

AMISR Contributions to Equatorial Aeronomy

D. L. Hysell and J. L. Chau

<http://jro.igp.gob.pe>

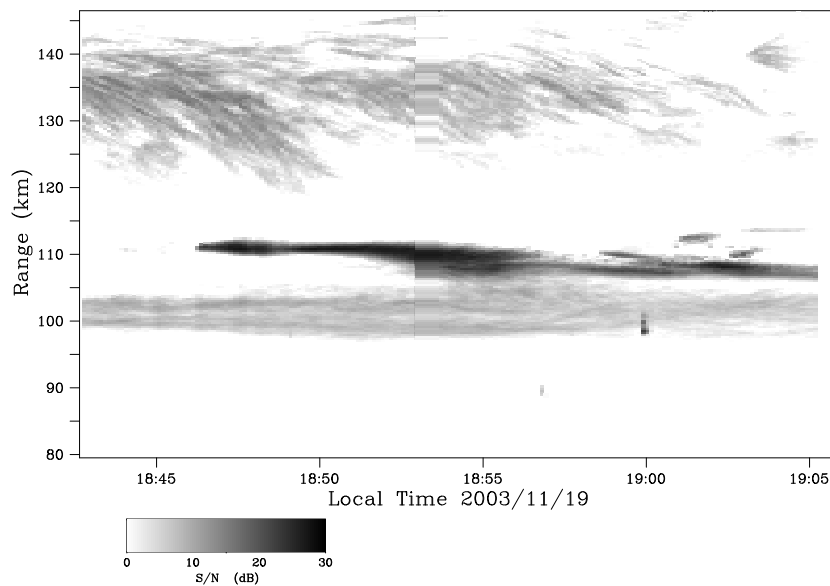
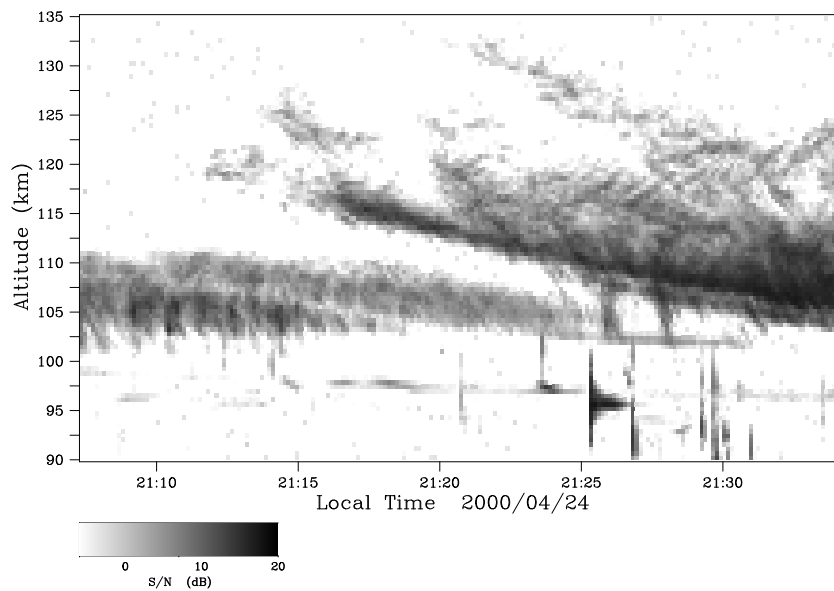
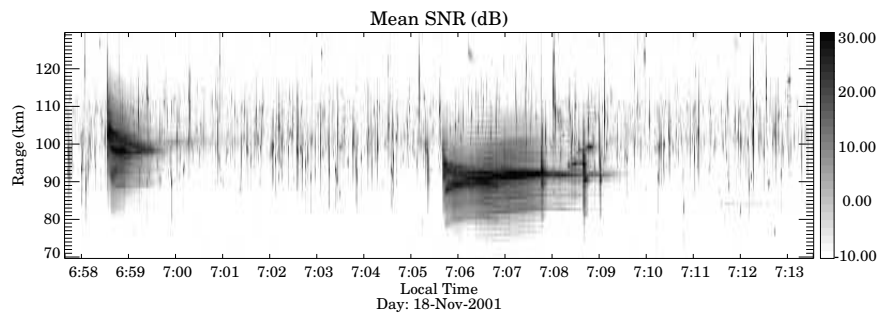
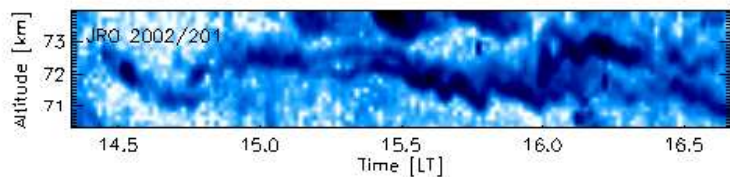
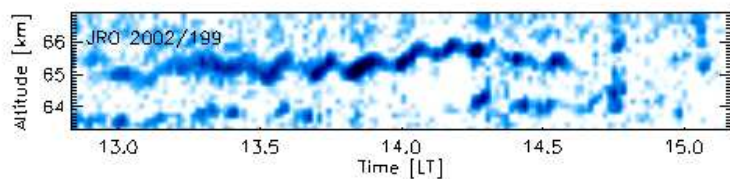
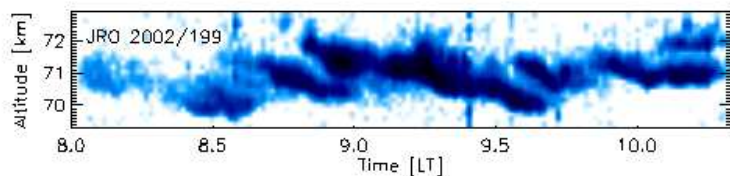
Earth and Atmospheric Sciences, Cornell University, Ithaca, New York

Jicamarca Radio Observatory, Lima, Peru

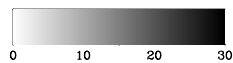
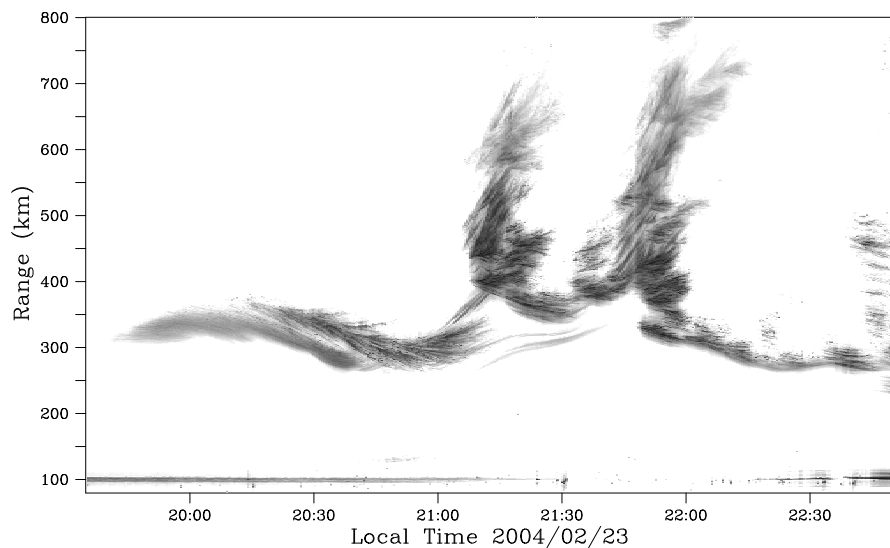
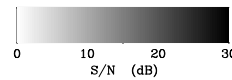
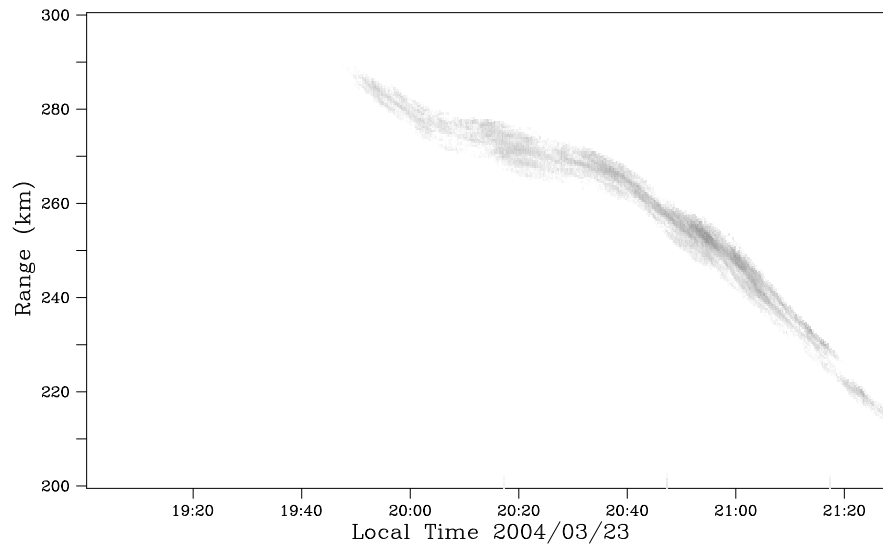
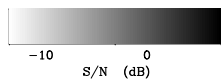
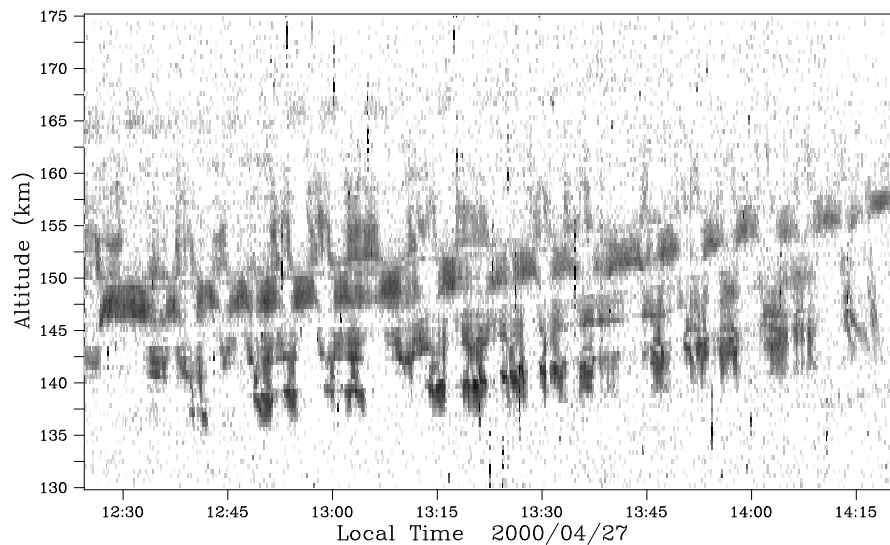
AMISR-8 system description

