

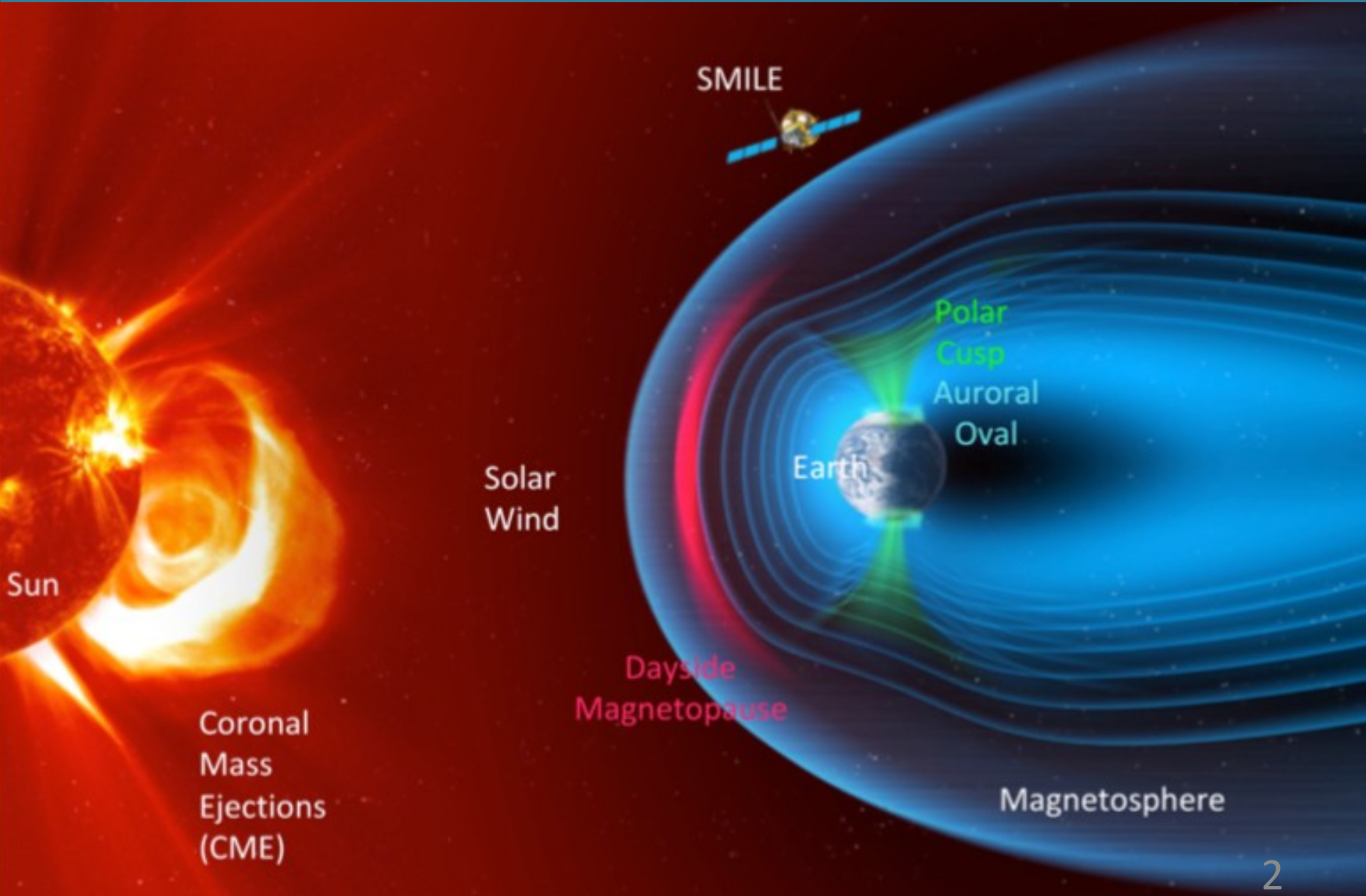
Algorithm for determining auroral oval boundaries based on various manifestations of auroral activity



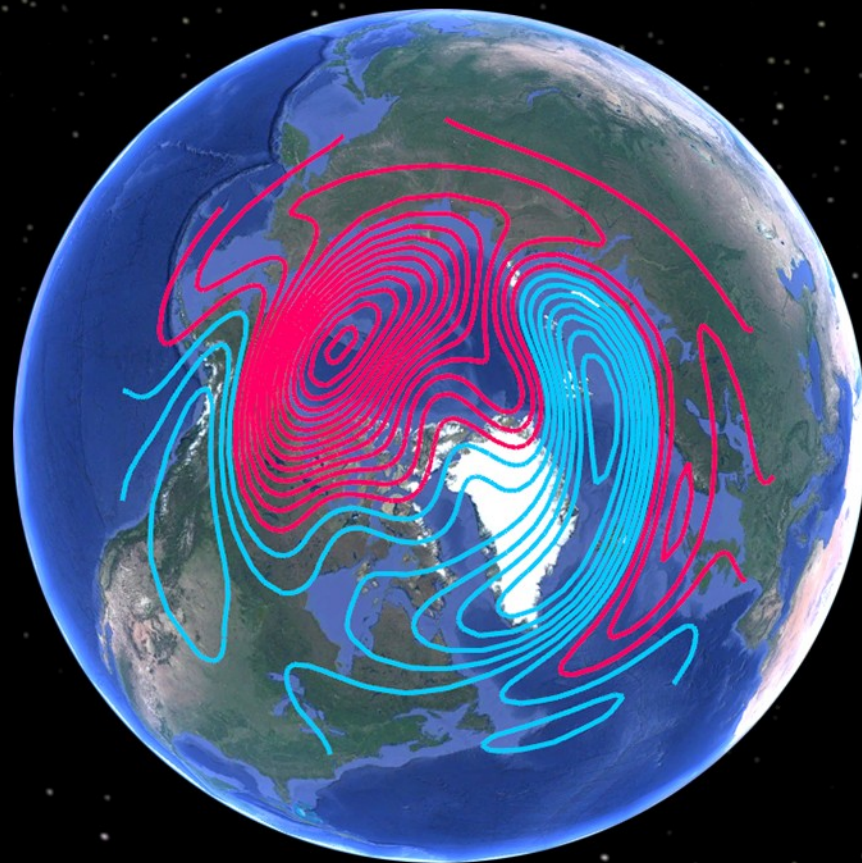
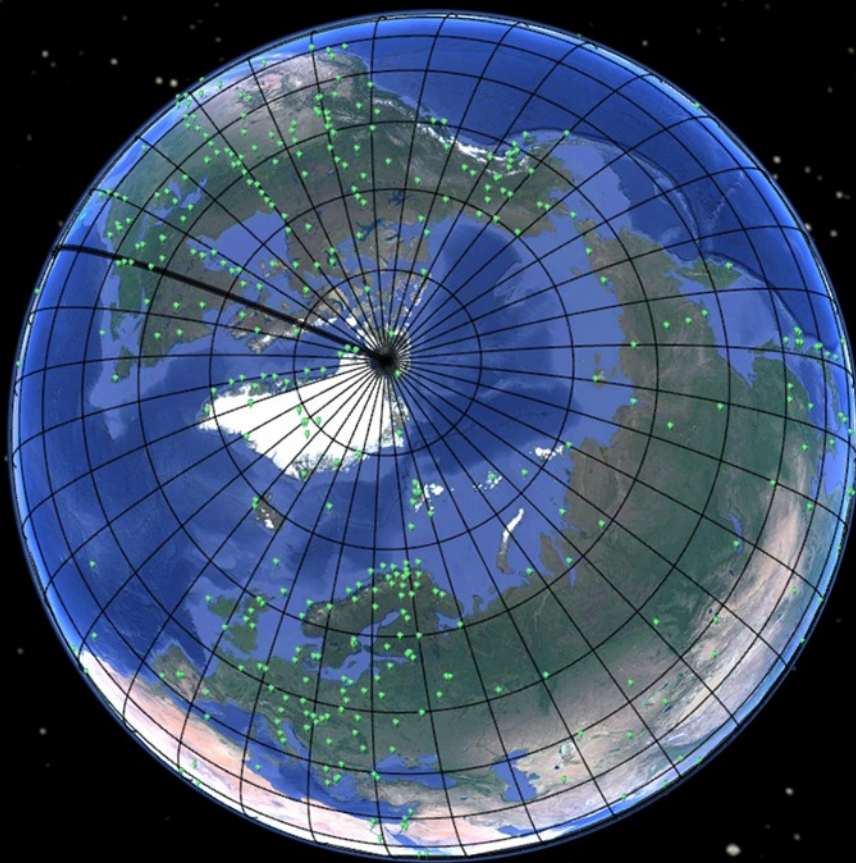
Penskikh Y., Kapustin V.

