GLM Flash Data Trends During Tropical Cyclone Intensification Changes

David J. PeQueen
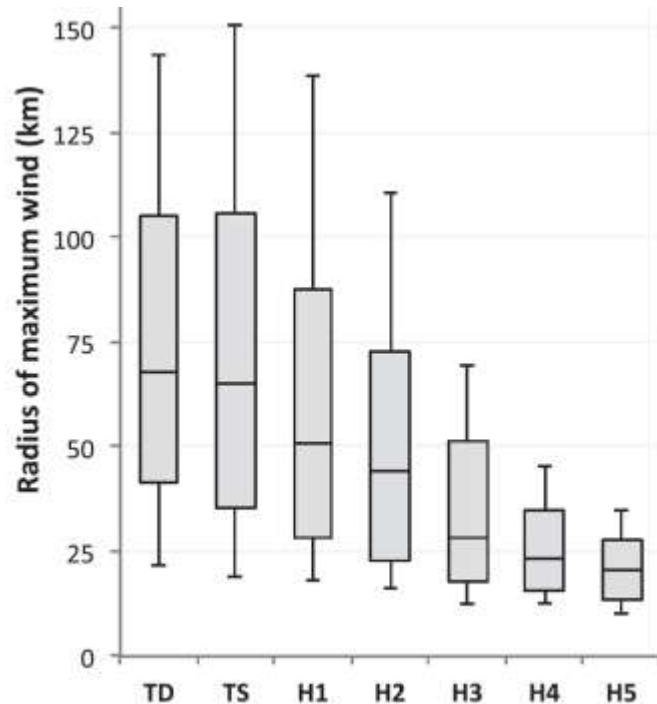Eric C. Bruning
9 September 2020
GLM Science Team Meeting

Tropical Cyclone Intensity

Rapid Intensification
- 30 kt or greater increase in max TC sustained wind in a 24-hr period
- Needs warm sea surface temperatures and low wind shear
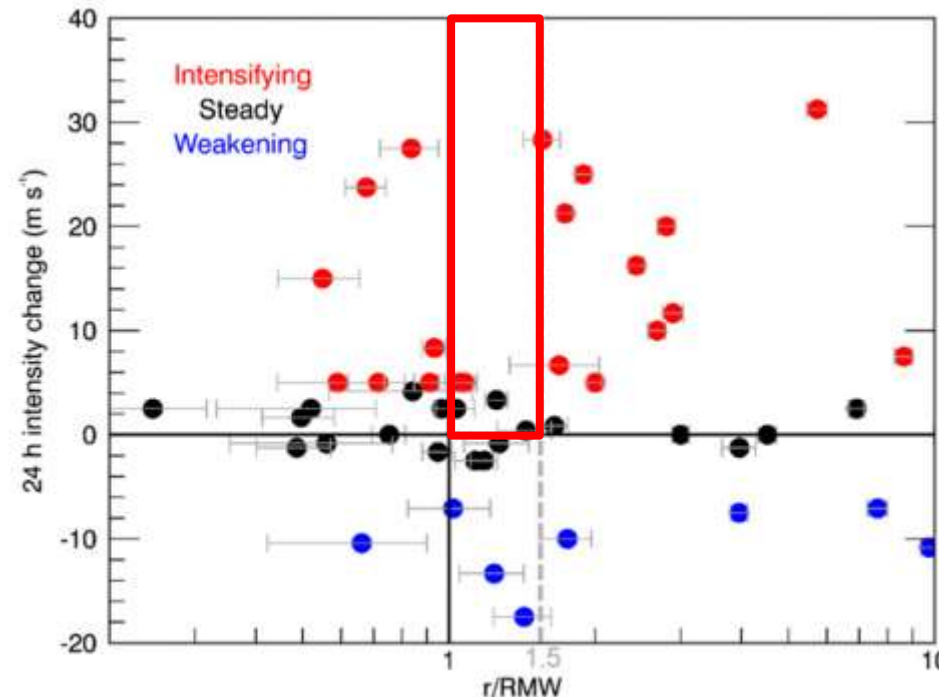
Radius of Maximum Wind (RMW)

