Low Hanging Fruit

RBSP-ECT Science Team

Examples of Objectives from the Science Flowdown

Objective 1:
Identify the processes responsible for the acceleration and transport of relativistic and near-relativistic particles, determine when and where these processes occur, and determine their relative significance.

Approach 1.1. Determine the effects of local processes on particle acceleration: their significance, spatial regions, temporal variability and dependence on geophysical parameters

Approach 1.2. Determine the effects of convective transport, ULF wave fields, and "radial" diffusion processes on particle acceleration: their significance, spatial regions, temporal variability and dependence on geophysical parameters.

Approach 1.3: Determine the frequency, characteristics, and effects of shock-related acceleration events.

Approach 1.4. Investigate whether other local acceleration or transport processes (such as Alfvén waves, electrostatic structures, etc.) have important effects on radiation belt structure and dynamics or on the specific characteristics of individual events.

Approach 1.5. Model the effects of fully adiabatic transport and acceleration on radiation belt particles in order to bound the relative contributions of all non-adiabatic acceleration and transport mechanisms.

These are a great place to start but our low hanging fruit discussions have to get more specific. How will we “determine the effects…”? What data sets? Etc.

ECT Discussions pointed out several Things to Remember

- Orbit precession is slow but...
- ΔMLT = 0°-180°
- ΔMLT at fixed R is constant and orbit is very wide
- Remember drift shell splitting and non-constant velocities
- Remember energy dependence of drift

General Outcomes

- Looking for predicted signatures that are “smoking guns” for specific processes and/or distinguish between two processes
- Using models as both context and tests. E.g. Use RBSP particle data to drive the DREAM-RC model. Use DREAM-RC to calculate distribution of waves. Compare back to RBSP waves
- Define criteria for declaring an electron enhancement event

Quick Science Study Example

- Comparison of theory and observations for characteristic signatures of EMIC waves
- Required Theory/Modeling (already exist)
  - Calculations of Daa and Dpp
  - Calculations of effects on energy & pitch angle distributions
- Required Observations
  - Energy & pitch angle distributions
- What do we expect?
  - We will compare PSD as a function of E and PA

