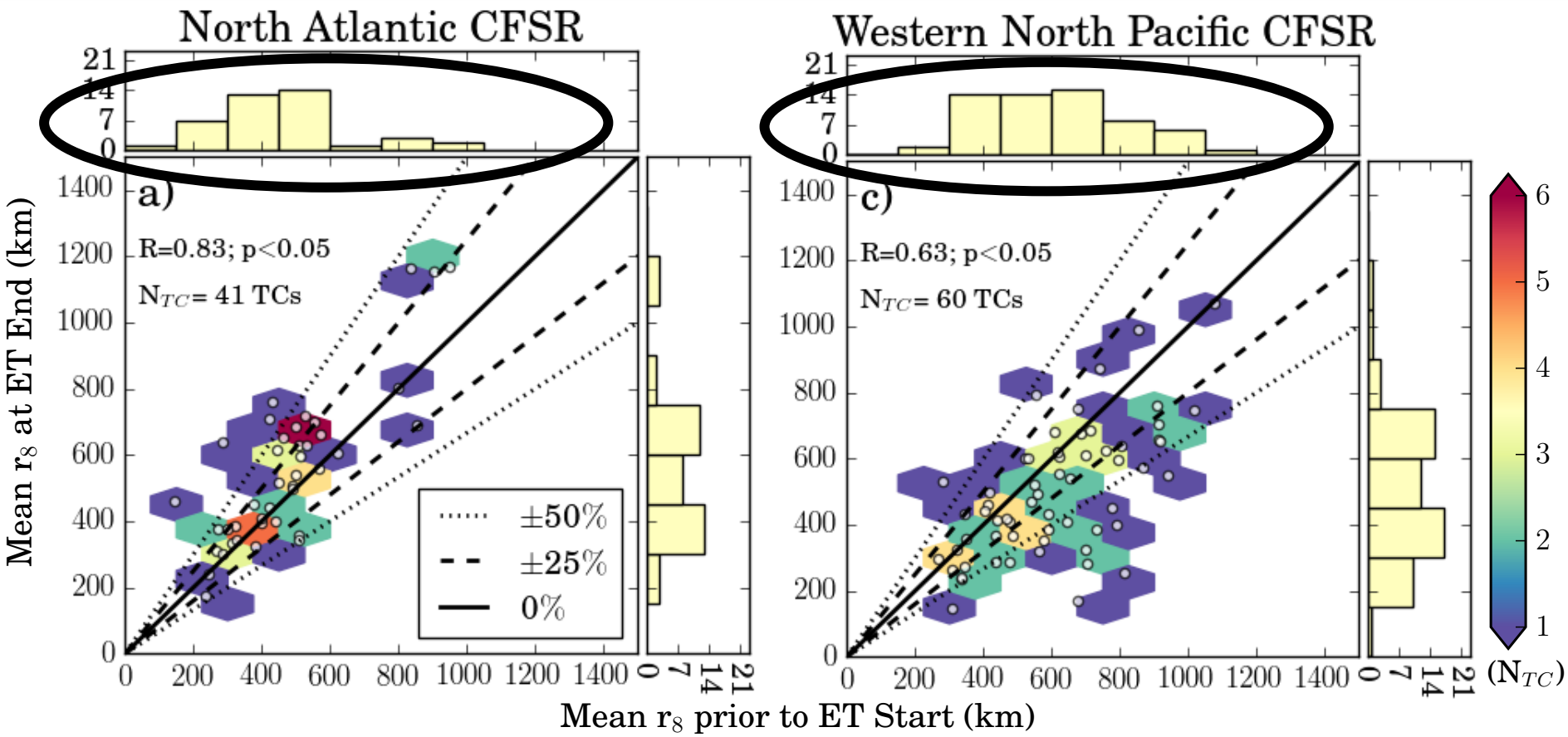

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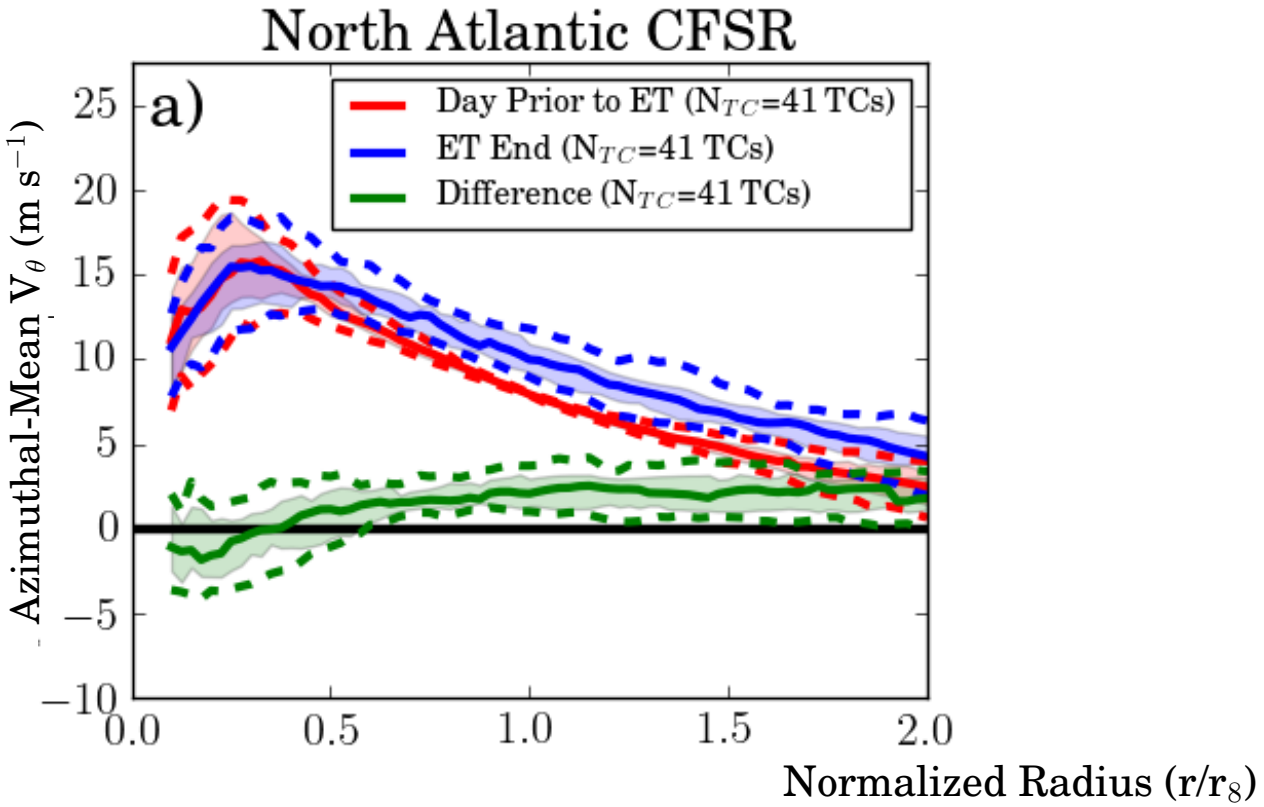
- Western North Pacific r_8 larger prior to ET start potentially explaining lack of growth during ET

