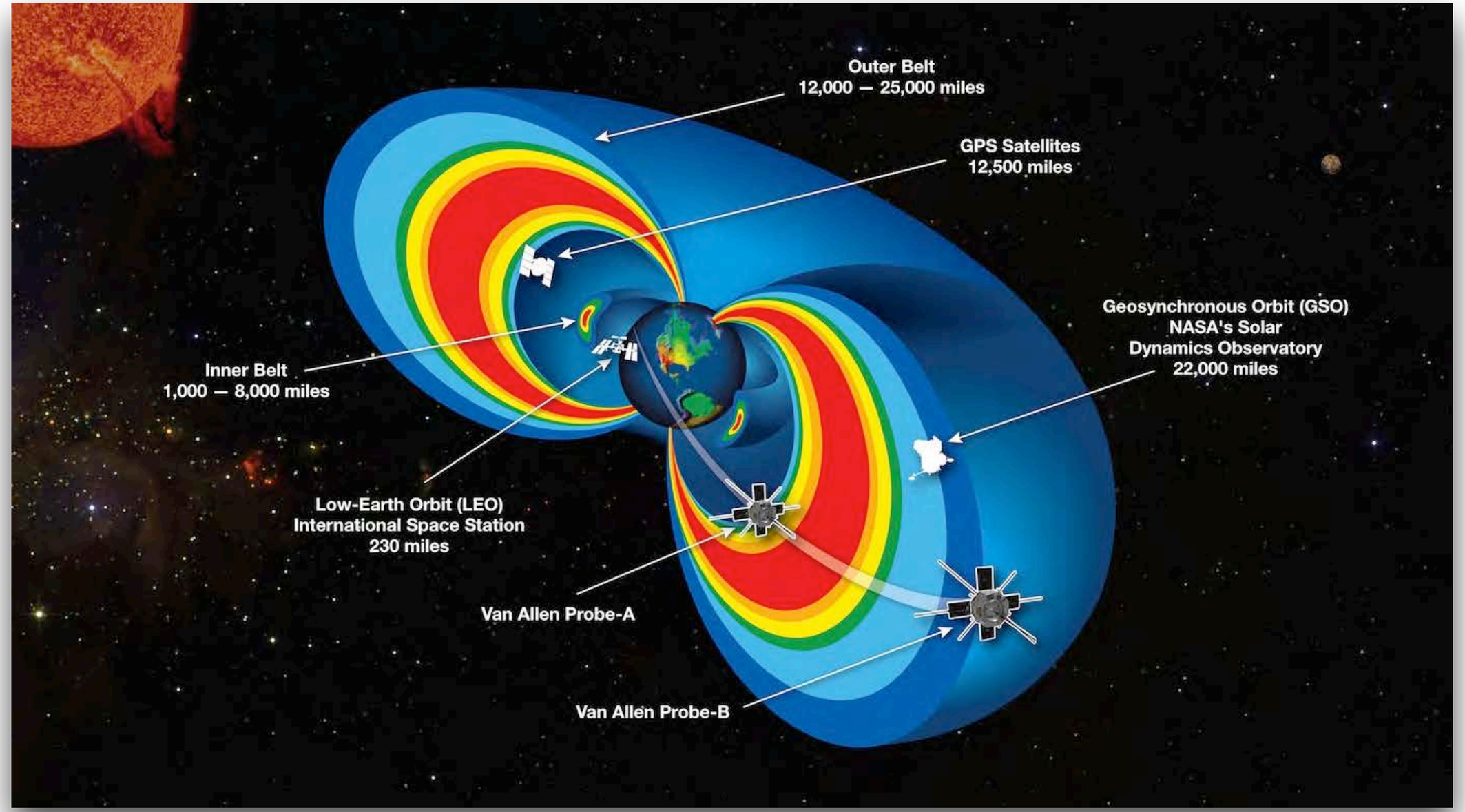


Total Radiation Belt Electron Content:

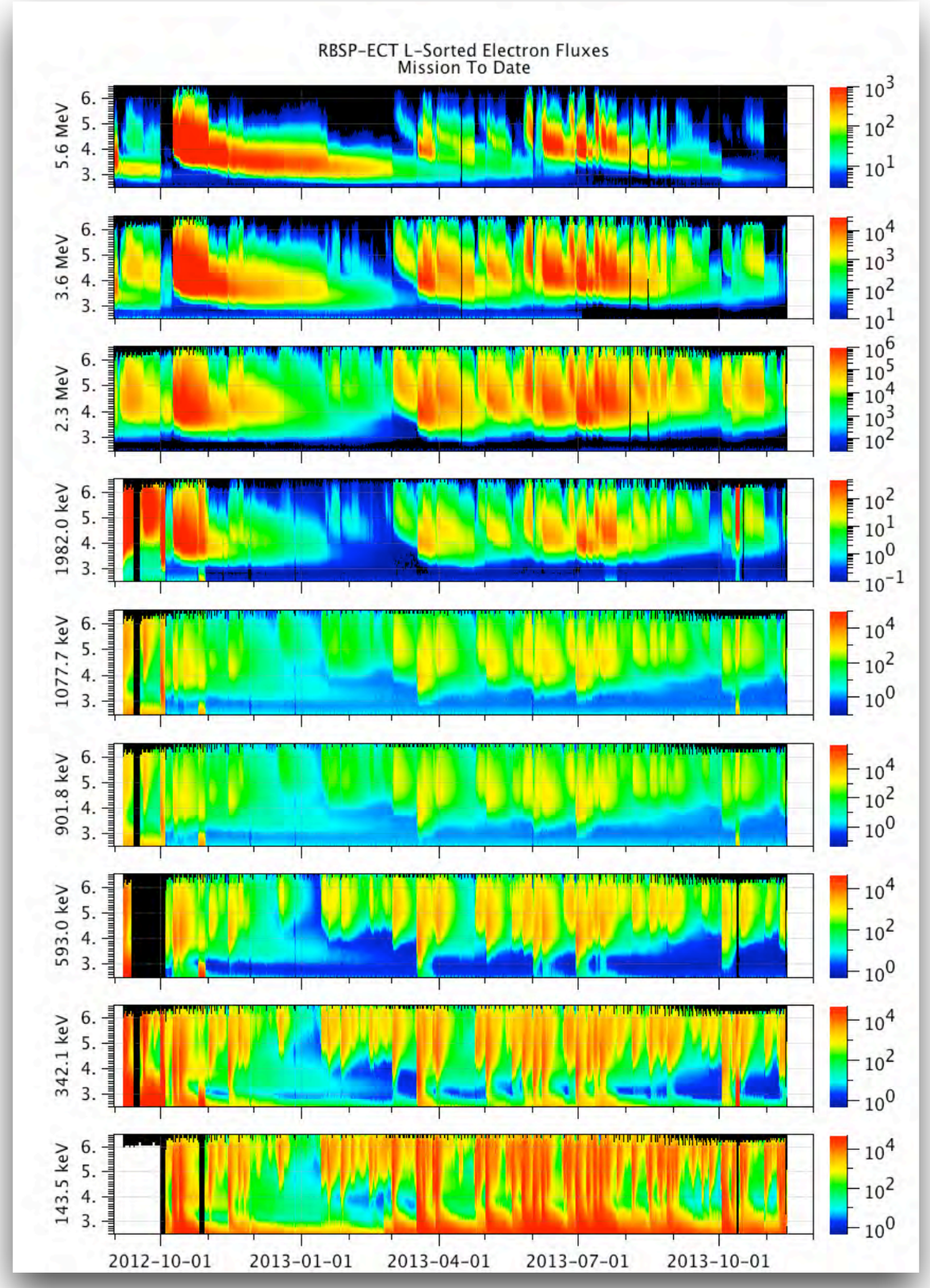
A New Radiation Belt Data Product

Chia-Lin Huang University of New Hampshire

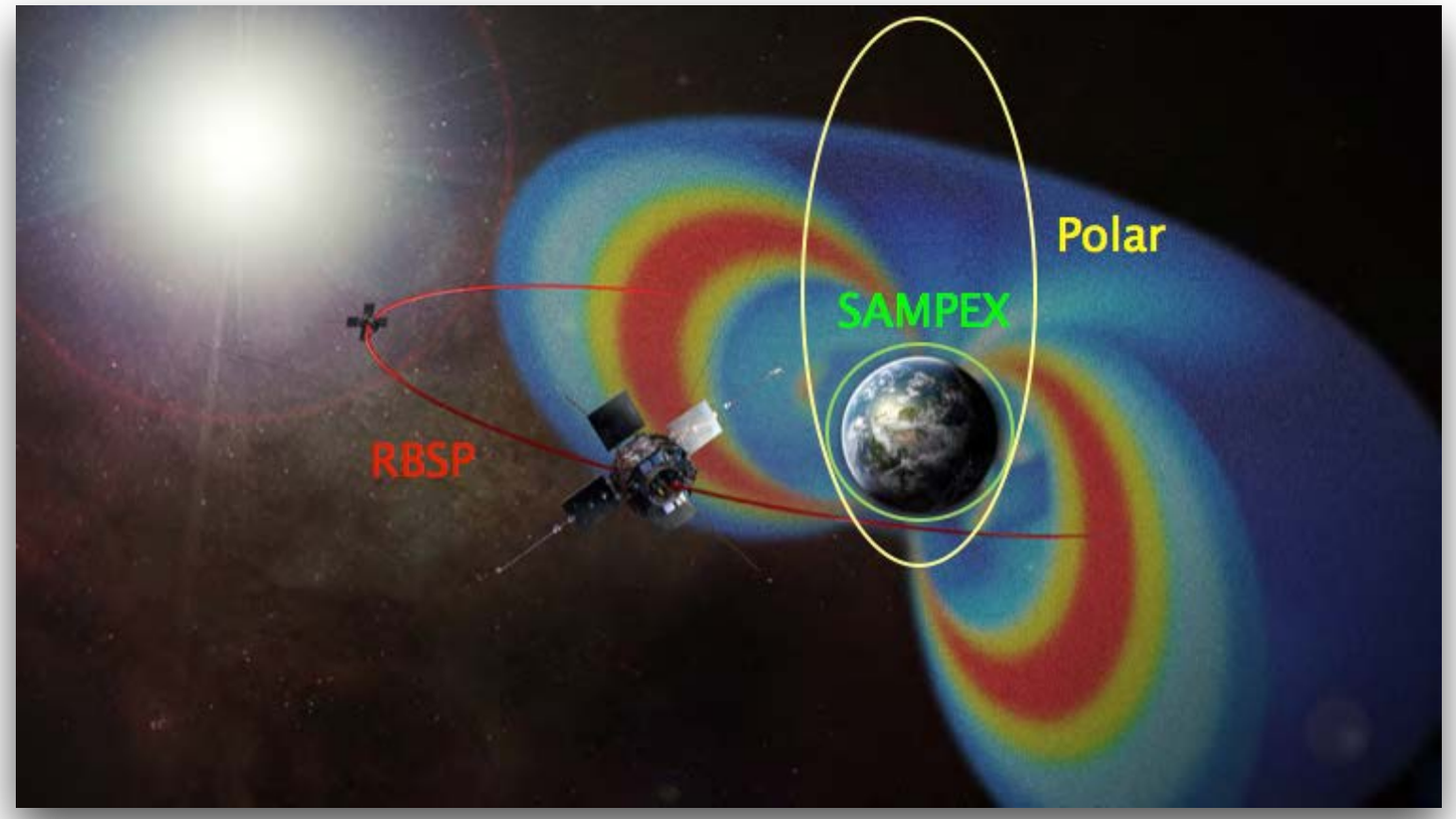
Typical Radiation Belt Data Product

- **Flux data:** energy, pitch angle, location (MLT & L), and time