Institute of Solar-Terrestrial Physics
Irkutsk

Auroral oval



Magnetogram inversion technique (MIT-ISTP)

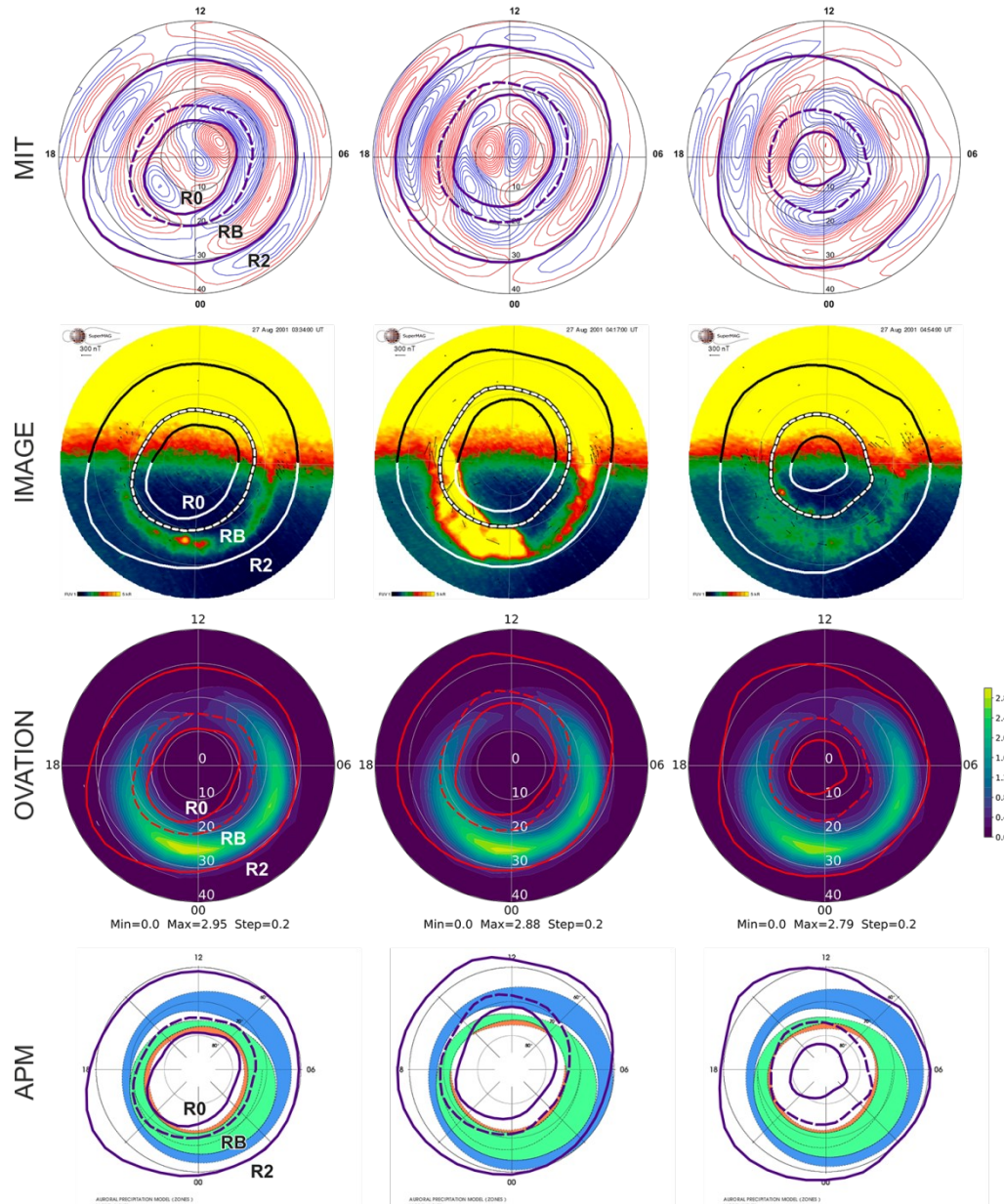


Comparison FAC-boundaries with auroras (IMAGE), OVATION and APM models

фаза роста, 03:34UT

взрывная фаза, 04:17UT

фаза восстановления, 04:55UT



Auroral precipitation: Ovation PRIME Model (2010)