Parameter	value
Transmit frequency	430–450 MHz
Transmit peak power	128 kW
Transmit average power	≤ 12.8 kW
Transmit pulse width	$1\ \mu\text{s} - 2\ \text{ms}$
Antenna	crossed dipole array (circular pol.) 8 panels of 32 elements, 3.5 m x 2 m
Receiver front end	low-noise transistor amplifier on each element
Receiver back end	digital receiver PC level boards

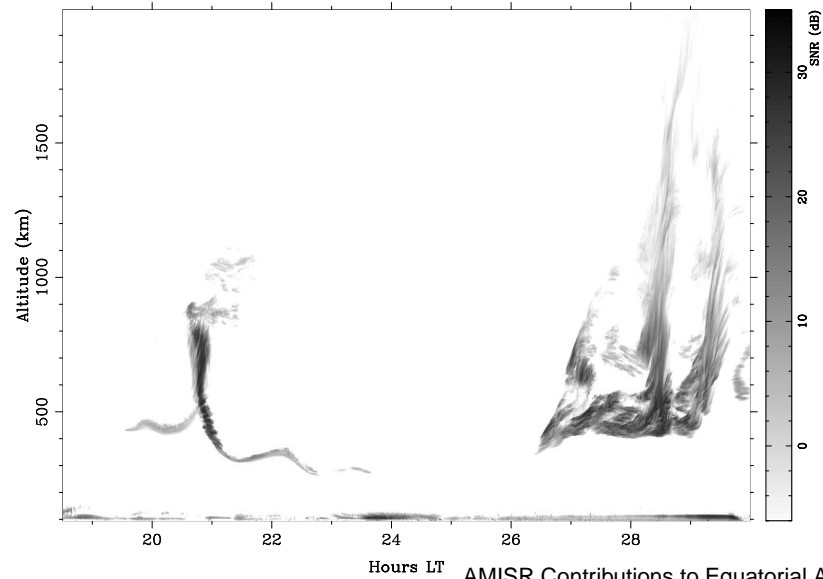
Gallery