- **Phase space density data:** three adiabatic invariants (*μ, K, L*), and time



New Radiation Belt Data Product

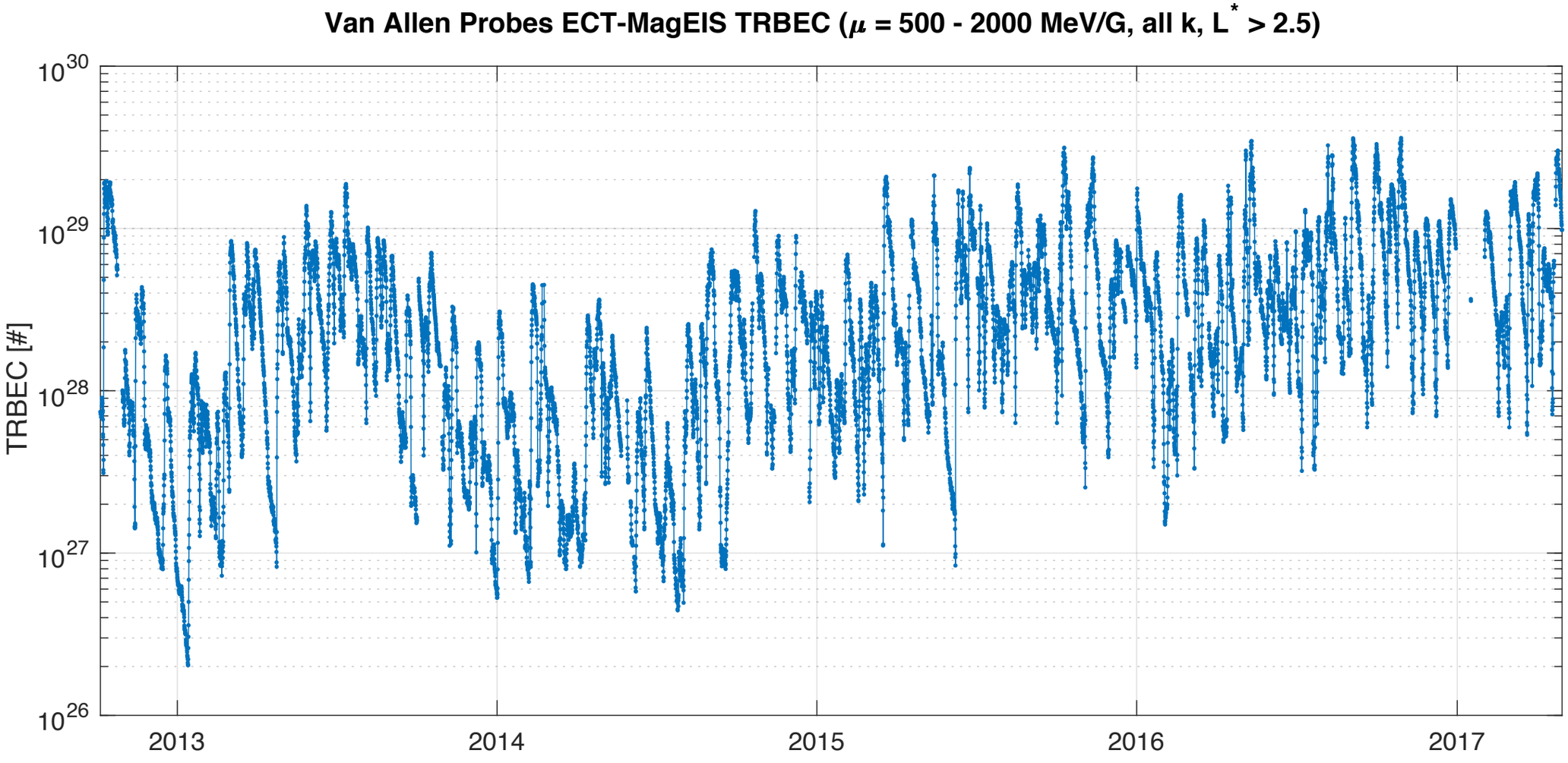


- **Goal:** Instead of 4 dimensional data, we create a simple and global index to represent RB electrons by integrating the phase space density data with flexibility
- **Improvements** from previous studies by Selesnick (Polar) and Baker (SAMPEX): better orbit, particle measurements, calculation method, and index time resolution (3-hour vs daily index).