diff2001 239 14100 15.6 GW

ovation
2001-08-27 03:55:00 UT

fall

12

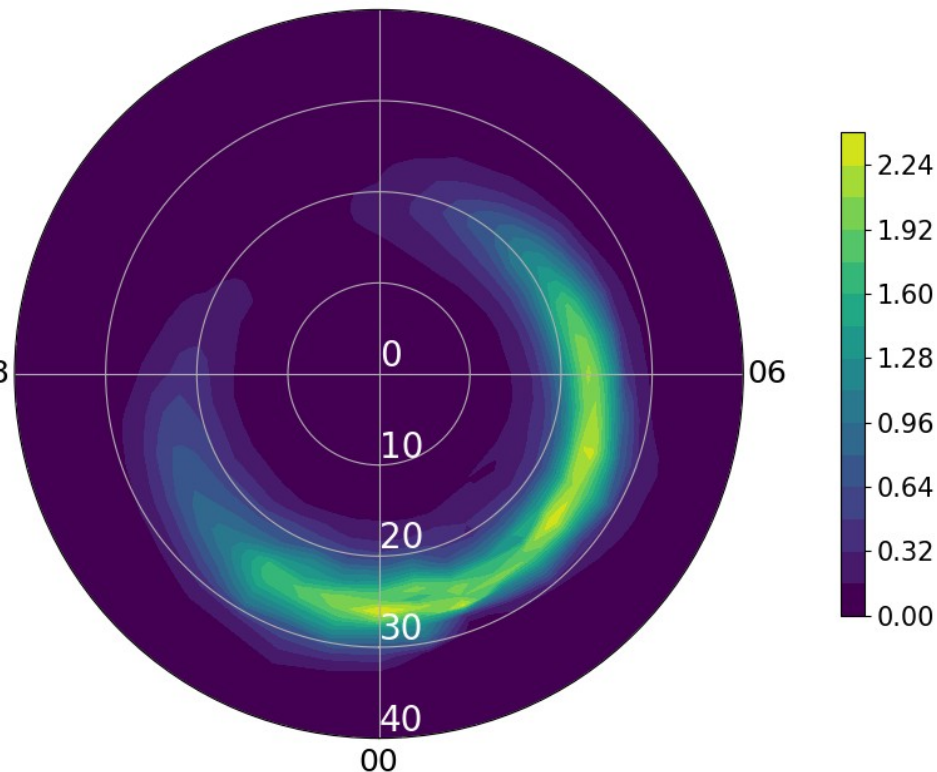
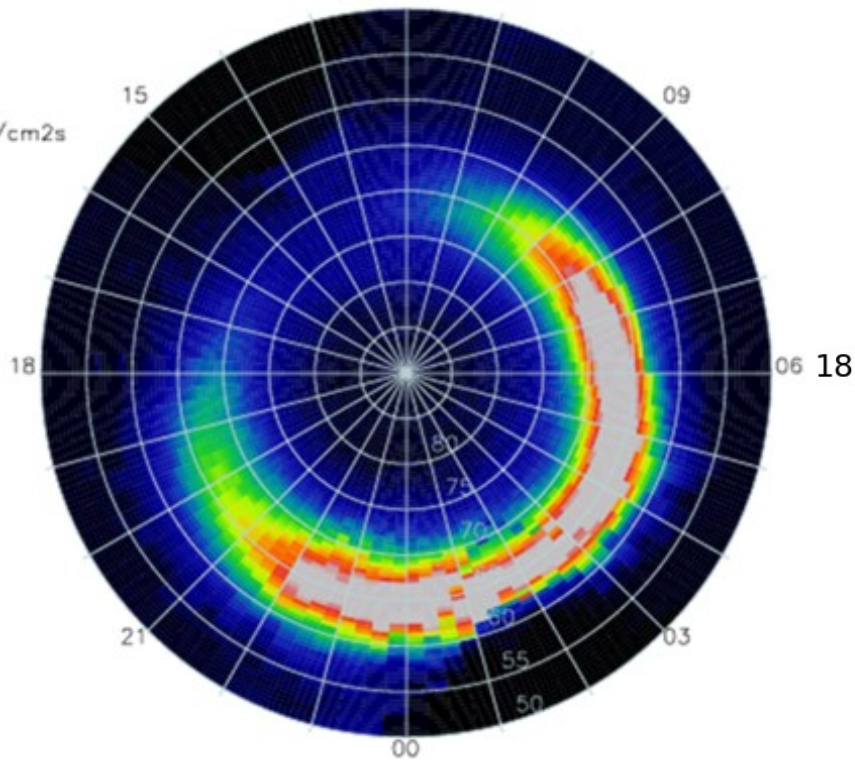
12