Diffusion Coefficients from Theory

LI ET AL.: EVOLUTION OF ENERGETIC ELECTRONS

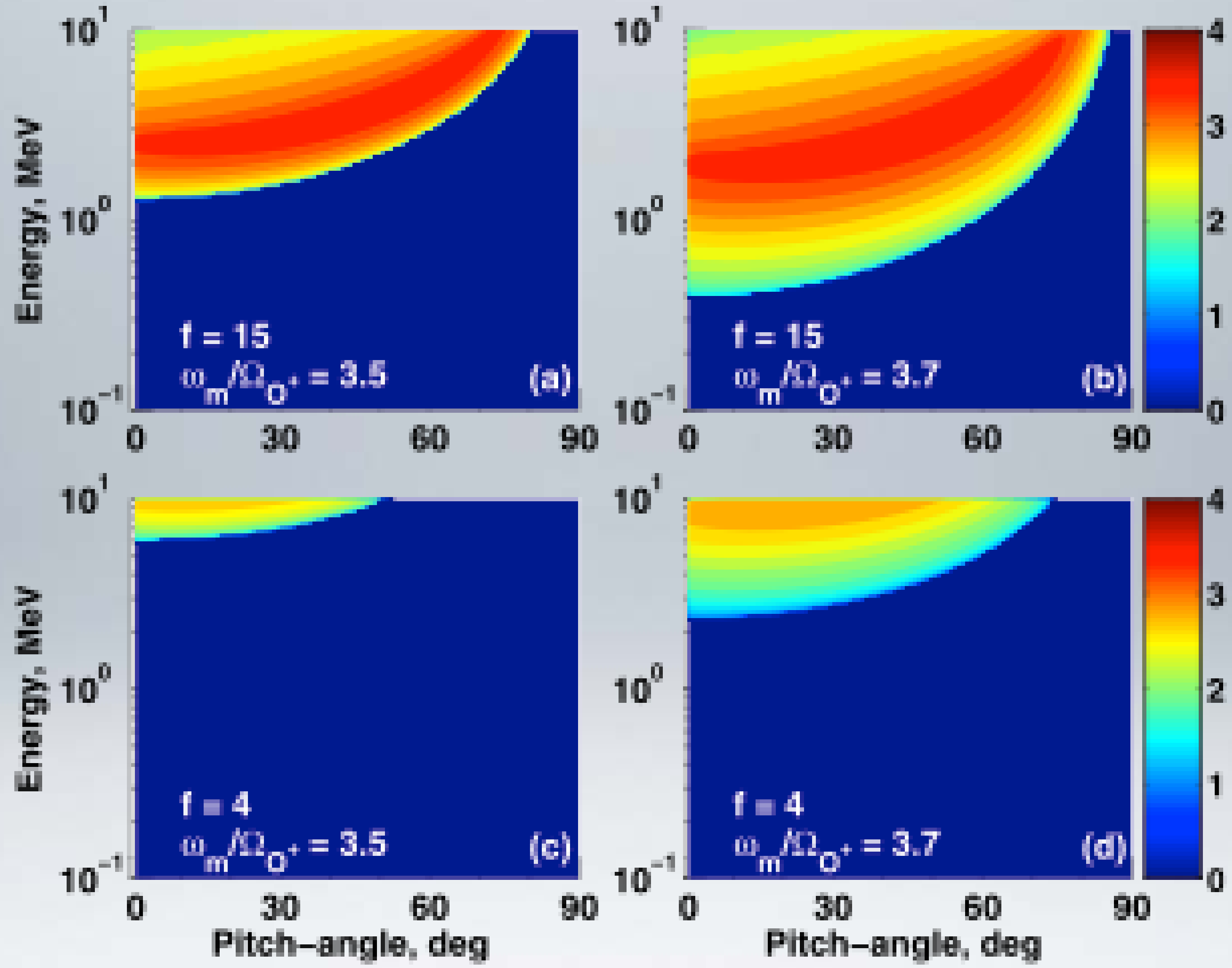
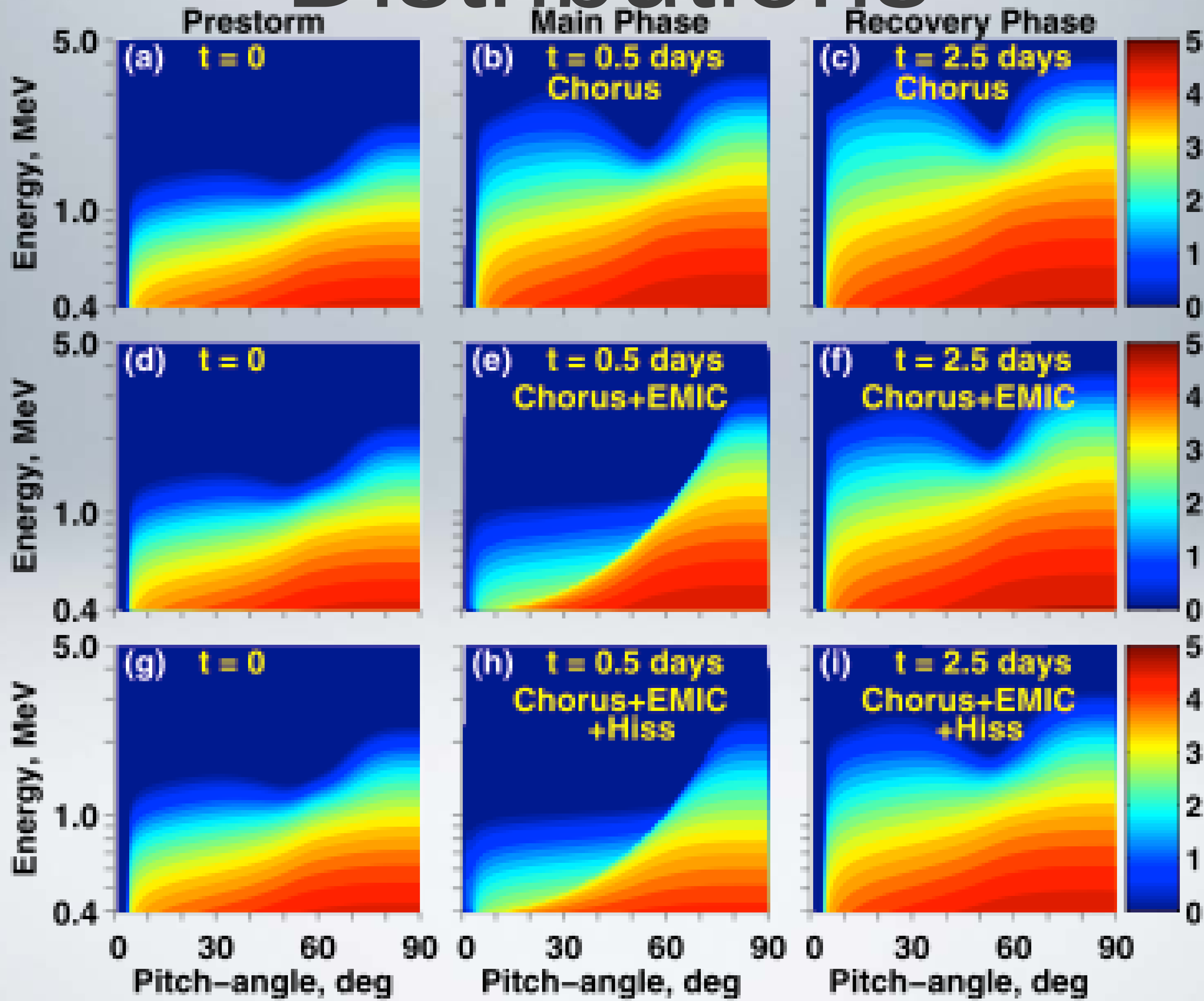
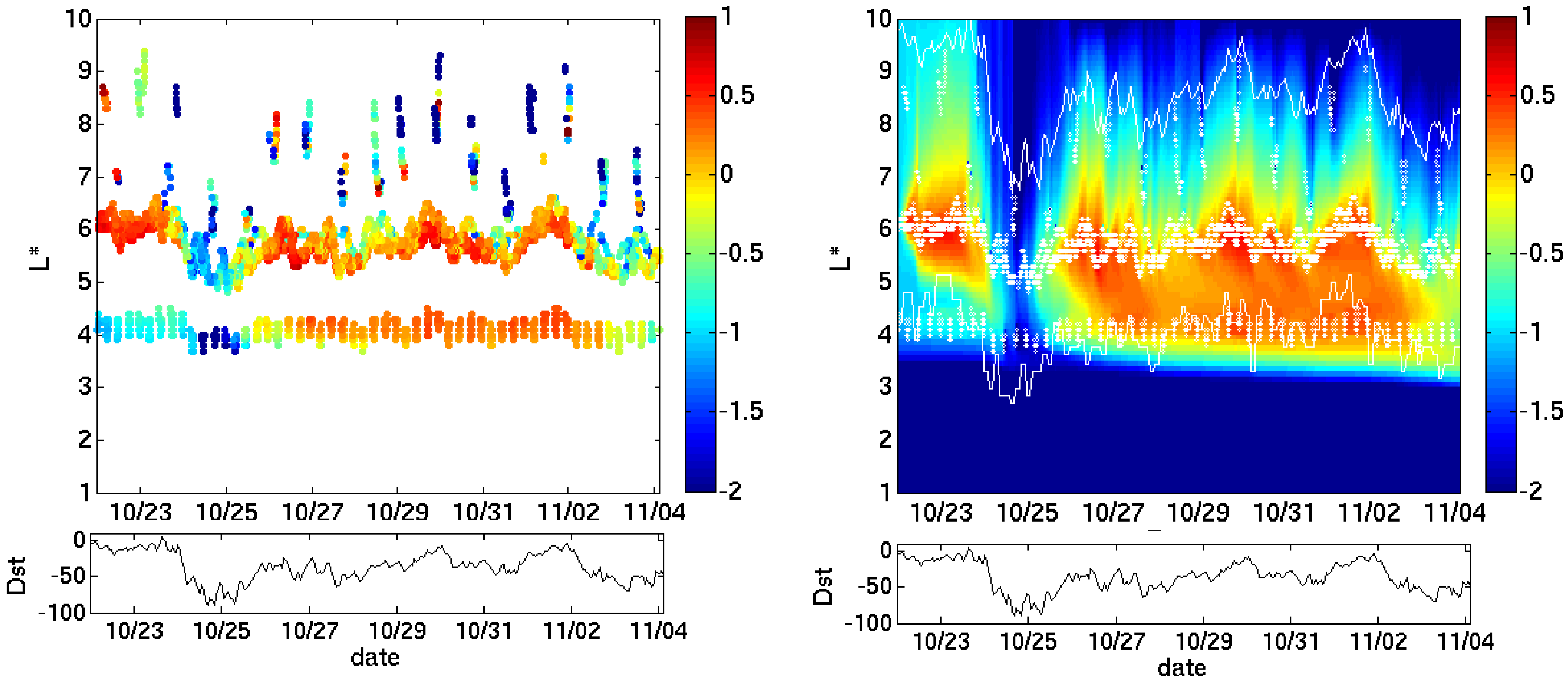