Total Radiation Belt Electron Content (TRBEC)

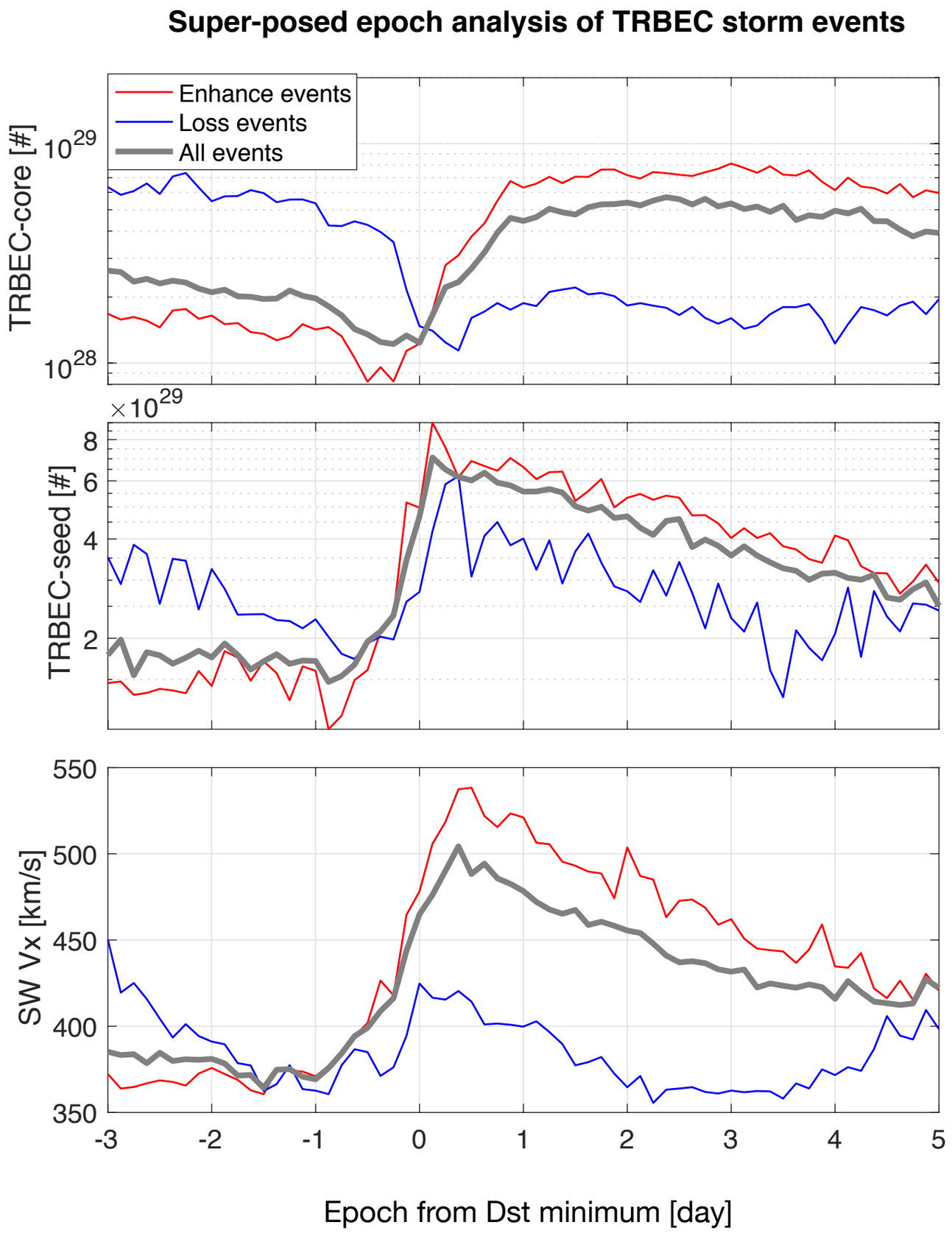
- Integrate number of electrons in an elemental phase space:

$$dN \approx 8.134 \times 10^{29}\, \bar{f}(\mu, K, L^*) \frac{\sqrt{\mu}}{L^{*2}} d\mu dK dL^*.$$