ergs/cm²s

1.50

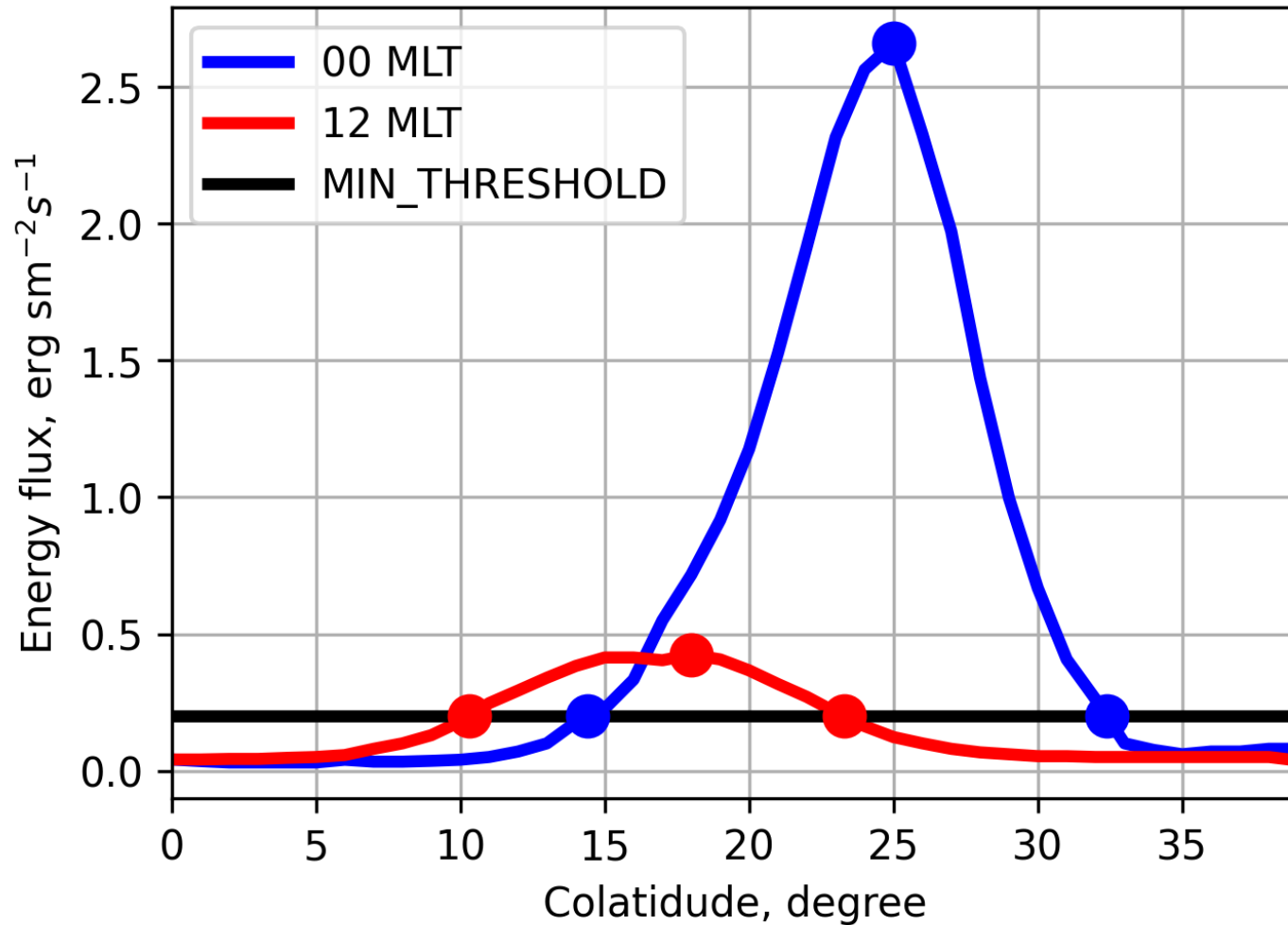
0.75

0.00



Min=0.0 Max=2.4 Step=0.16

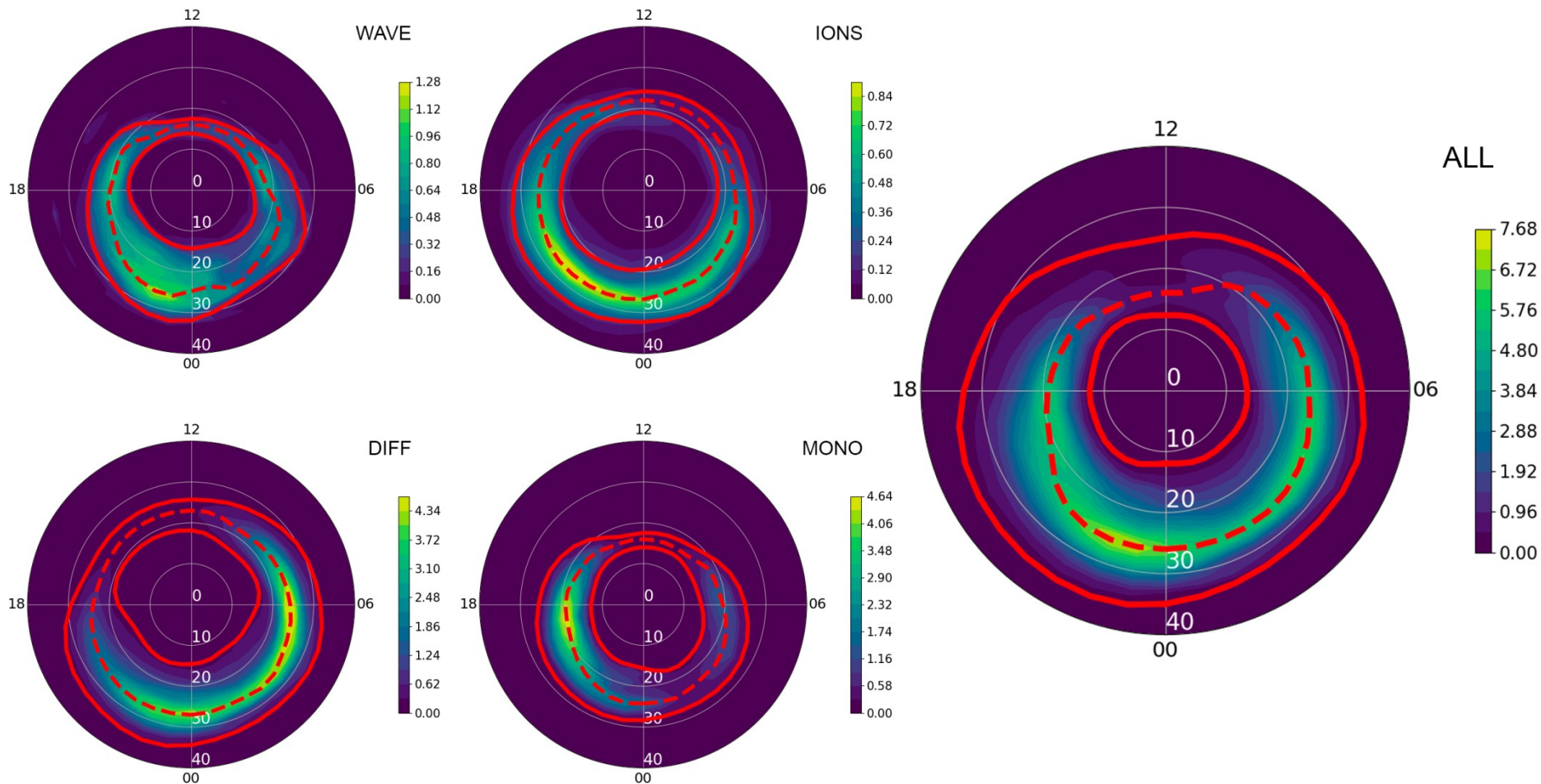
OVATION PRIME: profiles for 00 and 12 MLT



MIN_THRESHOLD = 0.2

Kosar et al [2018]