Change in Radial Profile of TC Winds During ET



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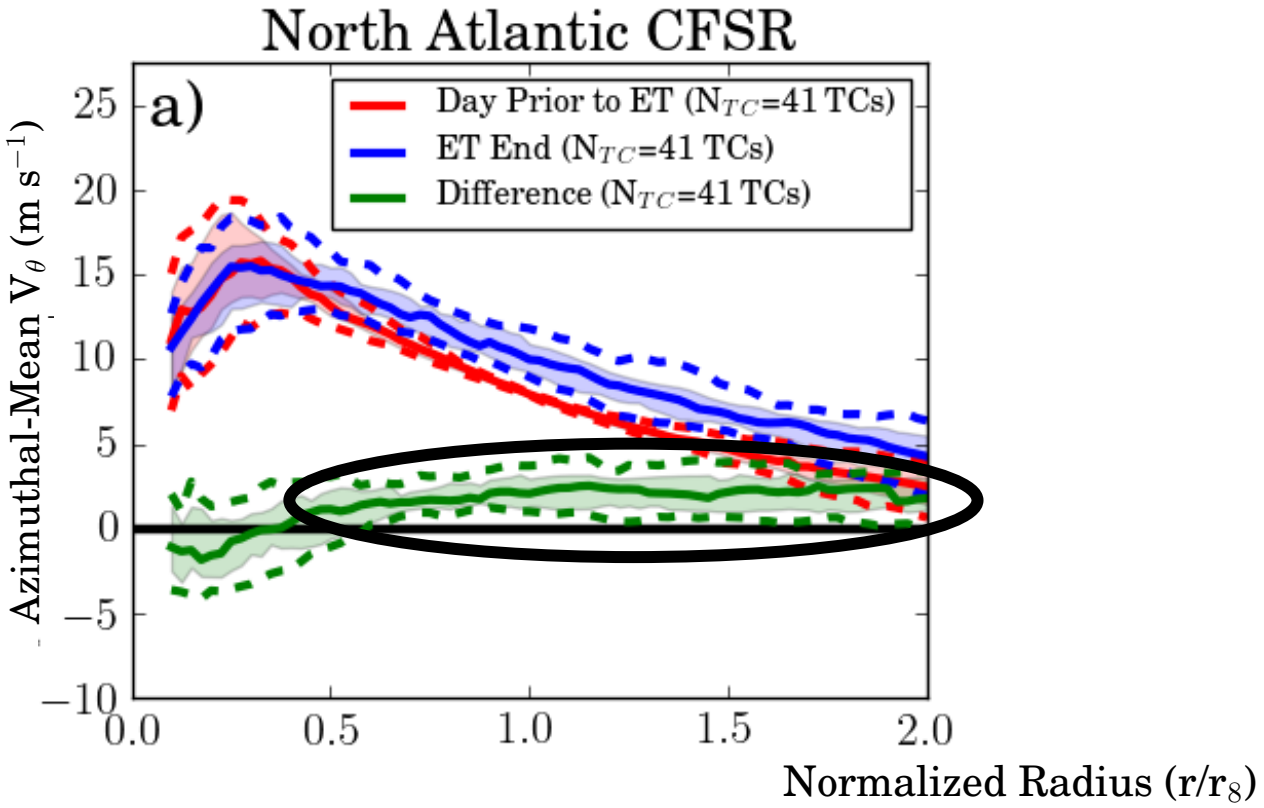

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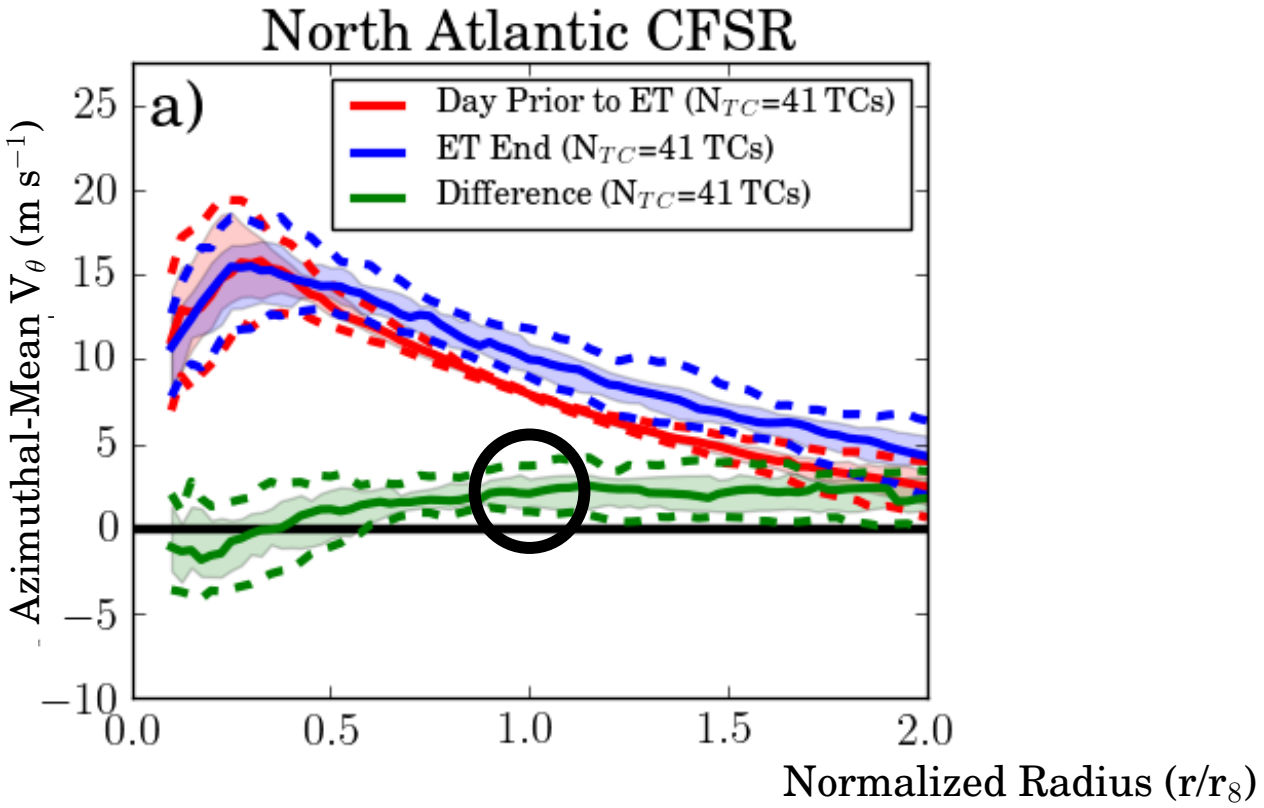