Category	Winds [kt]
1	64-82
2	83-95
3	96-112
4	113-136
5	137+

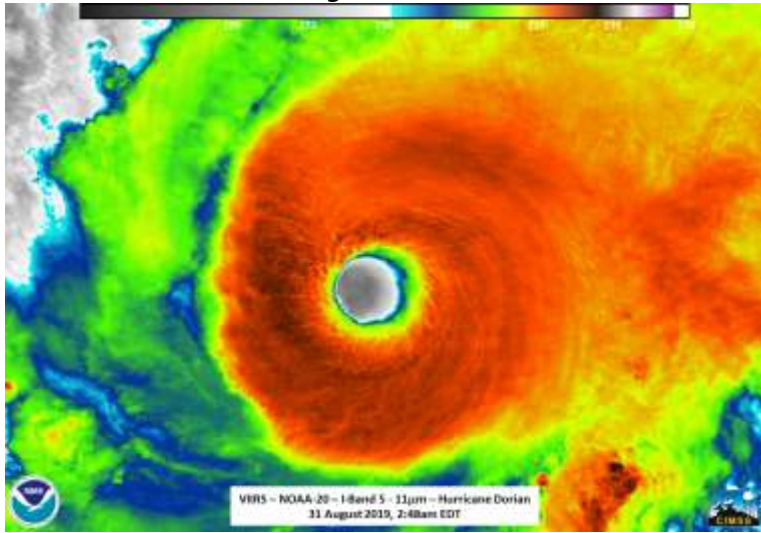2005-2014 TCs in FLIGHT+ data set. (Stevenson et al. 2018, Fig. 1).

ICLB radial position relative to the RMW

NA TCs 24-hr intensity change (Stevenson et al. 2018, Fig. 5).

Stern et al. (2015) finds in idealized numerical simulations that "most contraction is completed prior to most intensification"
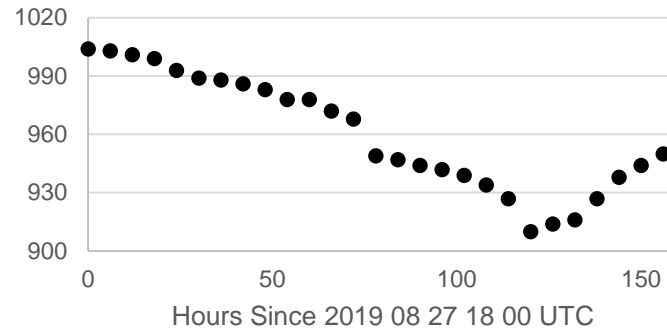
Photo Credit: nesdis.noaa.gov/content/hurricane-dorian-2019

Hurricane Dorian (2019 NA)

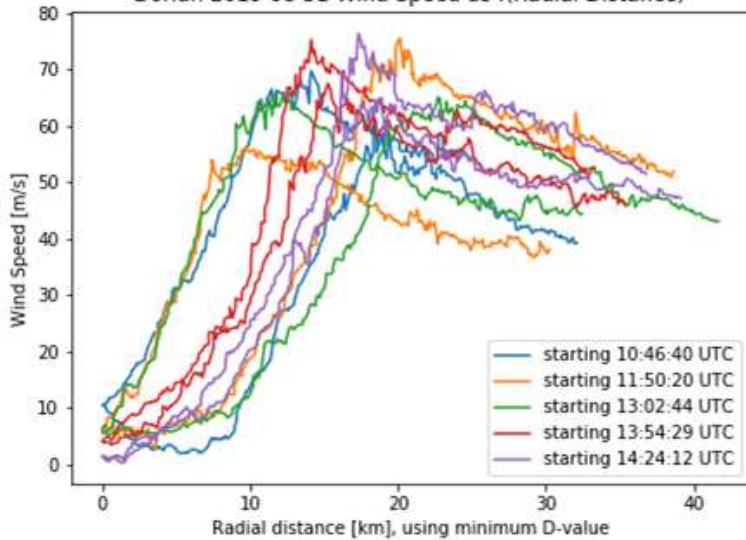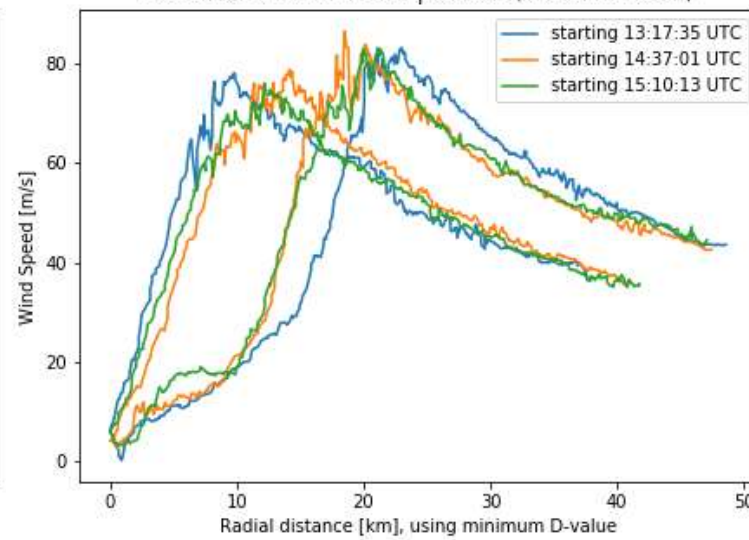Peak intensity: 910 mb; 160 kt (Category 5) on Sept. 1