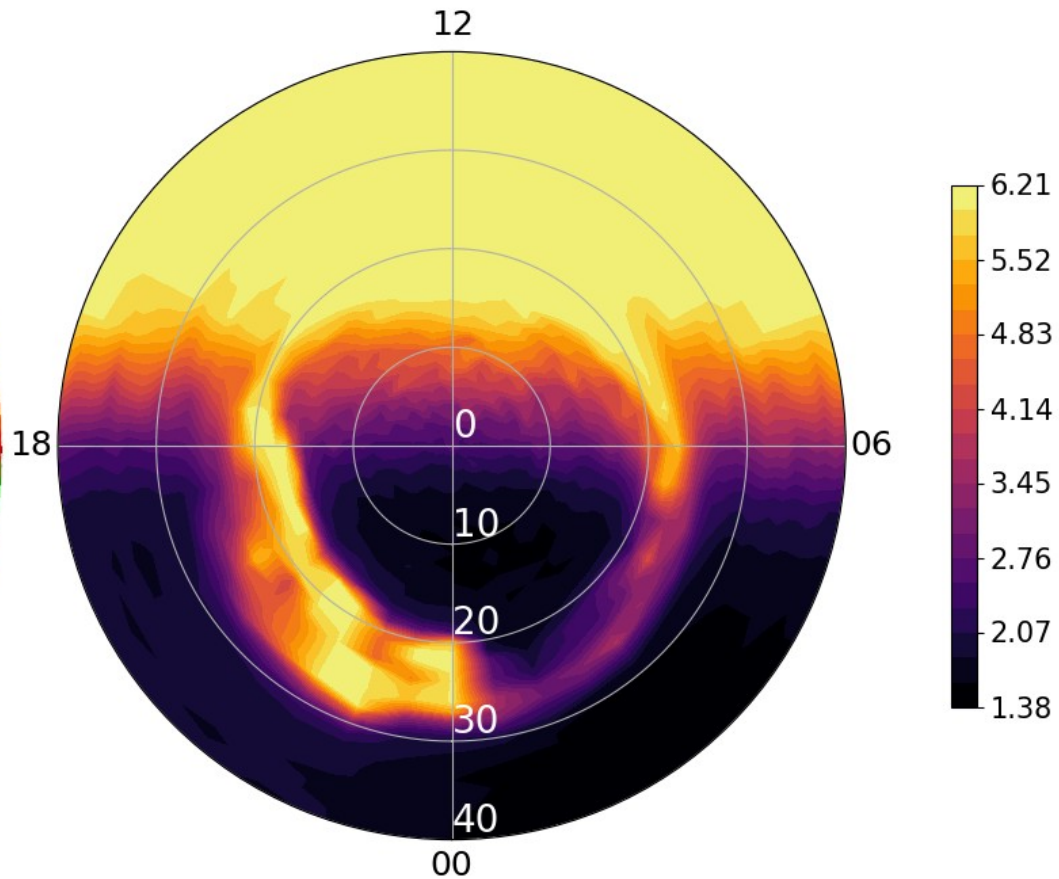
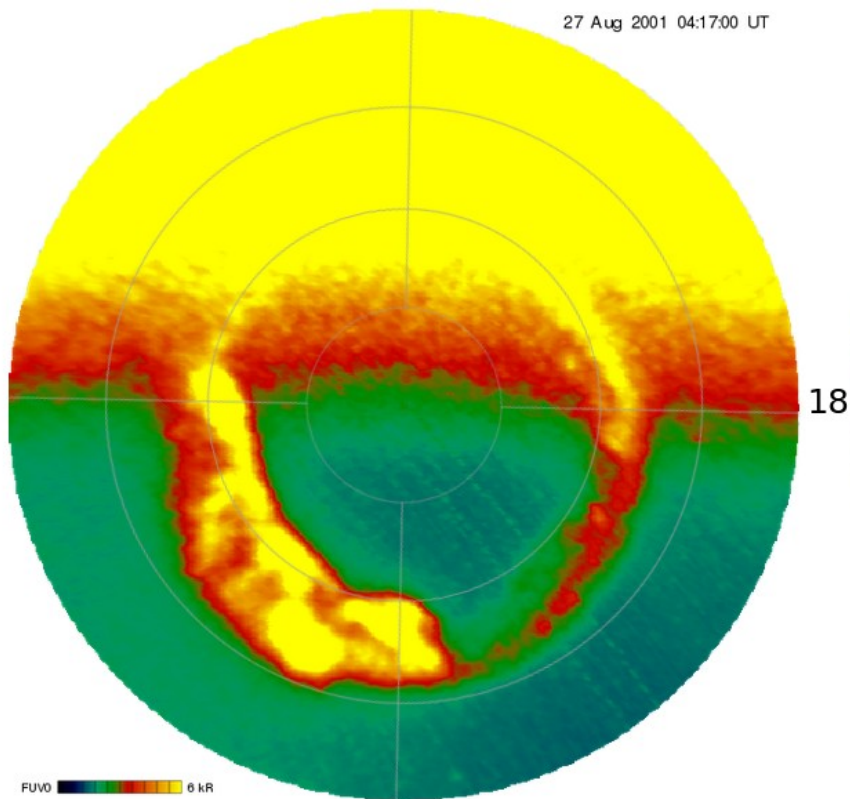
Boundaries for OVATION. Storm 2001-08-17 16:30 UT