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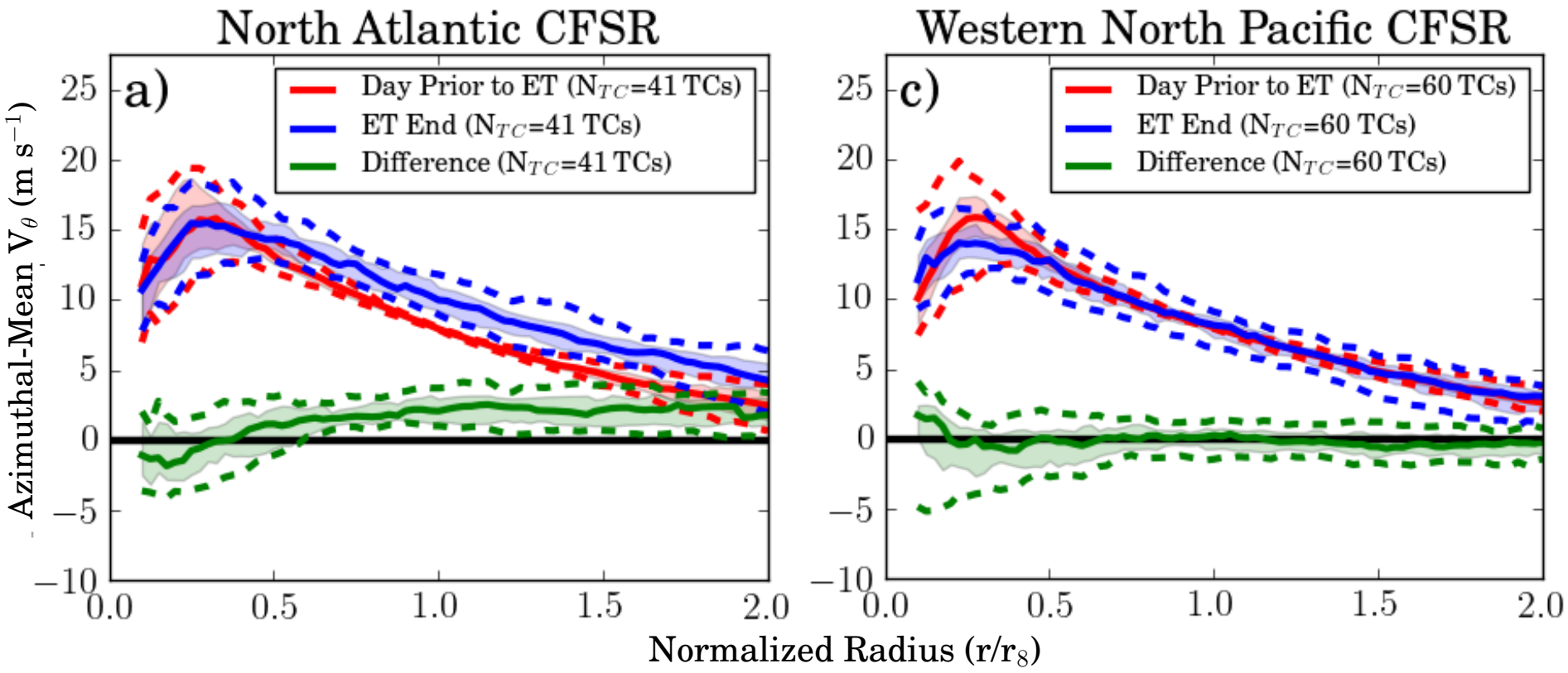