Minimum Pressure [mb]

Hours Since 2019 08 27 18 00 UTC

Wind Speed [kt]

Hours Since 2019 08 27 18 00 UTC
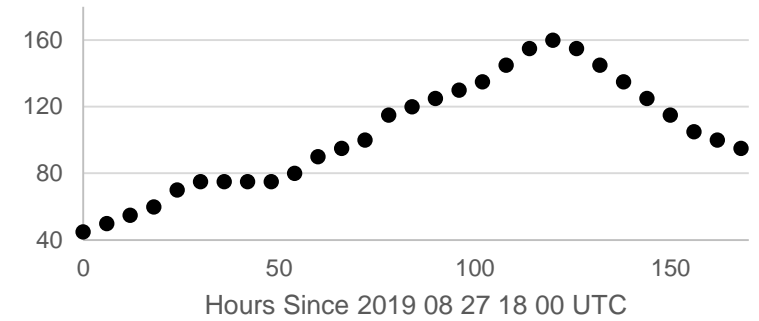
Determining the Radius of Maximum Wind

Dorian 2019 08 31 Wind Speed as f(Radial Distance)

Wind Speed [m/s]

Radial distance [km], using minimum D-value

starting 10:46:40 UTC
starting 11:50:20 UTC
starting 13:02:44 UTC
starting 13:54:29 UTC
starting 14:24:12 UTC

Dorian 2019 09 01 Wind Speed as f(Radial Distance)

Wind Speed [m/s]