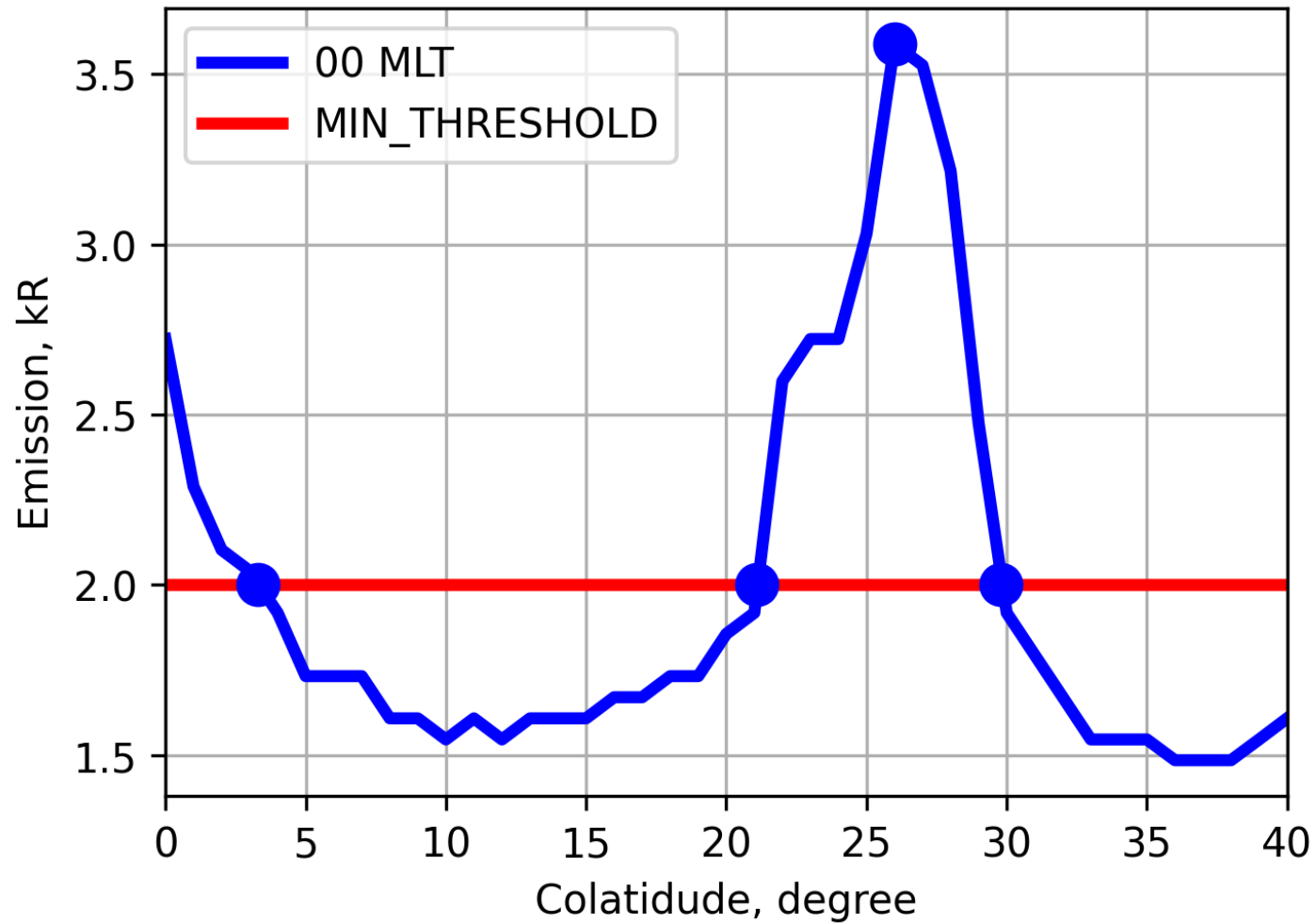
MIN_THRESHOLD = 0.2

Boundaries for IMAGE. Substorm 2001-08-27

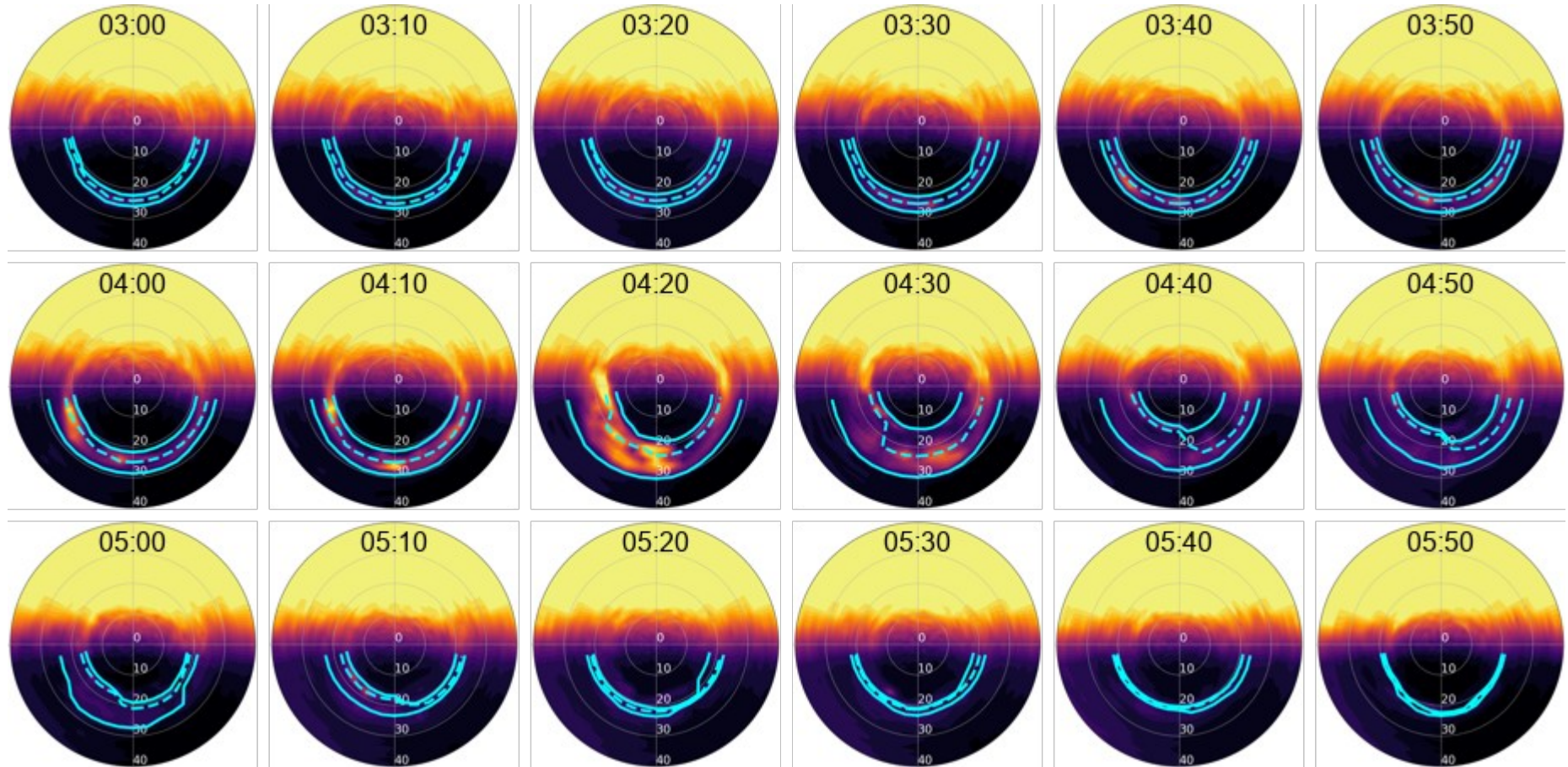
2001-08-27 04:17:00 UT



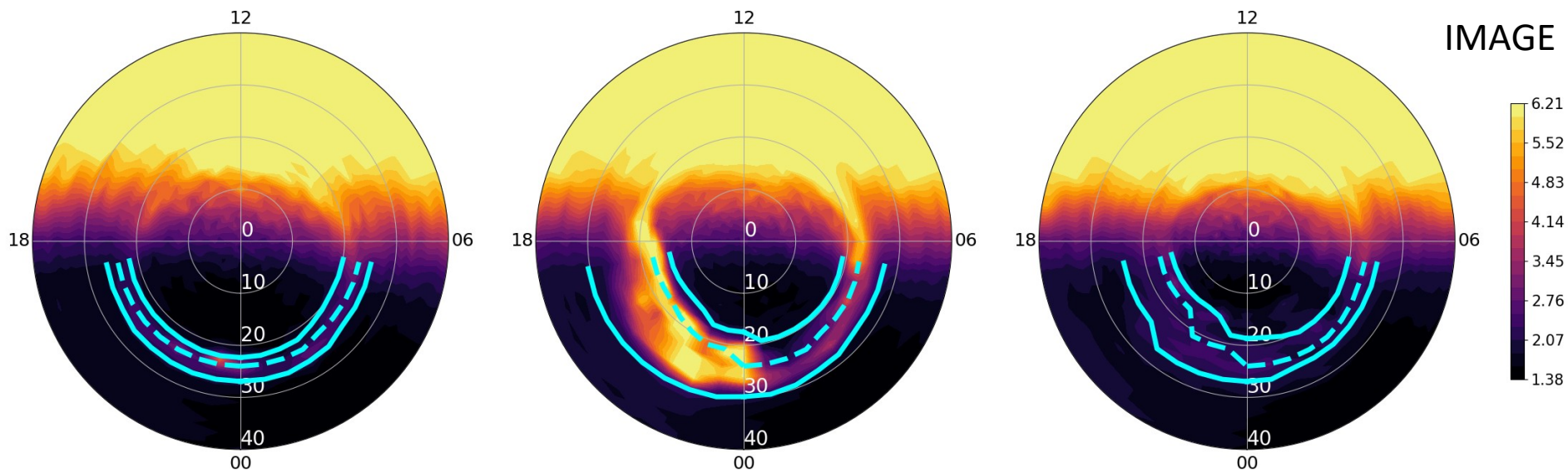
Boundaries for IMAGE. Substorm 2001-08-27