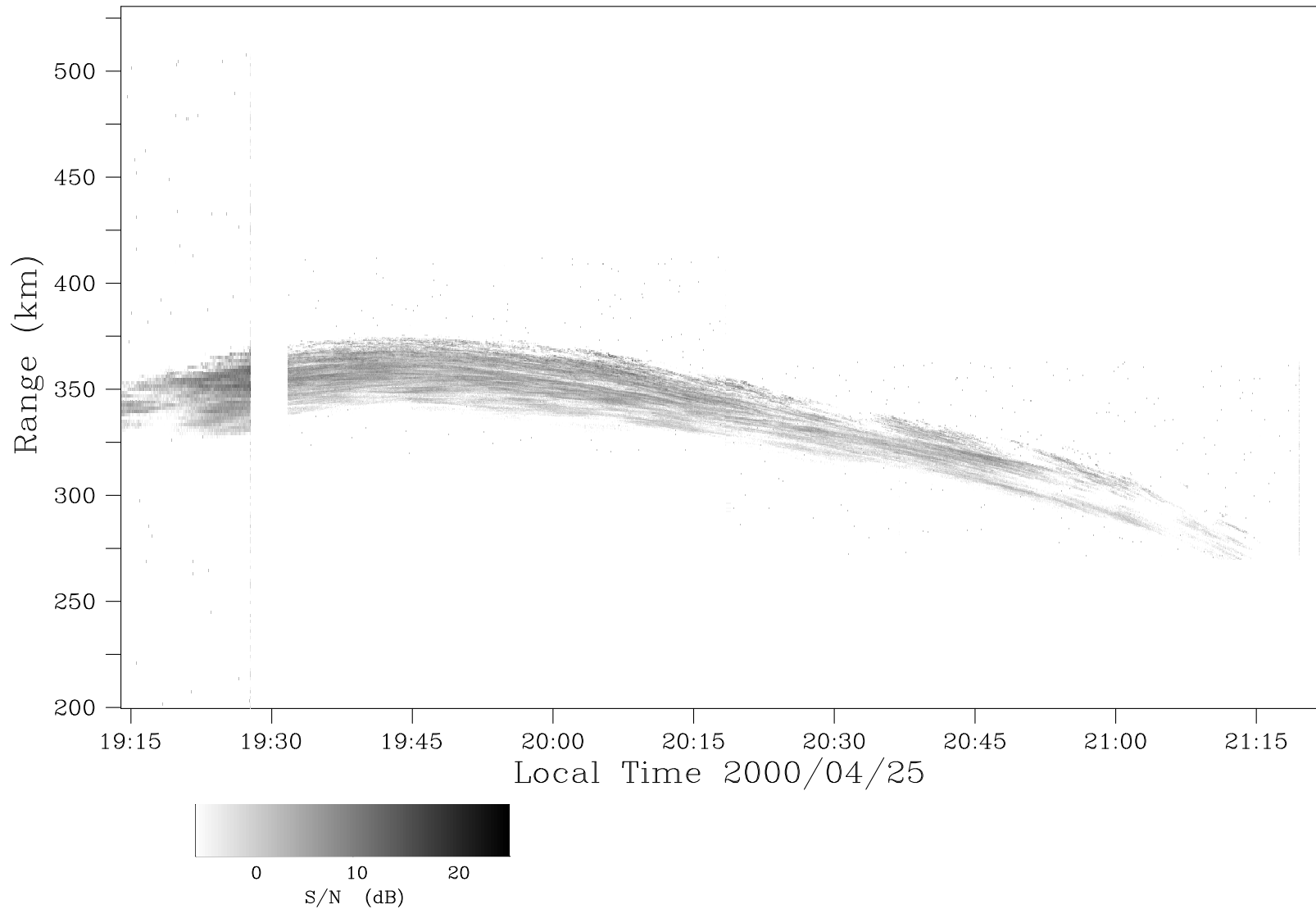
Gallery II



JULIA RTI Plot on October 01, 2002

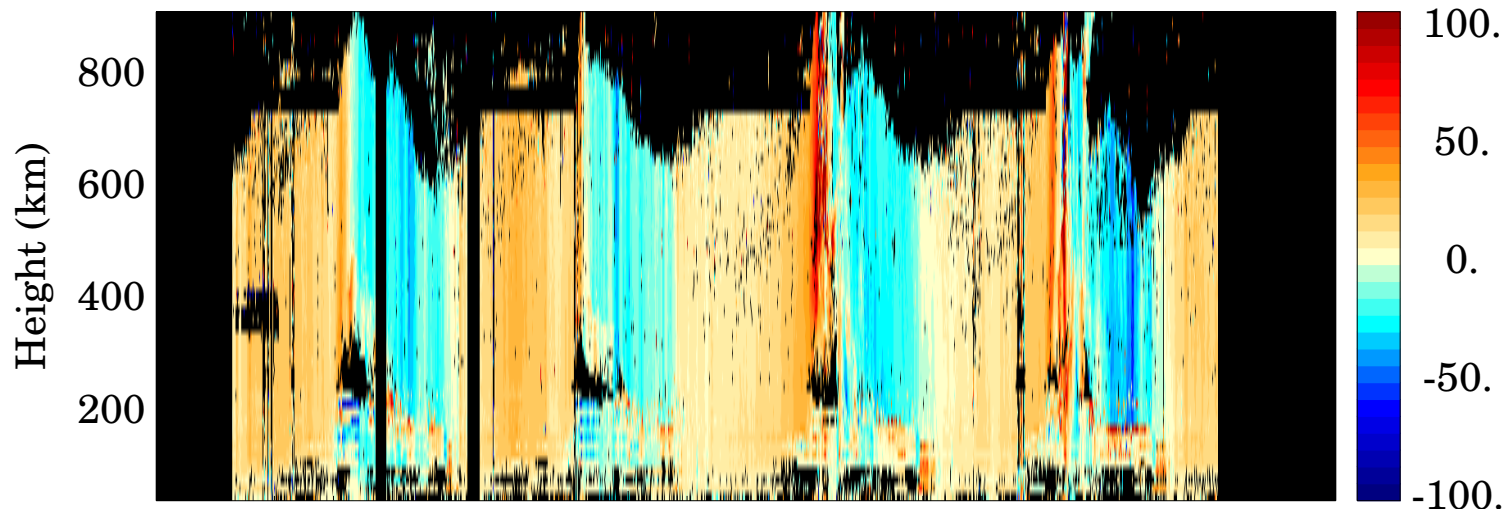


Bottom-type layers

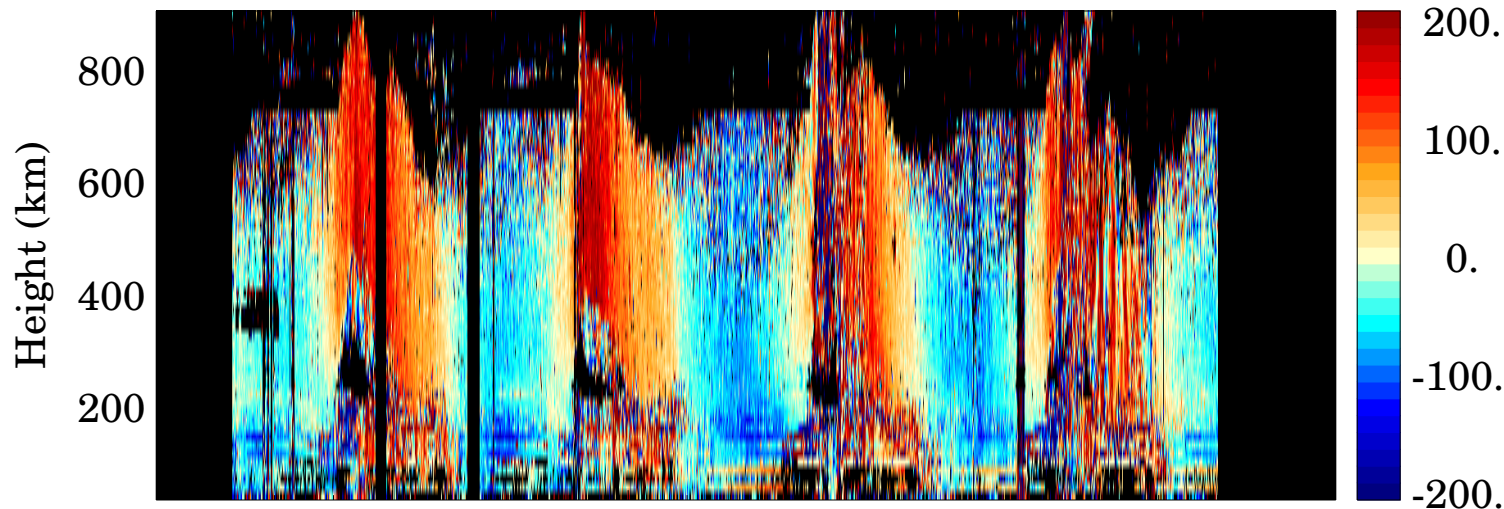


Shear flow

(a) Jicamarca Vertical Drifts (m s^{-1})

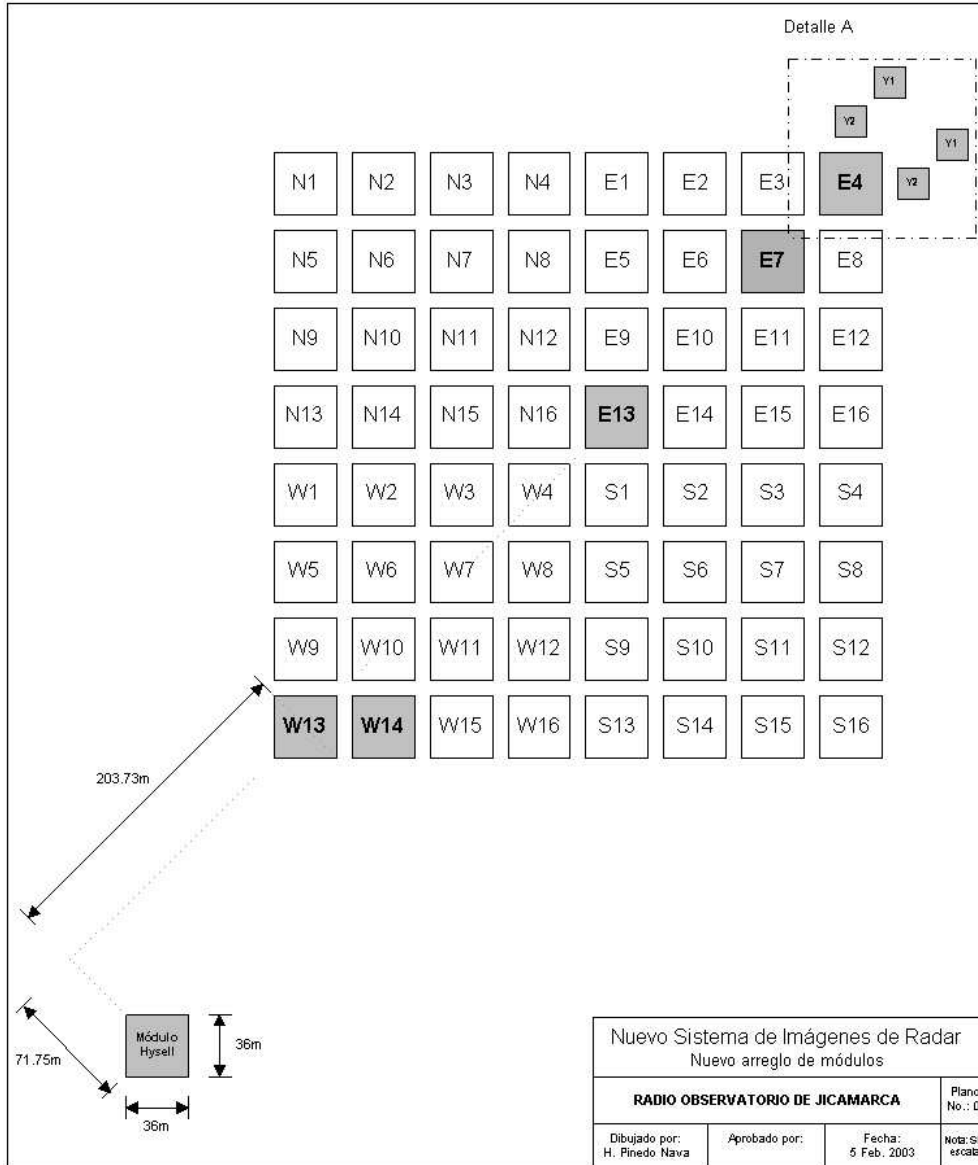


(b) Jicamarca Zonal Drifts (m s^{-1})



11 12 13 14 15 16
Local Time: From: 11-Nov-2002 (315) to: 15-Nov-2002 (319)