Radial distance [km], using minimum D-value

starting 13:17:35 UTC
starting 14:37:01 UTC
starting 15:10:13 UTC

Dorian Average RMW [km]
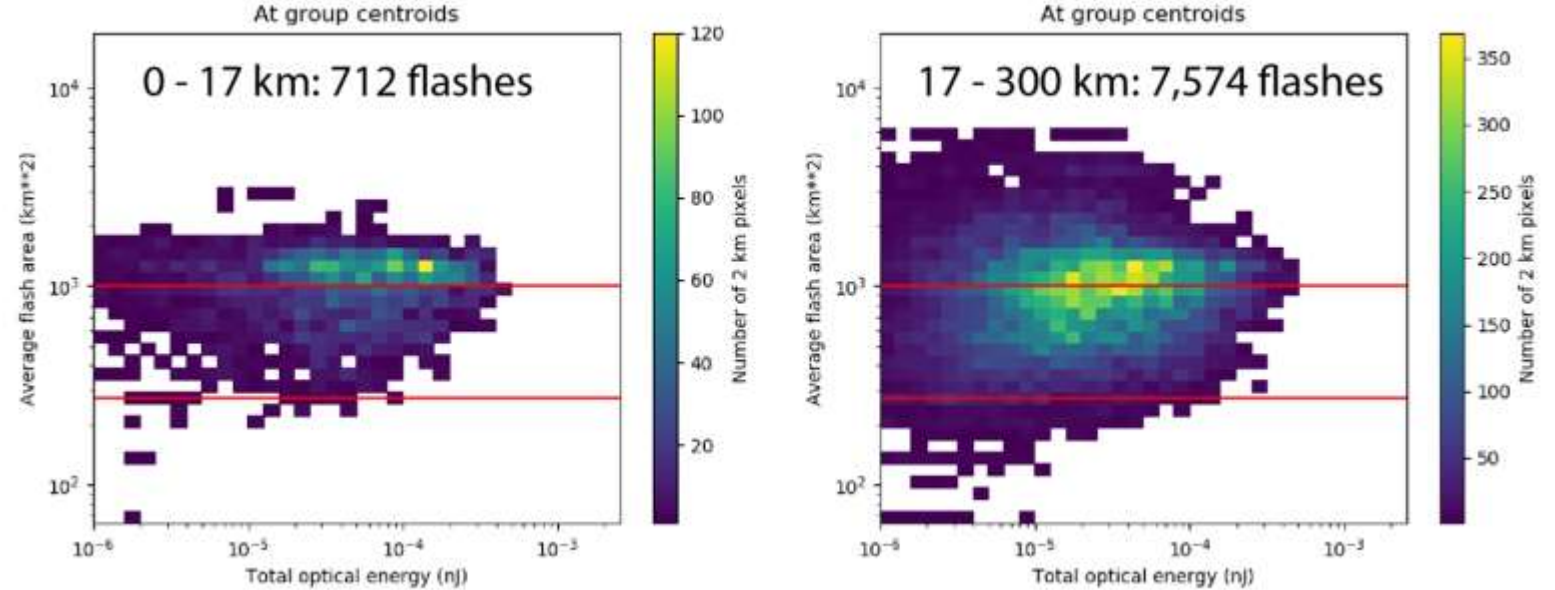
Hours Since 2019 August 30, 13 UTC
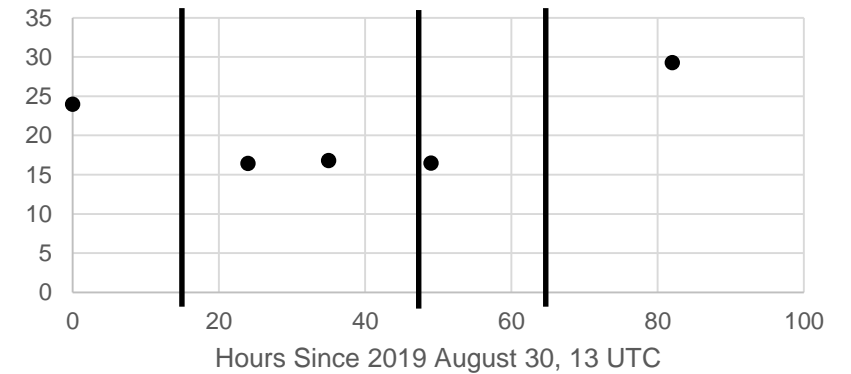
Hurricane Dorian (2019 NA)

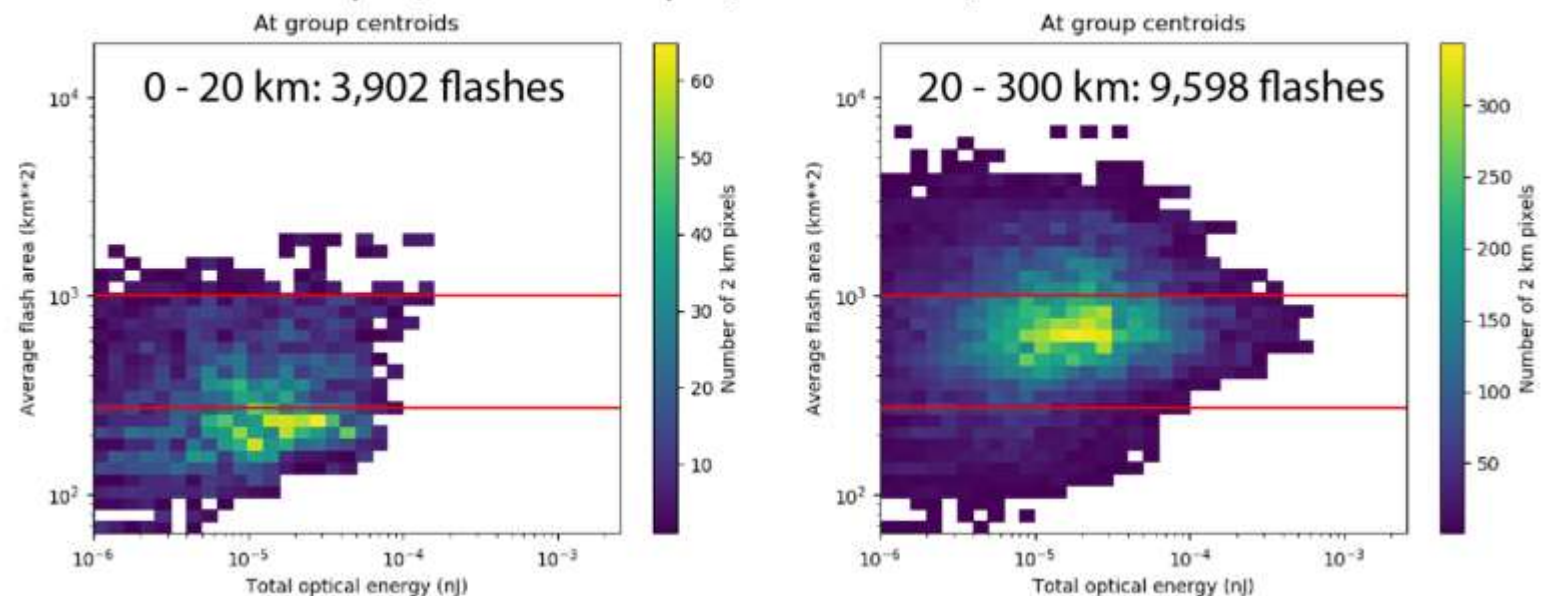Dramatic shift in core lightning characteristics that is less evident in the rainband flashes