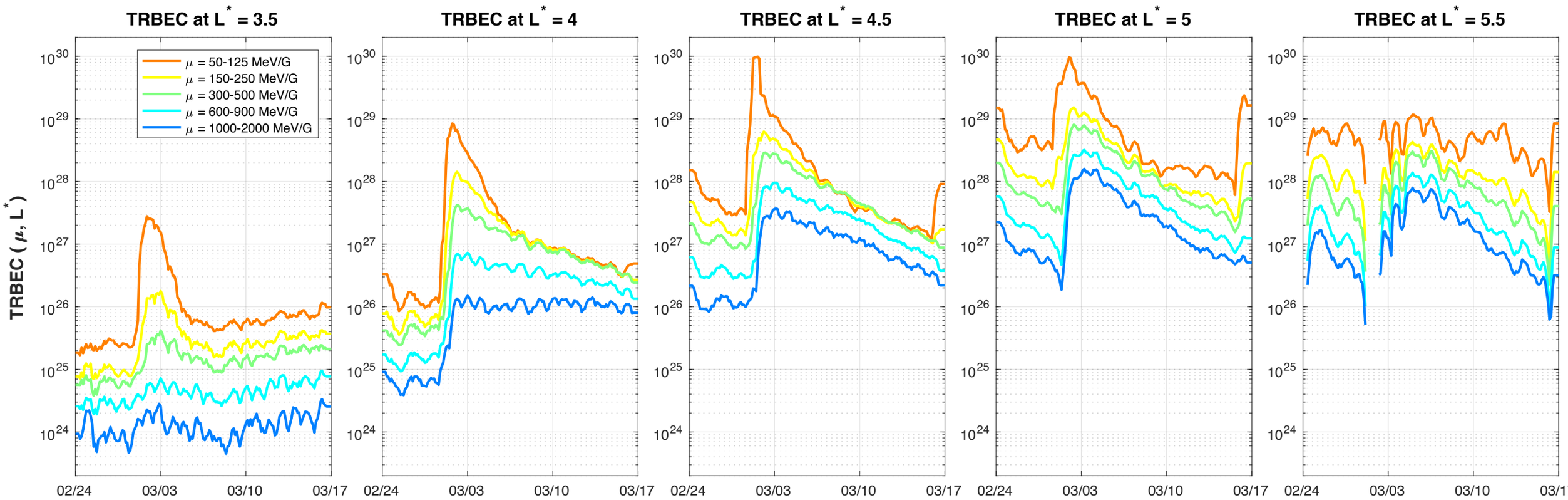
Storm Time Superposed Epoch Analysis

- **59** storm events with enhanced electron
- **18** storm events with loss electron