Aperture synthesis imaging



Apr. 25, 2000

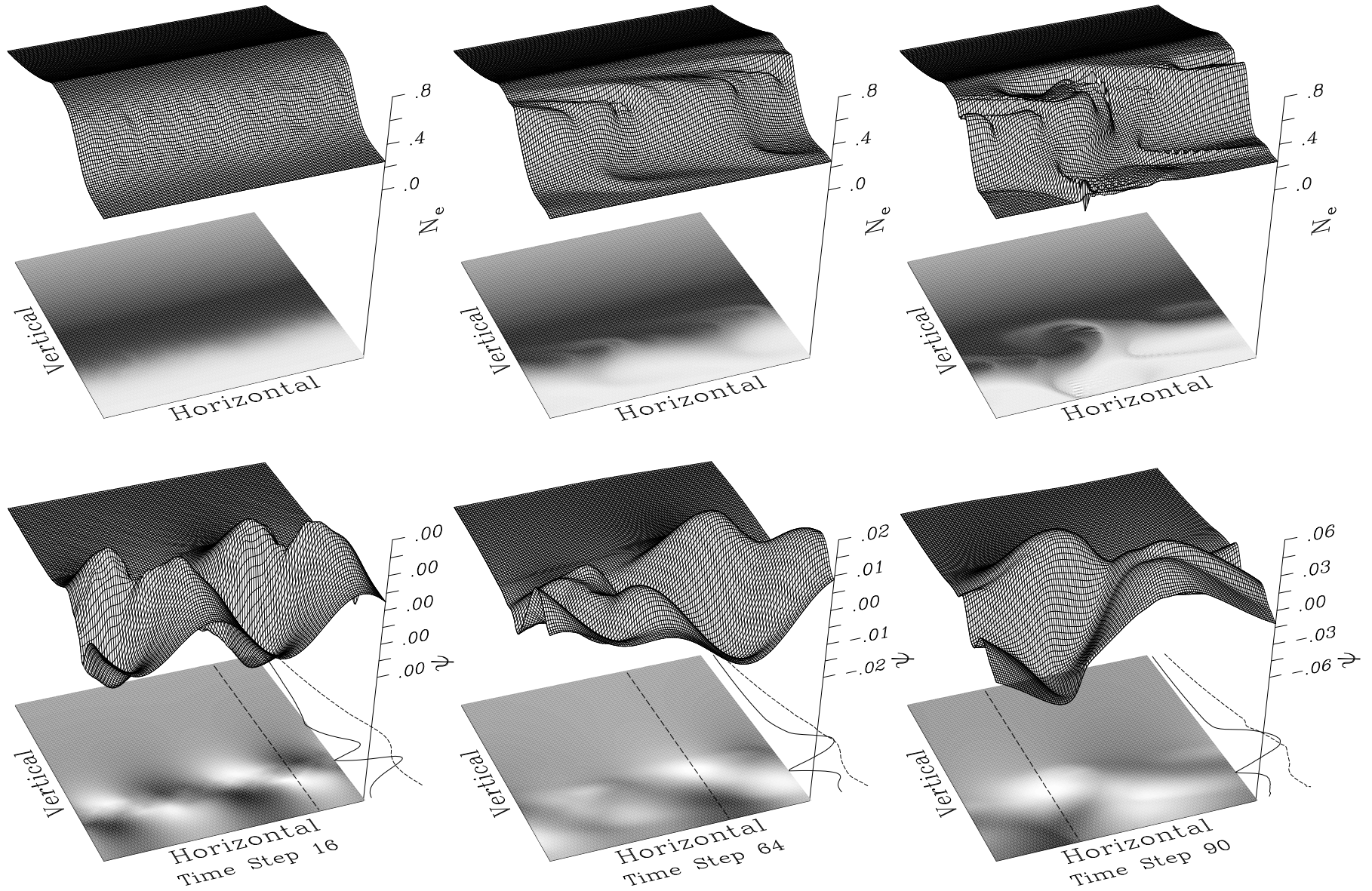
Apr. 25, cont

Nov. 27, 2003

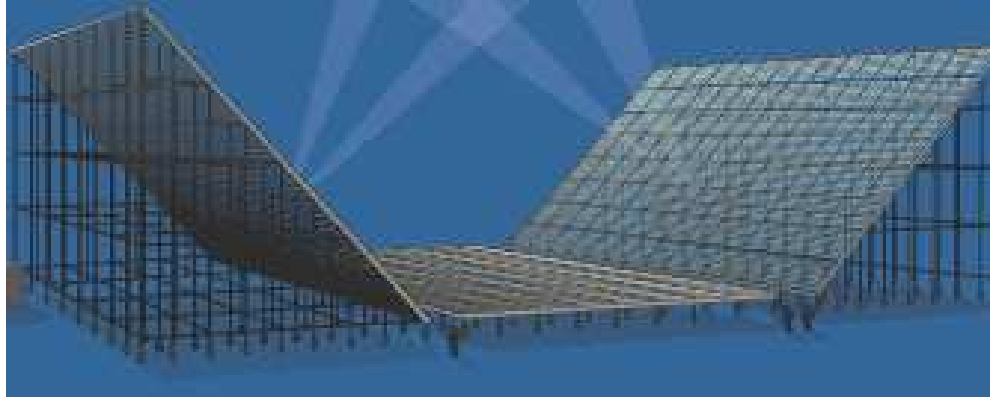
Nov. 27, cont

Nov. 27, cont

2D Simulation

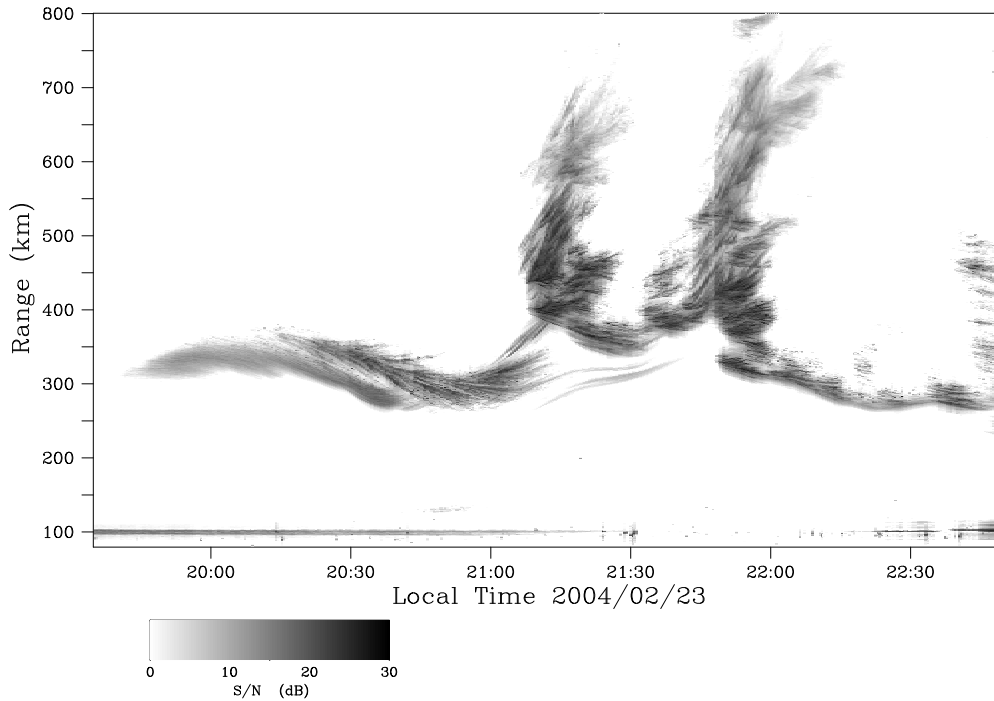


AMISR investigation

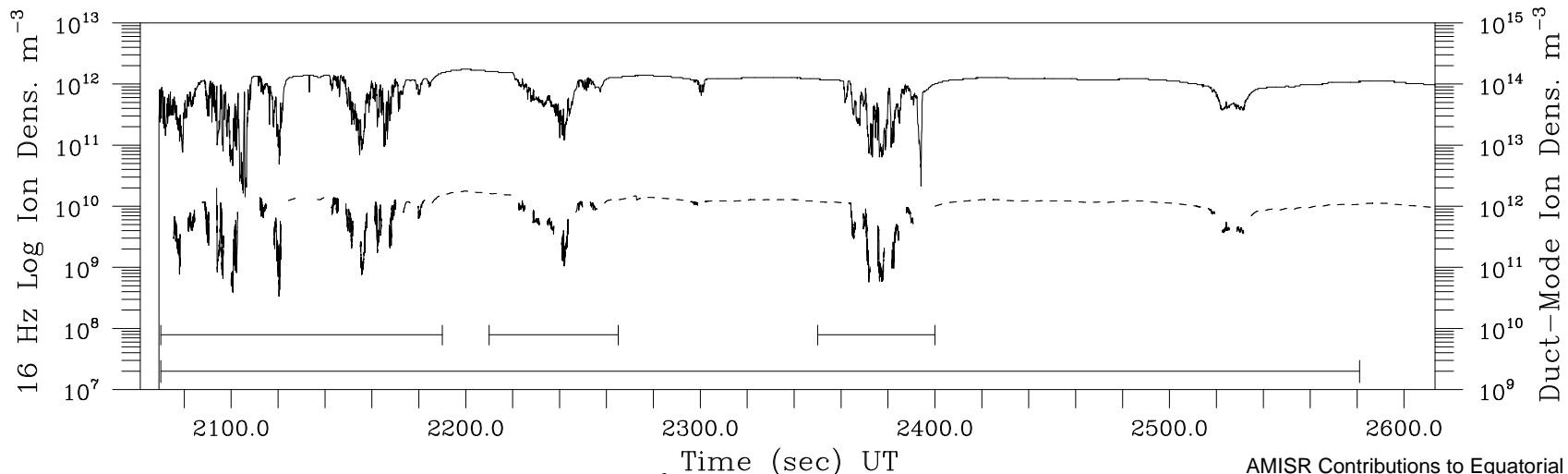


- Can we identify and understand spread F precursor waves?

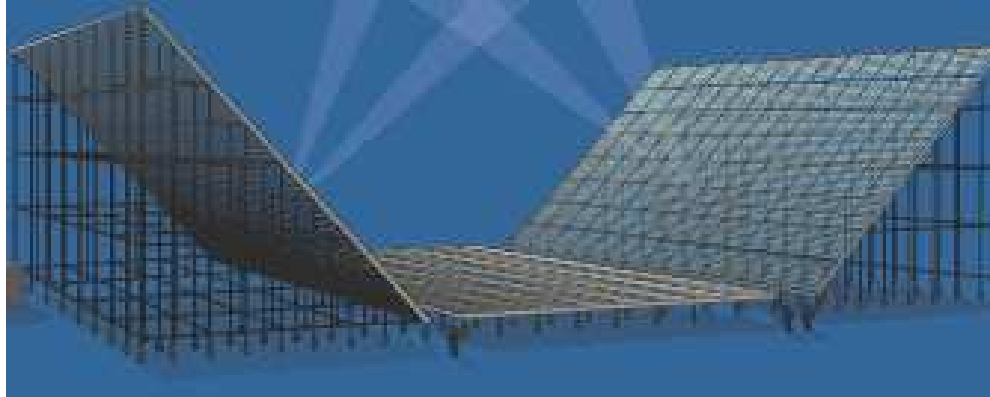
Plume morphology



Feb. 23 2004
cont.
cont.
cont.