- AFA decrease
- TOE decrease

2019 Aug 31, 0600 to Sep 1, 1200 UTC; 120 kt to 155 kt

2019 Sep 1, 1200 to Sep 2, 0600 UTC; 155 kt to 145 kt

Strengthening
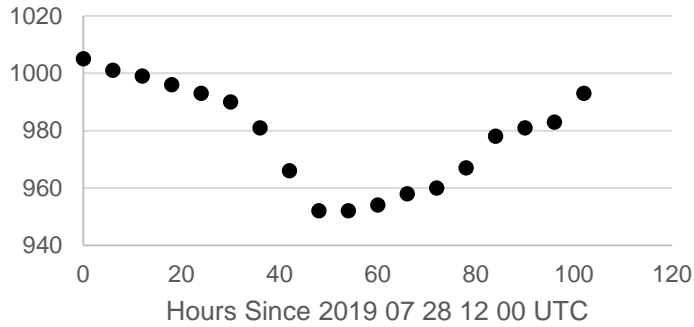
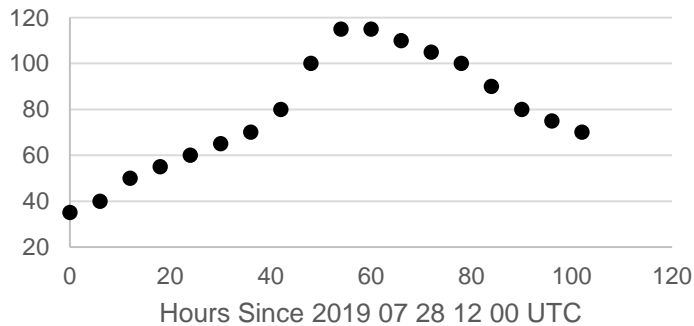Weakening