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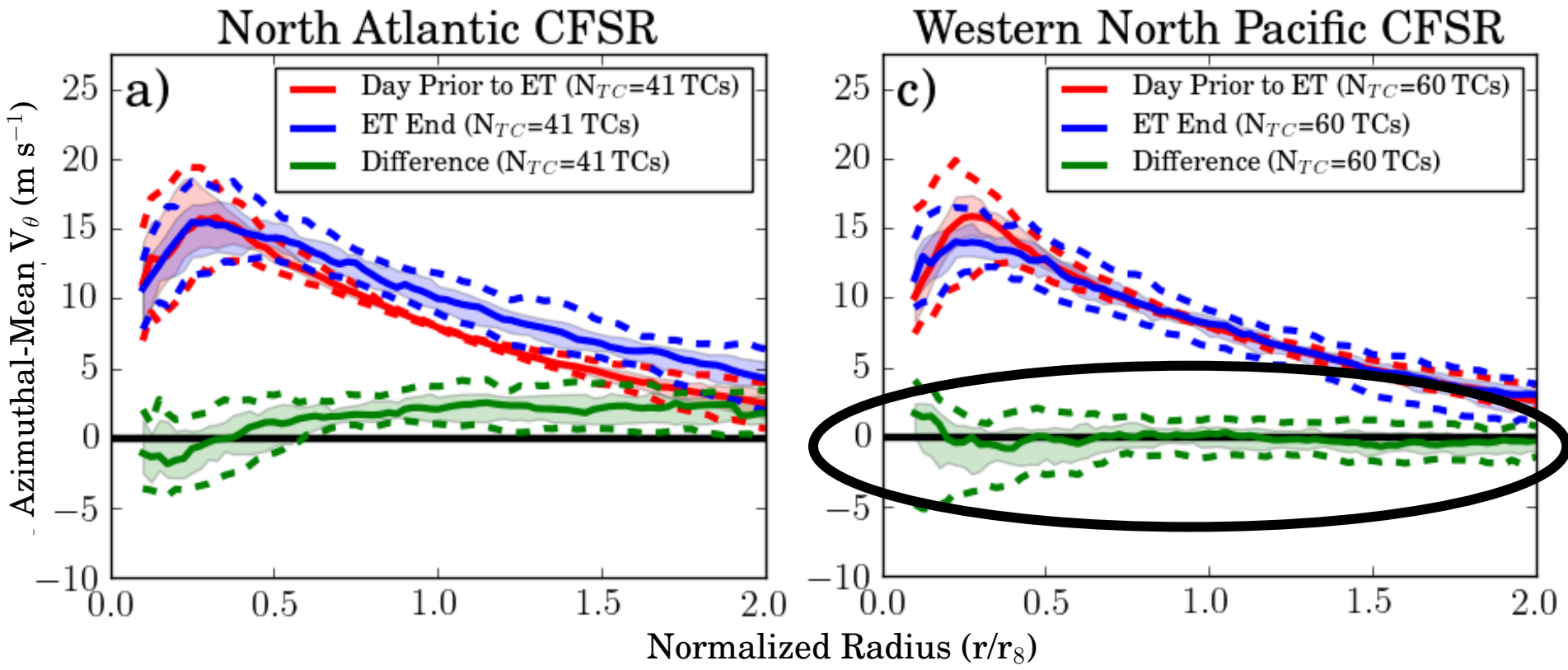