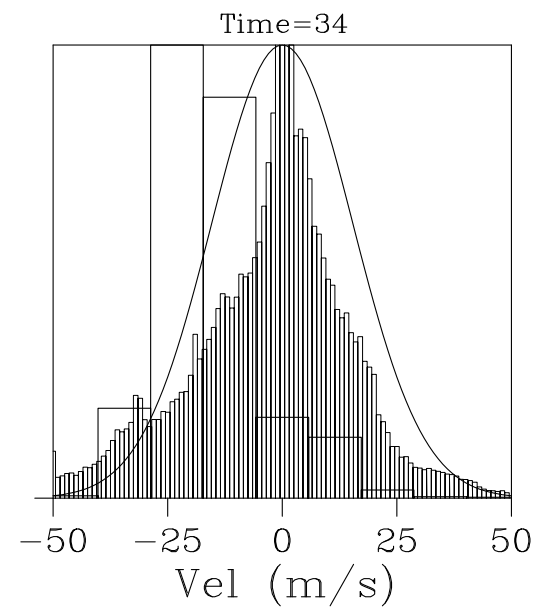
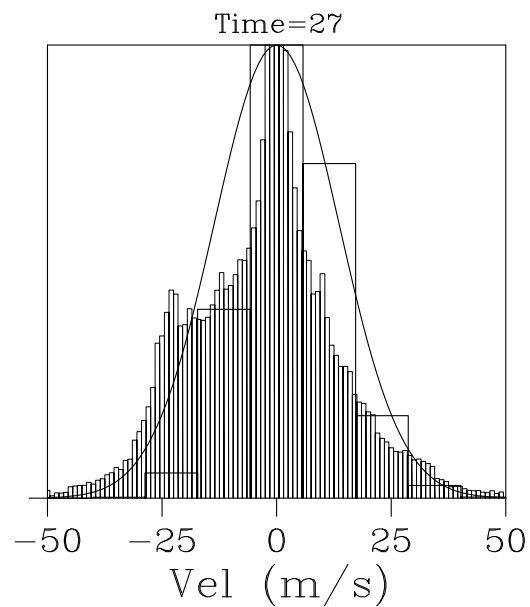
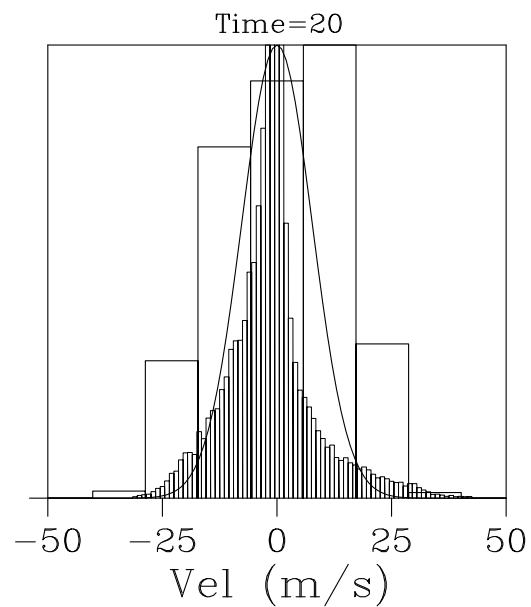


AMISR investigation



- Can we identify and understand spread F precursor waves?
- How does radar plume morphology relate to the underlying plasma depletion?

Doppler spectra



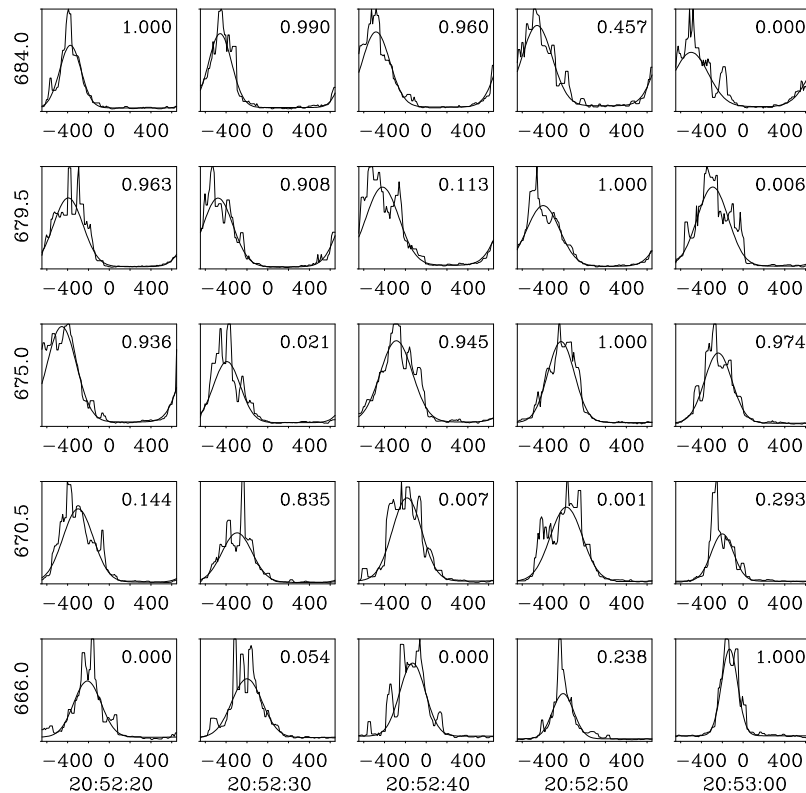
simulation

Theory and experiment

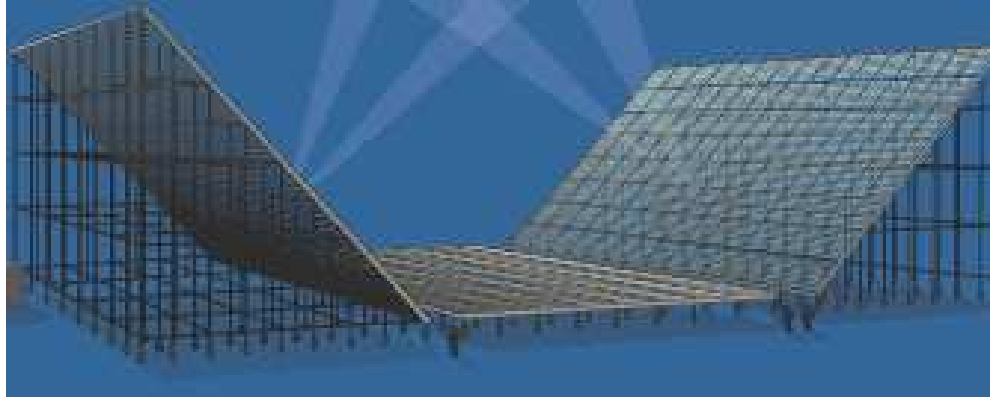
$$\begin{aligned}
 D(t) &\equiv \frac{\langle \mathbf{x}^2 \rangle}{2t} \\
 &= \frac{1}{B^2} \int_0^t \langle \mathbf{E}(0) \cdot \mathbf{E}(\tau) \rangle d\tau \\
 &= 2dR(t)/dt
 \end{aligned}$$

$$\begin{aligned}
 &\langle n^*(\mathbf{k}, t)n(\mathbf{k}, t + \tau) \rangle \\
 &= \langle |n(\mathbf{k}, t)|^2 \rangle e^{-k^2 R(\tau)}
 \end{aligned}$$

$$\frac{1}{2} \left(\frac{dR}{d\tau} \right)^2 = \frac{1}{2B^2} \sum_{\mathbf{k}} \langle |\mathbf{E}(\mathbf{k})|^2 \rangle \left(\frac{1 - \exp(-2k^2 R)}{2k^2} \right)$$