Hurricane Erick (2019 ENP)
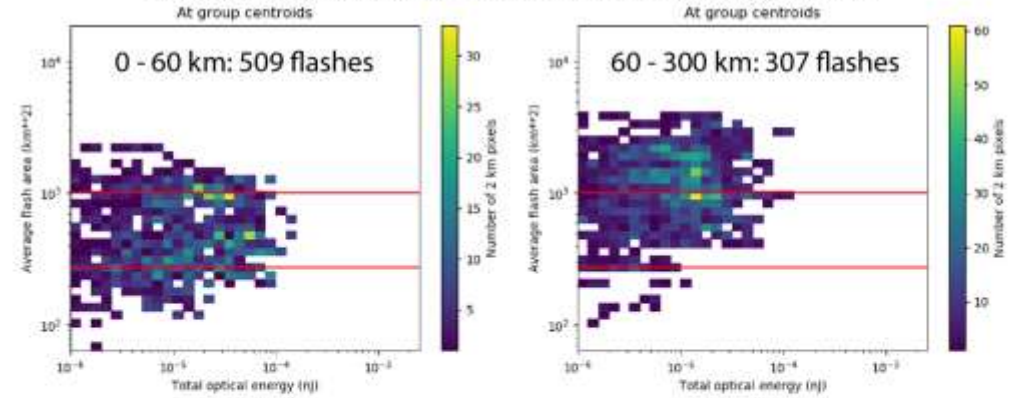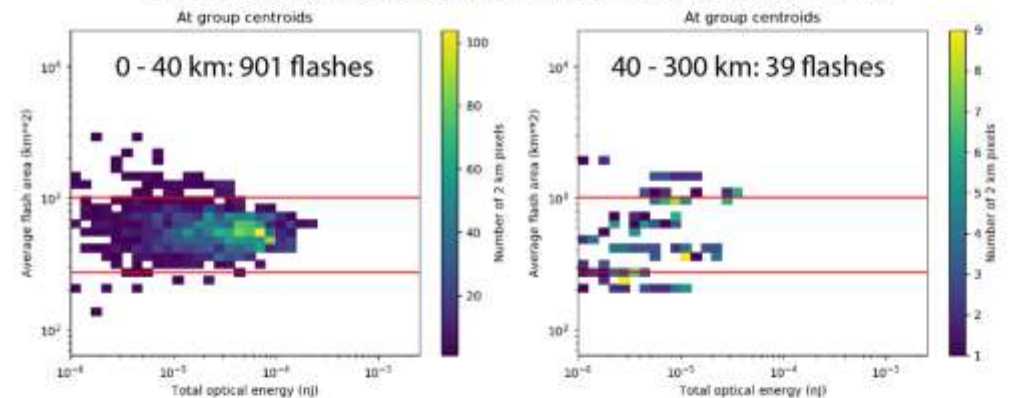
Peak intensity: 952 mb; 115 kt (Category 4) on Jul. 30-31

- Big spike in FED around time of peak intensity
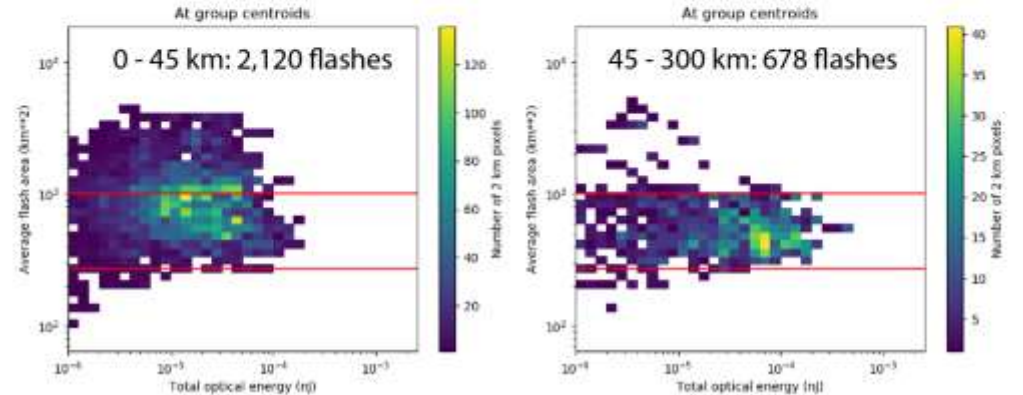- TOE decrease
- AFA slight increase

GOES-17 VISIBLE IMAGE AT 2022 UTC 30 JULY 2019 OF ERICK NEAR PEAK INTENSITY (COURTESY CIMSS).

Minimum Pressure [mb]

Hours Since 2019 07 28 12 00 UTC

Wind Speed [kt]

Hours Since 2019 07 28 12 00 UTC

2019 Jul 28, 1200 to Jul 30, 0000 UTC; 35 kt to 70 kt

0 - 60 km: 509 flashes

60 - 300 km: 307 flashes

Strengthening

2019 Jul 30, 0000 to Jul 31, 0000 UTC; 70 kt to 115 kt

0 - 40 km: 901 flashes

40 - 300 km: 39 flashes

Strengthening

2019 Jul 31, 0000 to Aug 1, 1800 UTC; 115 kt to 70 kt

0 - 45 km: 2,120 flashes

45 - 300 km: 678 flashes

Weakening

Diurnal Cycle in Dorian

Upcoming Work

➢ Complete pixel statistics for GLM-era systems (both NA & ENP) with RMW divisions and manual track corrections as needed

➢ Characterize diurnal cycle effect on pixel statistics
- Minimum detected TOE