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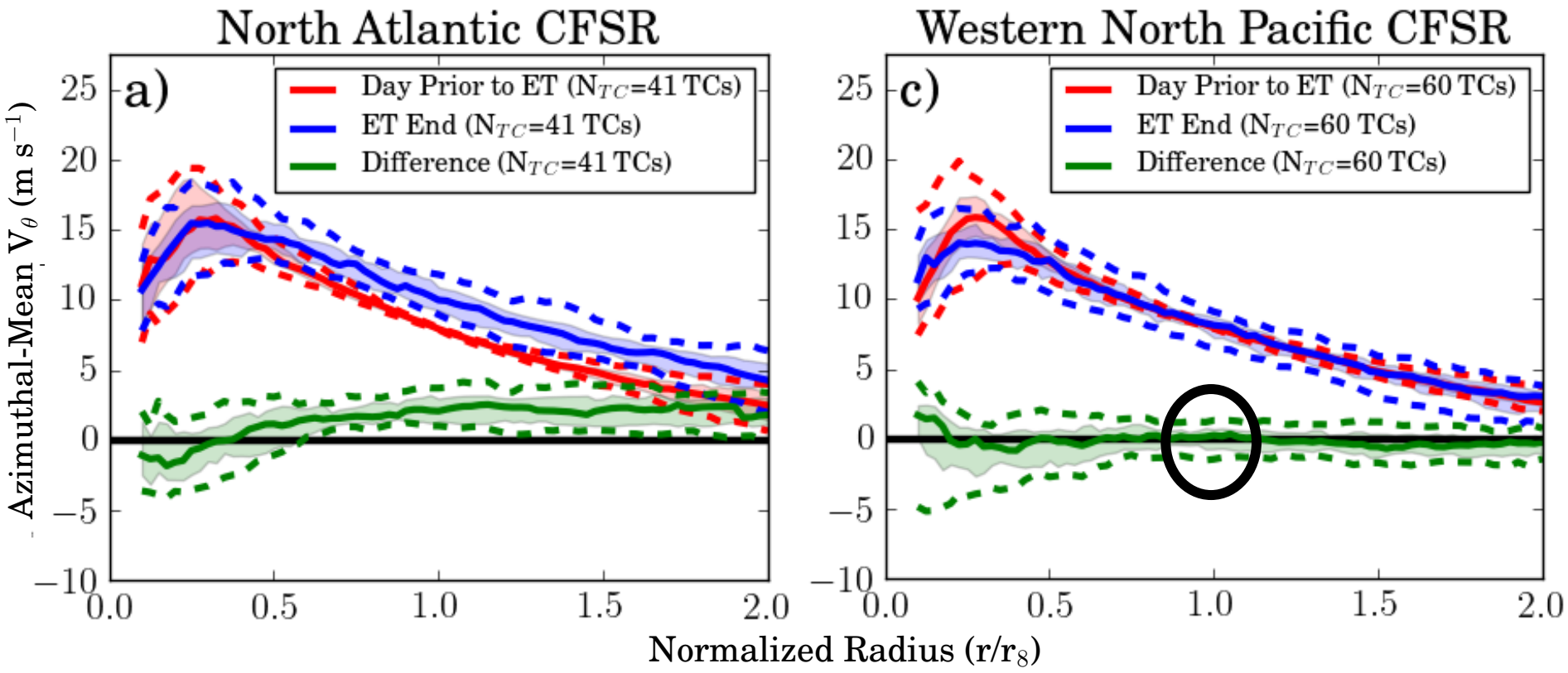

- Negligible change in TC winds at all radii during ET for western North Pacific TCs
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Summary and Discussion

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- TC size prior to ET start may determine the magnitude of TC size changes during ET

- Differences between basins may be attributed to western North Pacific TCs being larger and, thus, closer to extratropical cyclone size prior to ET