Boundaries for IMAGE. Substorm 2001-08-27



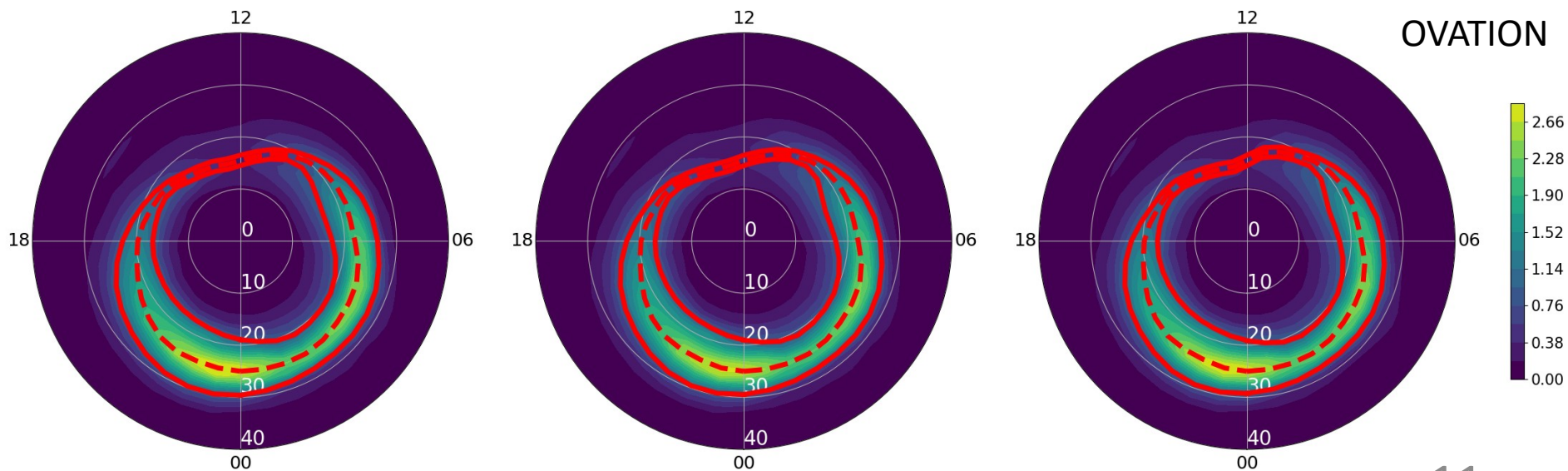
Boundaries for IMAGE and OVATION. Substorm 2001-08-27