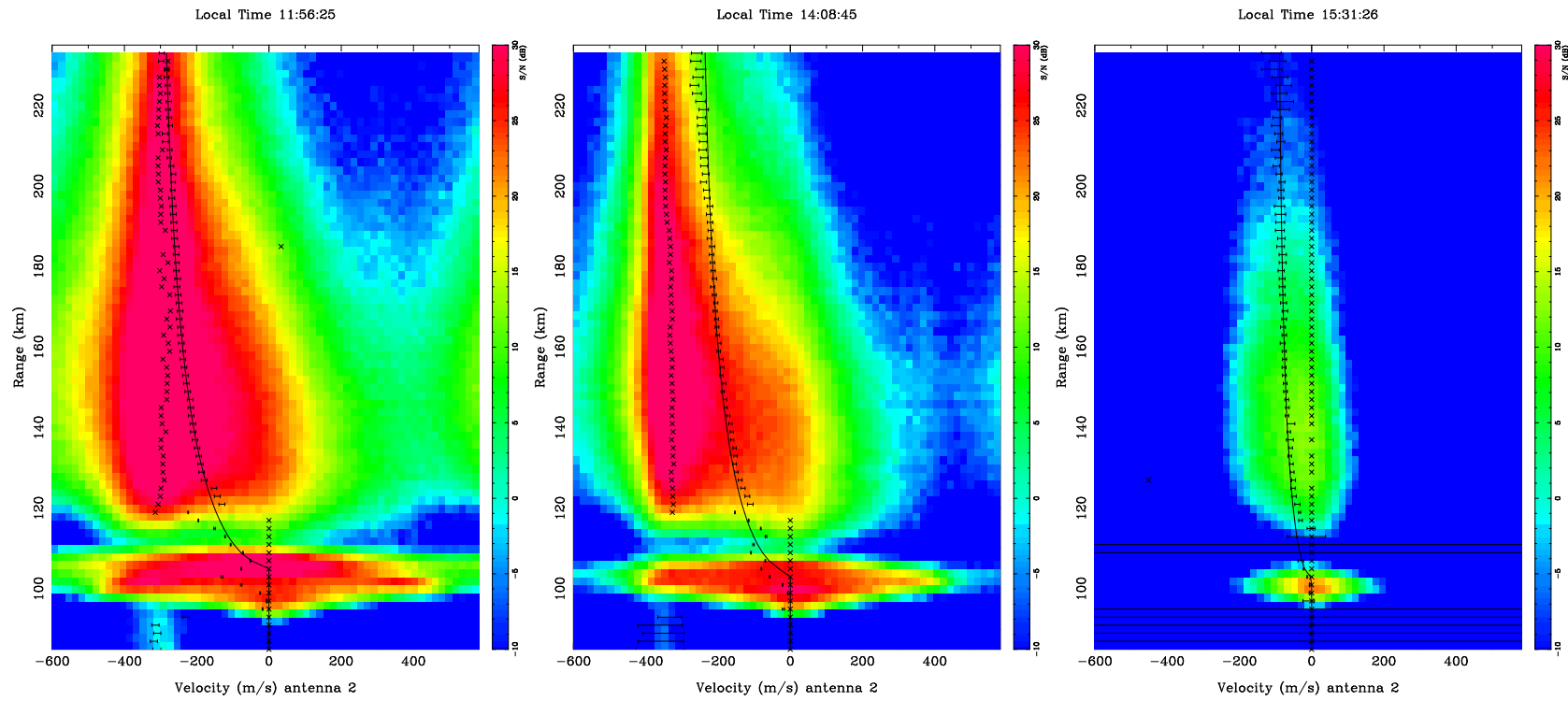


AMISR investigation



- Can we identify and understand spread F precursor waves?
- How does radar plume morphology relate to the underlying plasma depletion?
- How should we interpret the Doppler spectrum of F region plasma irregularities?

Electrojet waves

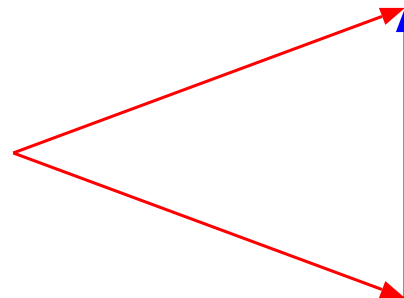
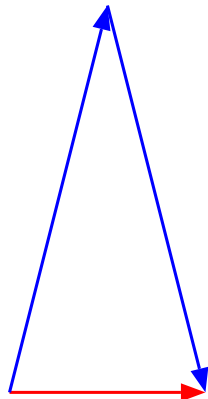


Linear, local theory

$$\omega = \frac{\mathbf{k} \cdot (\mathbf{V}_{de} - \mathbf{V}_{di})}{(1 + \psi)(1 + k_o^2/k^2)} + \mathbf{k} \cdot \mathbf{V}_{di}$$

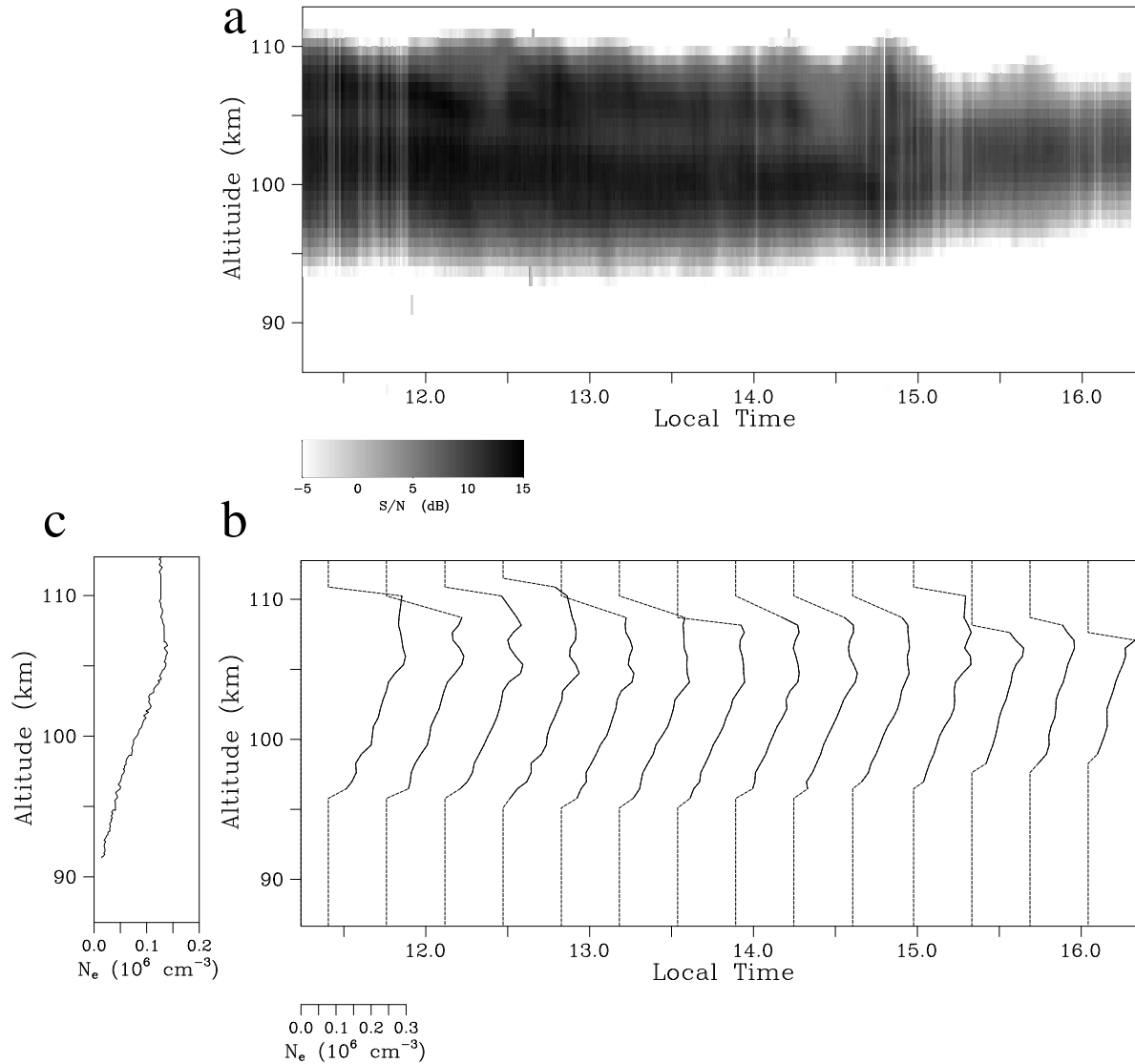
$$\gamma = \frac{\psi/\nu_i}{1 + \psi} \left((\omega - \mathbf{k} \cdot \mathbf{V}_{di})^2 - k^2 C_s^2 \right) + \frac{k_o}{k} (\omega - \mathbf{k} \cdot \mathbf{V}_{di}) - 2\alpha n_o$$

$$\frac{k_o}{k} = \frac{1}{1 + \psi} \frac{k_{\perp}}{k^2 L} \frac{\nu_i}{\Omega_i}, \quad \psi \equiv \frac{\nu_e \nu_i}{\Omega_e \Omega_i} \left(1 + \frac{\Omega_e^2}{\nu_e^2} \frac{k_{\parallel}^2}{k_{\perp}^2} \right)$$