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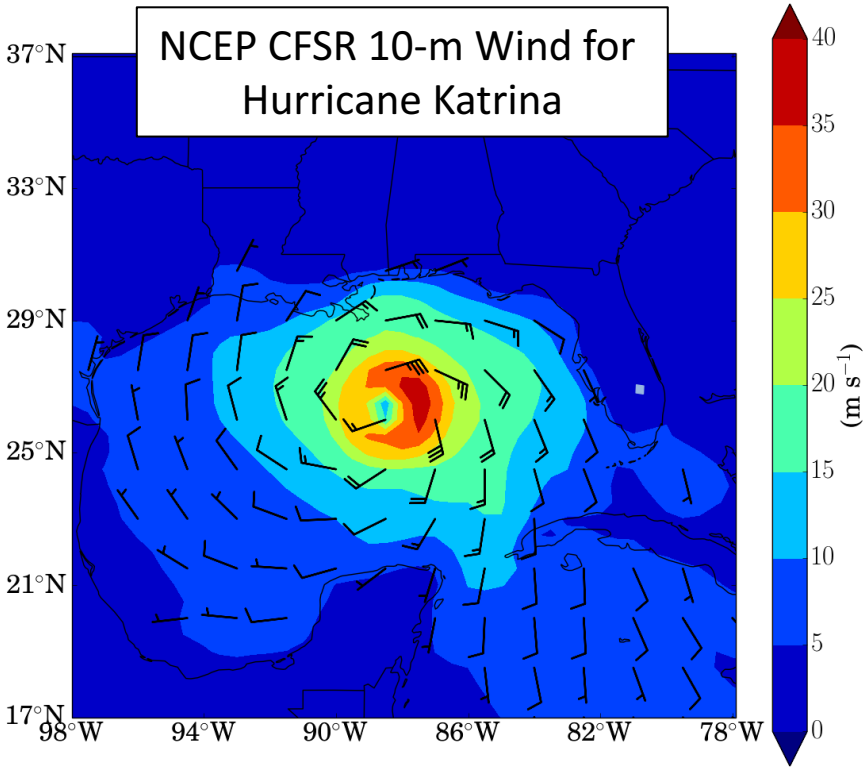
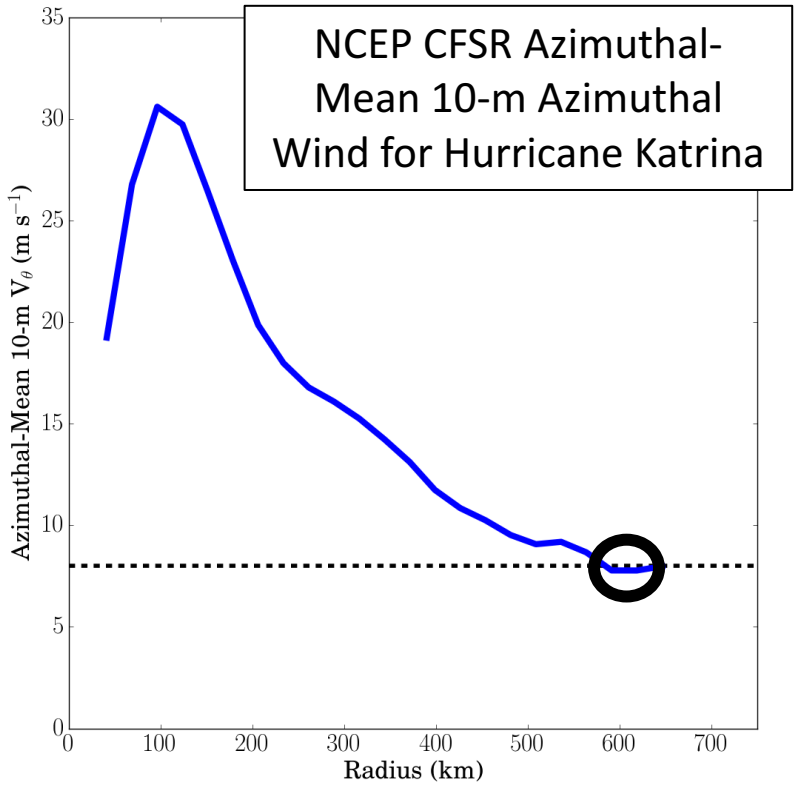
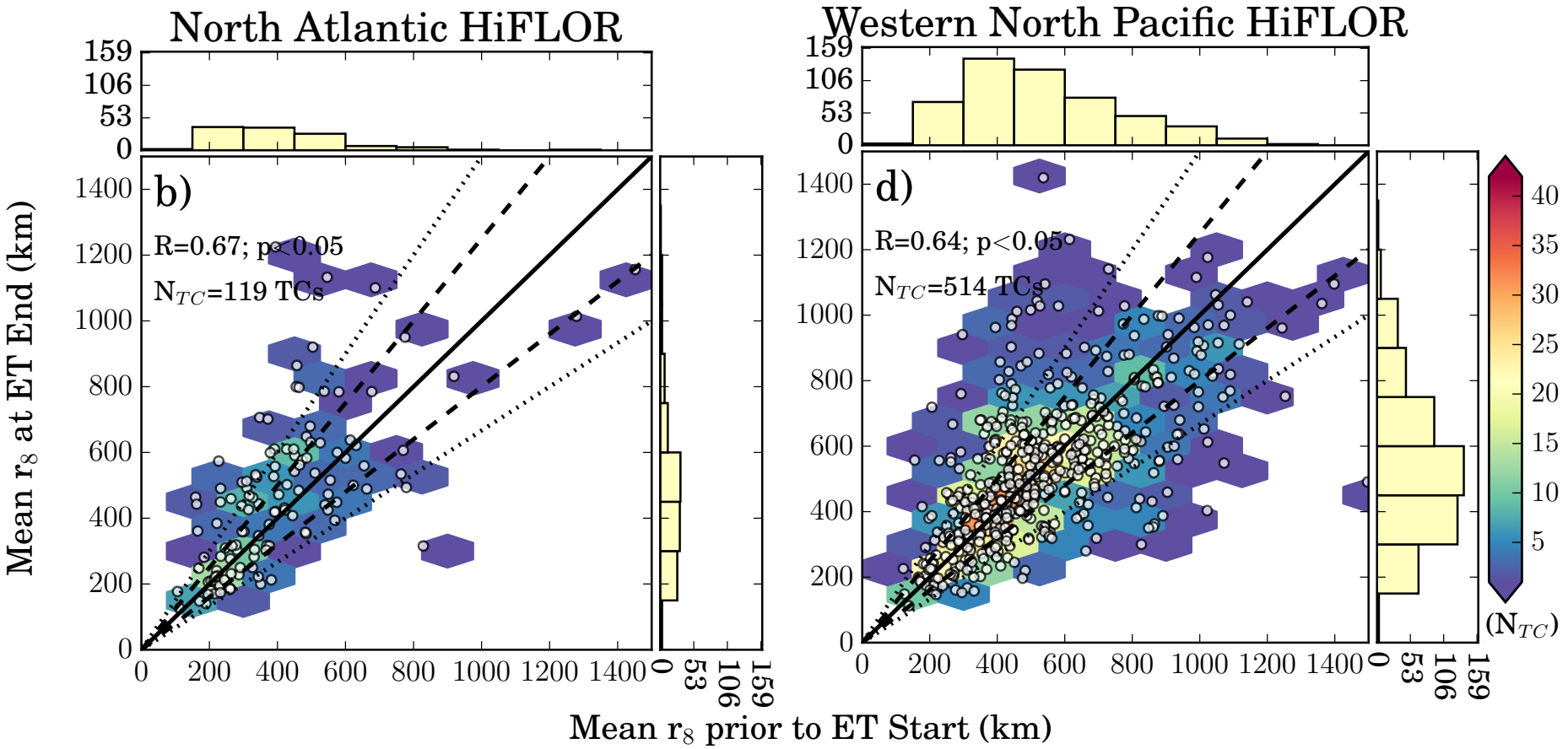

NCEP CFSR 10-m Wind for Hurricane Katrina
37°N
33°N
29°N
25°N
21°N
17°N
98°W
94°W
90°W
86°W
82°W
78°W
40
35
30
25
20
15
10
5
0
(m s^{-1})


NCEP CFSR Azimuthal-Mean 10-m Azimuthal Wind for Hurricane Katrina
Azimuthal-Mean 10-m V_θ (m s^{-1})
0
5
10
15
20
25
30
35
0
100
200
300
400
500
600
700
Radius (km)

Extra Slides



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