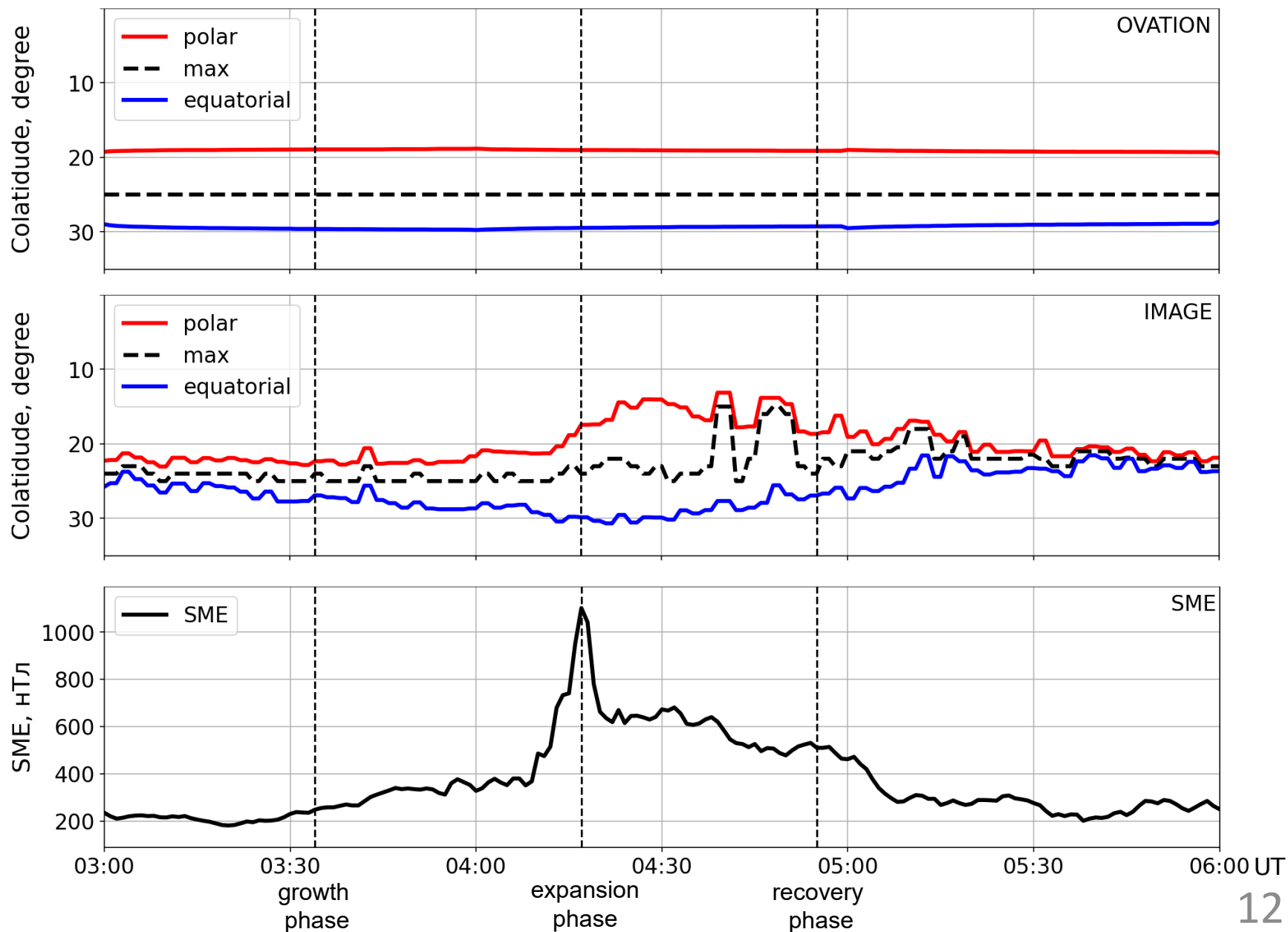
2001-08-27 03:34:00 UT

2001-08-27 04:17:00 UT

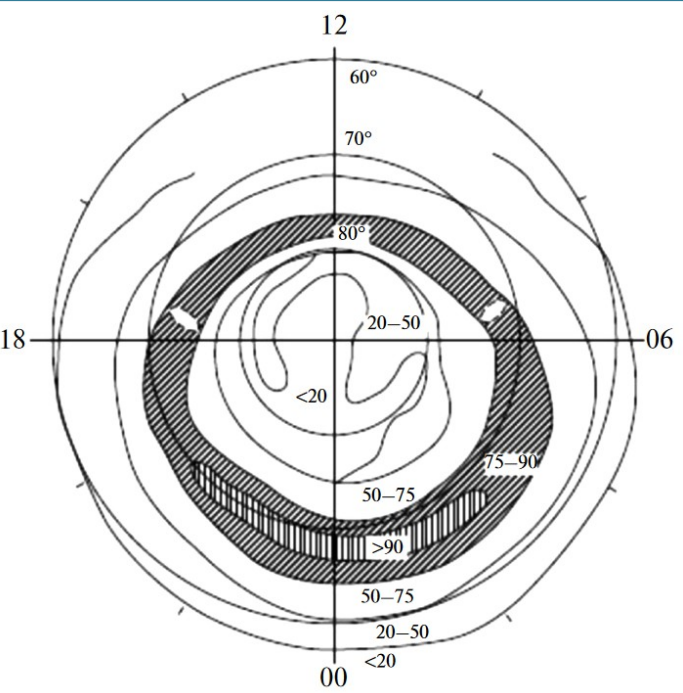
2001-08-27 04:55:00 UT



Substorm 2001-08-27: dynamics of boundaries for 00MLT



Statistical estimate of auroral oval boundaries



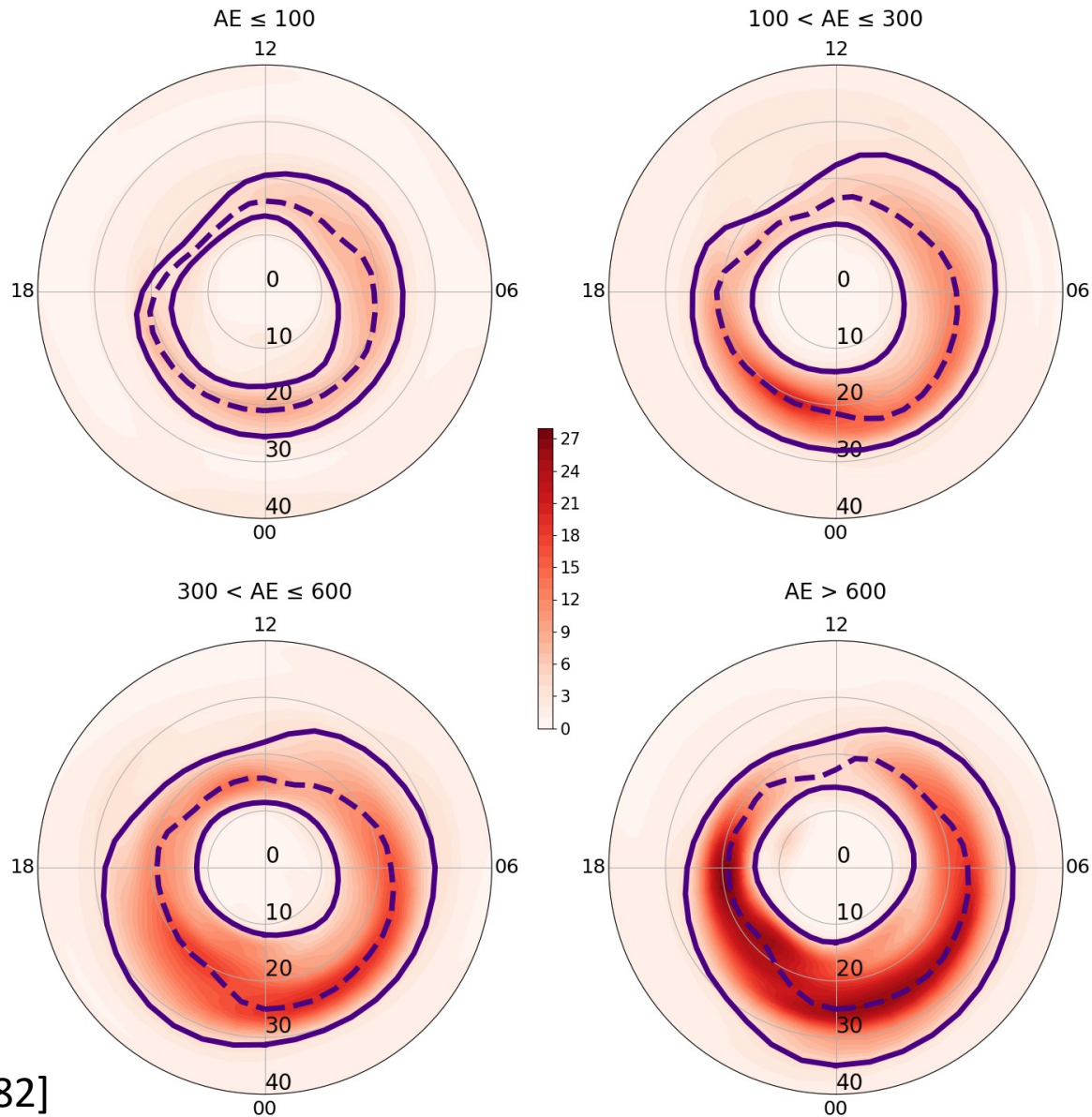
Probability of auroras in %
[Feldstein, 1963]

The zone of maximum probability of auroral auroras (Fritz – Vestine zone) is located at $\sim 67^\circ$ latitude ($\sim 23^\circ$ latitude) [Fritz, 1881; Vestine, 1944]

Statistics for substorm
27.08.2001 03:00 – 06:00 UT

Boundary	$M[X] \pm \sigma$		$M[X_{OVATION}] - M[X_{IMAGE}]$
	OVATION	IMAGE	Δ
Polar boundary	19.07 ± 0.01	19.34 ± 2.72	-0.27
Boundary of maximum values	25.00 ± 0.00	22.77 ± 2.31	+2.23
Equatorial boundary	29.33 ± 0.02	26.35 ± 2.51	+2.98

Boundaries for Hall conductivity. Spiro conductivity model



[Spiro et al., 1982]

Conclusion

1. **We have developed the algorithm** for determining the polar and equatorial boundaries of the auroral oval and the line of maximum values based on various manifestations of auroral activity.
2. **We tested the algorithm** on precipitation of auroral particles (OVATION Prime model), auroras (IMAGE satellite data), and conductivity of ionospheric plasma in the auroral zone (Spiro conductivity model).
3. In comparison with IMAGE, **the boundaries for Ovation Prime practically did not change** during the substorm 2001-08-27.
4. **The algorithm can be adapted to other auroral activity data.**



**Thank you
for your attention!**