Figure 4. Two-dimensional bounce-averaged pitch angle diffusion coefficients in units of $\log_{10}(\text{days}^{-1})$ for EMIC waves inside plumes (f = 15) with (a) $\omega_m/\Omega_{O+} = 3.5$, $\delta\omega/\Omega_{O+} = 0.25$, $\omega_{lc}/\Omega_{O+} = 3.25$, and $\omega_{uc}/\Omega_{O+} = 3.75$ and (b) $\omega_m/\Omega_{O+} = 3.7$, $\delta\omega/\Omega_{O+} = 0.25$, $\omega_{lc}/\Omega_{O+} = 3.45$, and $\omega_{uc}/\Omega_{O+} = 3.95$ at $L = 4.5$. Two-dimensional bounce-averaged pitch angle diffusion coefficients in units of $\log_{10}(\text{days}^{-1})$ for EMIC waves outside plumes (f = 4) with (c) $\omega_m/\Omega_{O+} = 3.5$, $\delta\omega/\Omega_{O+} = 0.25$, $\omega_{lc}/\Omega_{O+} = 3.25$, and $\omega_{uc}/\Omega_{O+} = 3.75$ and (d) $\omega_m/\Omega_{O+} = 3.7$, $\delta\omega/\Omega_{O+} = 0.25$, $\omega_{lc}/\Omega_{O+} = 3.45$, and $\omega_{uc}/\Omega_{O+} = 3.95$ at $L = 4.5$. EMIC waves are assumed to be in a multi-ion magnetospheric plasma composed of 70% H^+, 20% He^+, and 10% O^+.