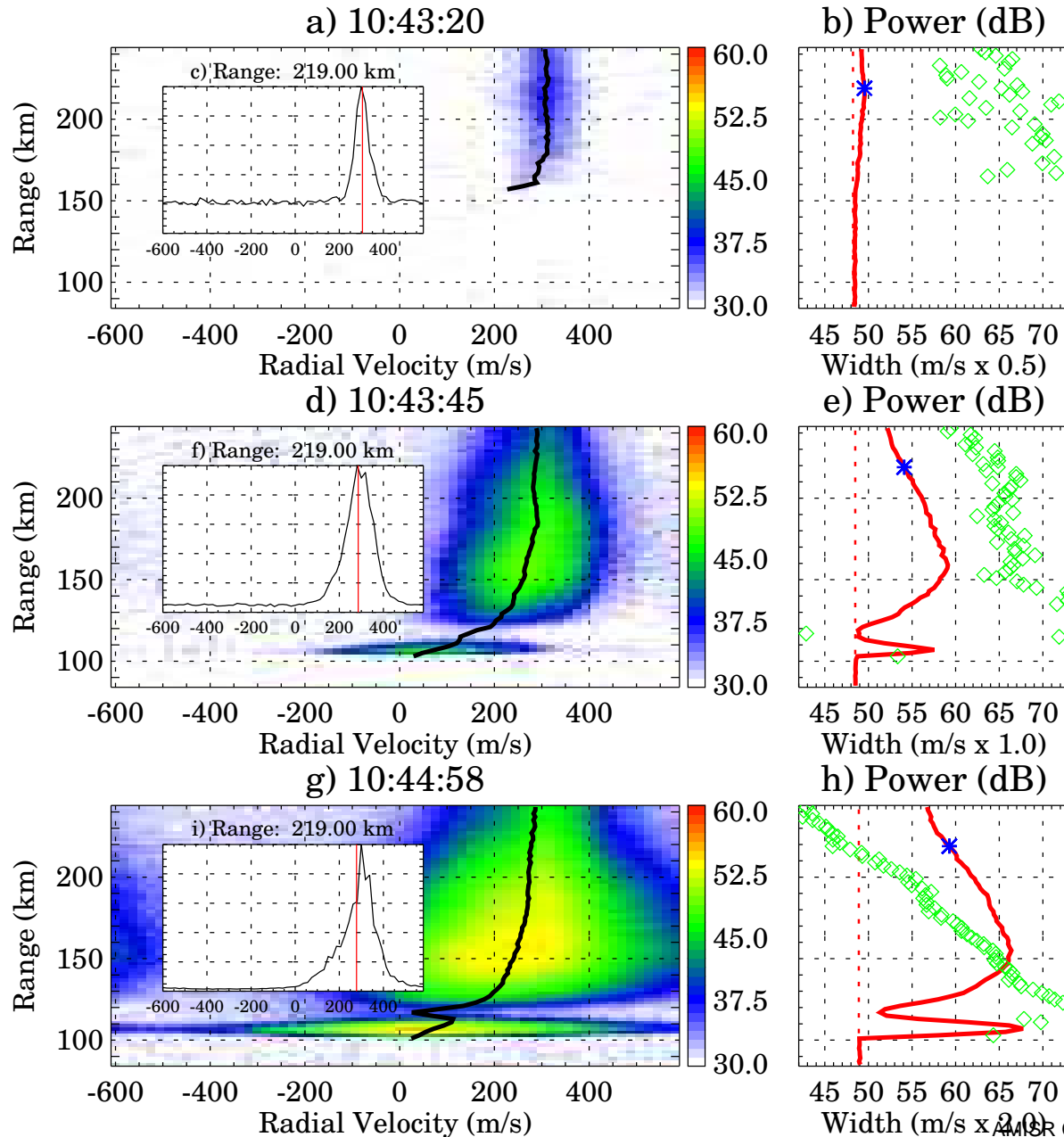


daytime sunset nighttime

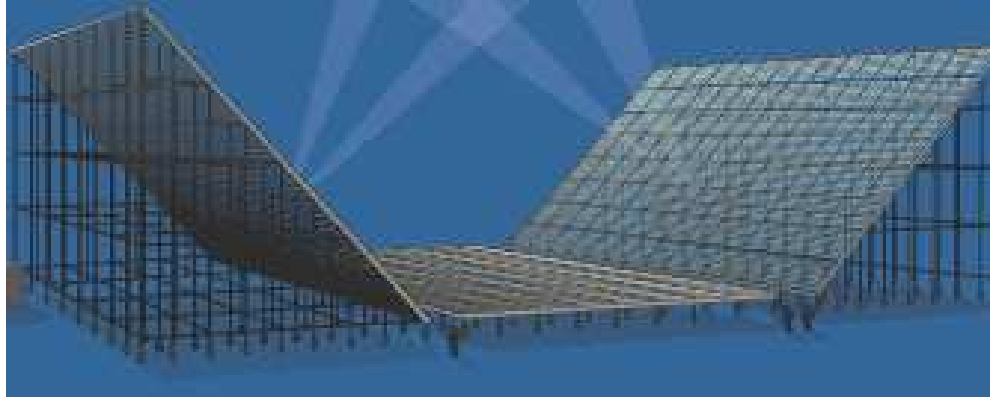
Pure two-stream waves



Counter electrojet

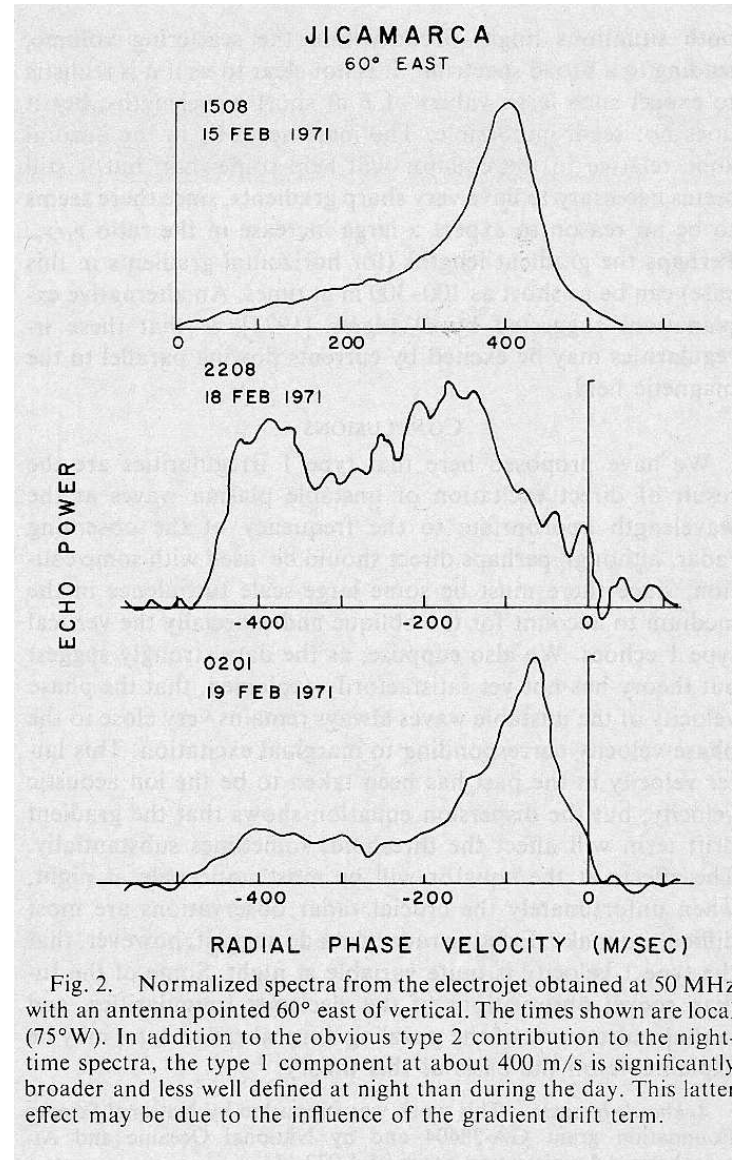
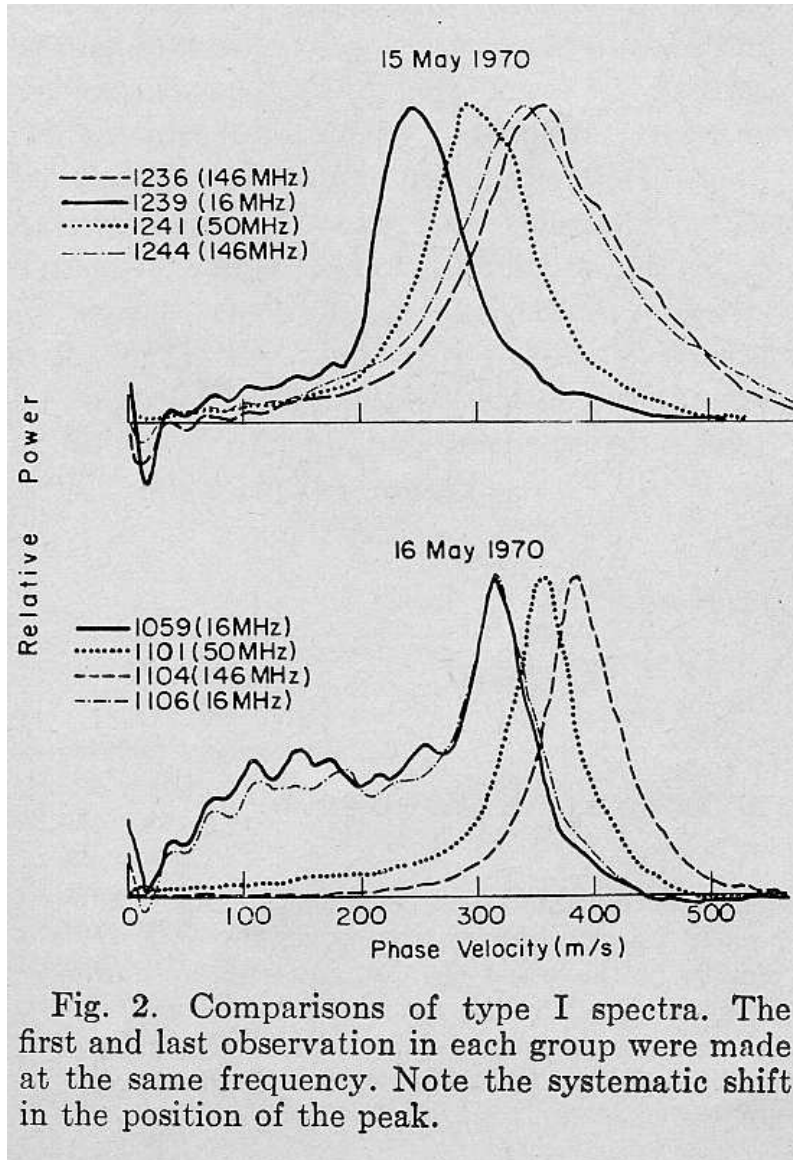