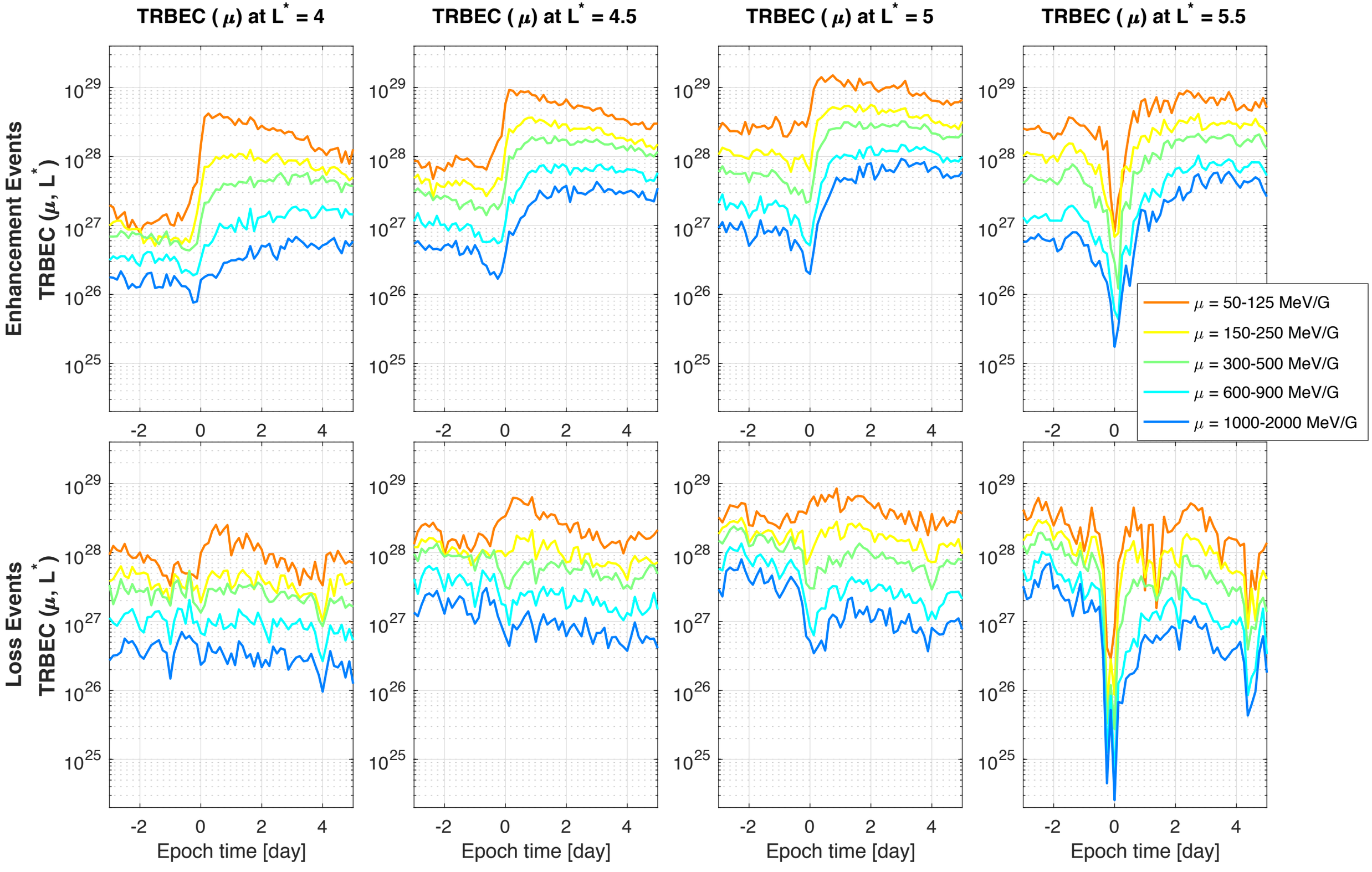


TRBEC (μ, L*)

2013 February-March Event



TRBEC (μ, L*) - Enhance and Loss Events



Summary

- New TRBEC data available from 2012 to 2017
- TRBEC is useful for both event and statistical studies (except microphysics work)
- Other applications include:
    - Substorm study by Colin Forsyth
    - Geospace systematic analysis by Joe Borovsky
    - RB electron precipitation effect on atmospheric chemistry by FIREBIRD team and Kathy Duderstadt.

Thanks to our collaborators:

Alex Boyd, Andrew Jordan, Sonya Smith, Yiheng Zheng, Lunjin Chen, Geoff Reeves, J.B. Blake, Seth Claudepierre, Drew Turner, Joe Fennell, Yuri Shprits, Dan Baker, and the RBSP-ECT team

Fun Facts on Radiation Belt Electrons

TRBEC ($5x10^{28}$ electrons) x electron mass = RBE mass

46 g ~ 2 donuts

TRBEC ($5x10^{28}$ electrons) x 0.5 MeV = RBE energy

$4x10^{15}$ Joules (Petajoule)

Chemical energy of combusting 1 million barrel of crude oil or 60 times of the energy released by the atomic bomb that exploded over Hiroshima