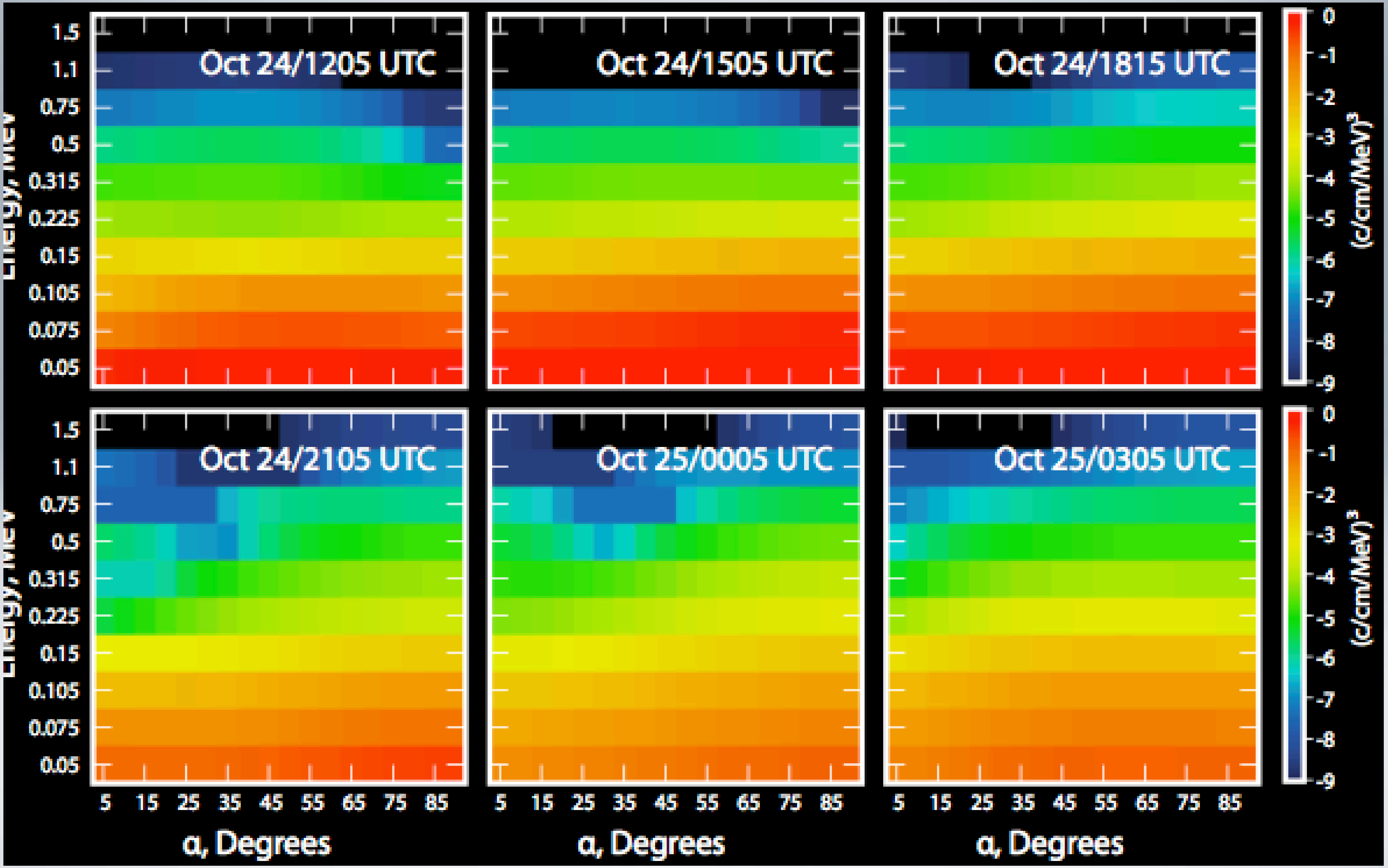
Expected Electron Distributions



Look for an electron dropout



Observed Electron Distributions



Further Investigation

- Comparison with EMIC wave observations
- Use models to find what wave parameters reproduce obsv.
- Comparison of different events
- Study of minimum energy cut-off
- Spatial distributions