AMISR investigation



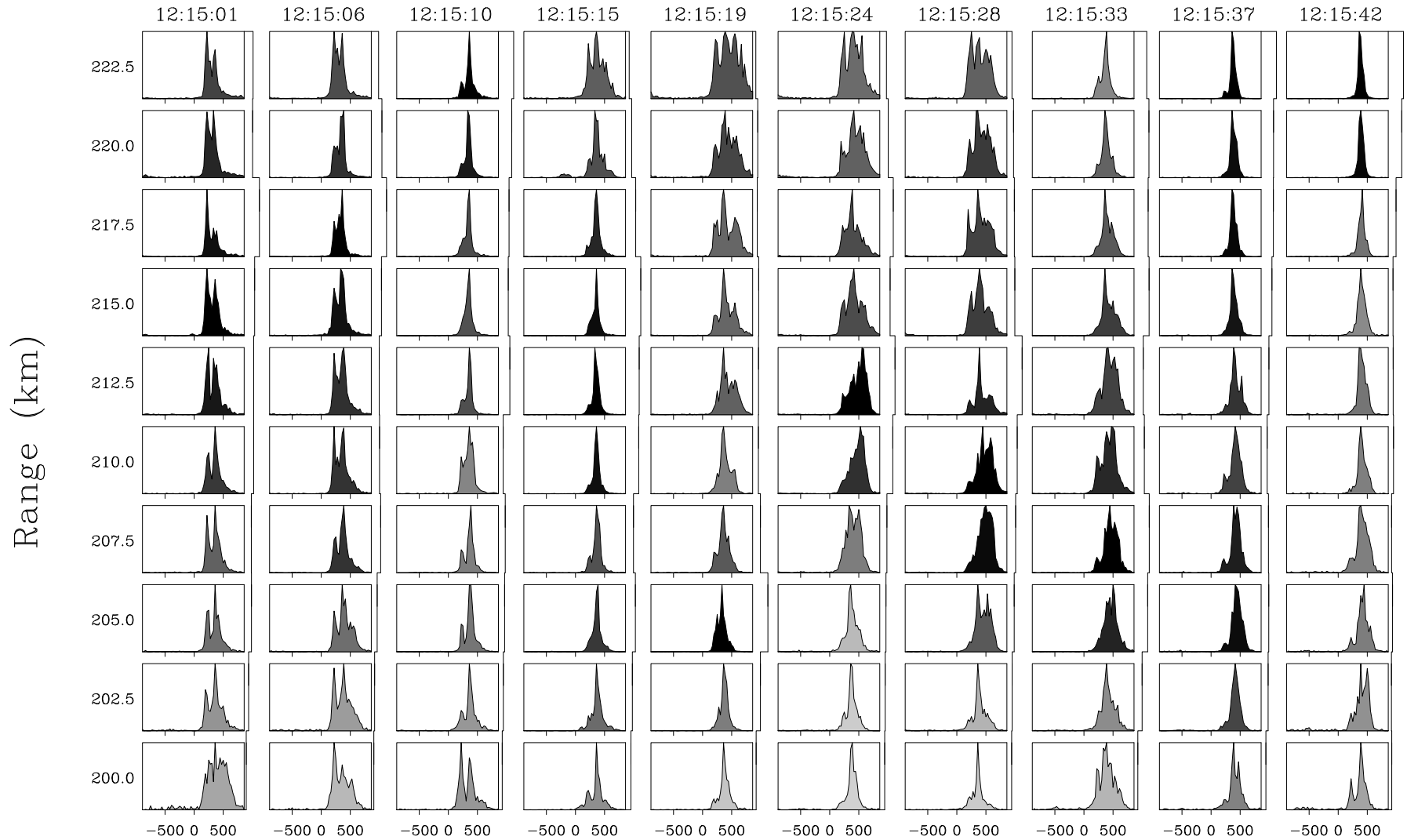
- Can we identify and understand spread F precursor waves?
- How does radar plume morphology relate to the underlying plasma depletion?
- How should we interpret the Doppler spectrum of F region plasma irregularities?
- How should we interpret Doppler spectra due to pure two-stream turbulence in the electrojet?

Frequency effects

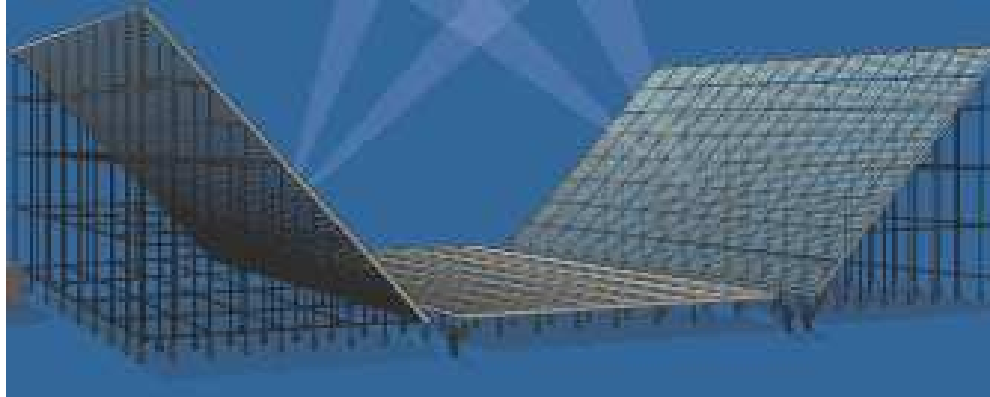


Balsley and Farley [1971], Farley and Fejer [1975]

Auroral electrojet

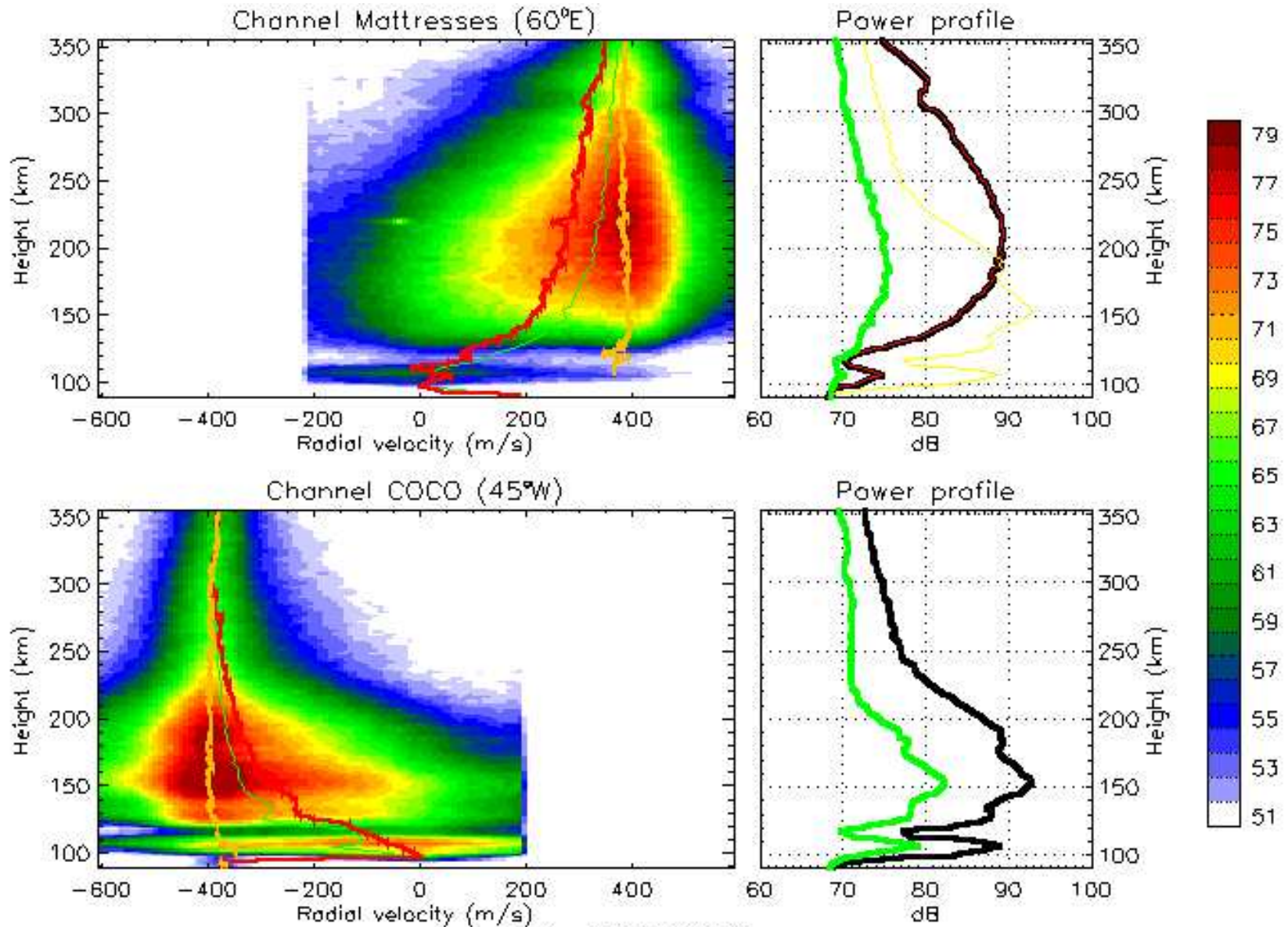


AMISR investigation



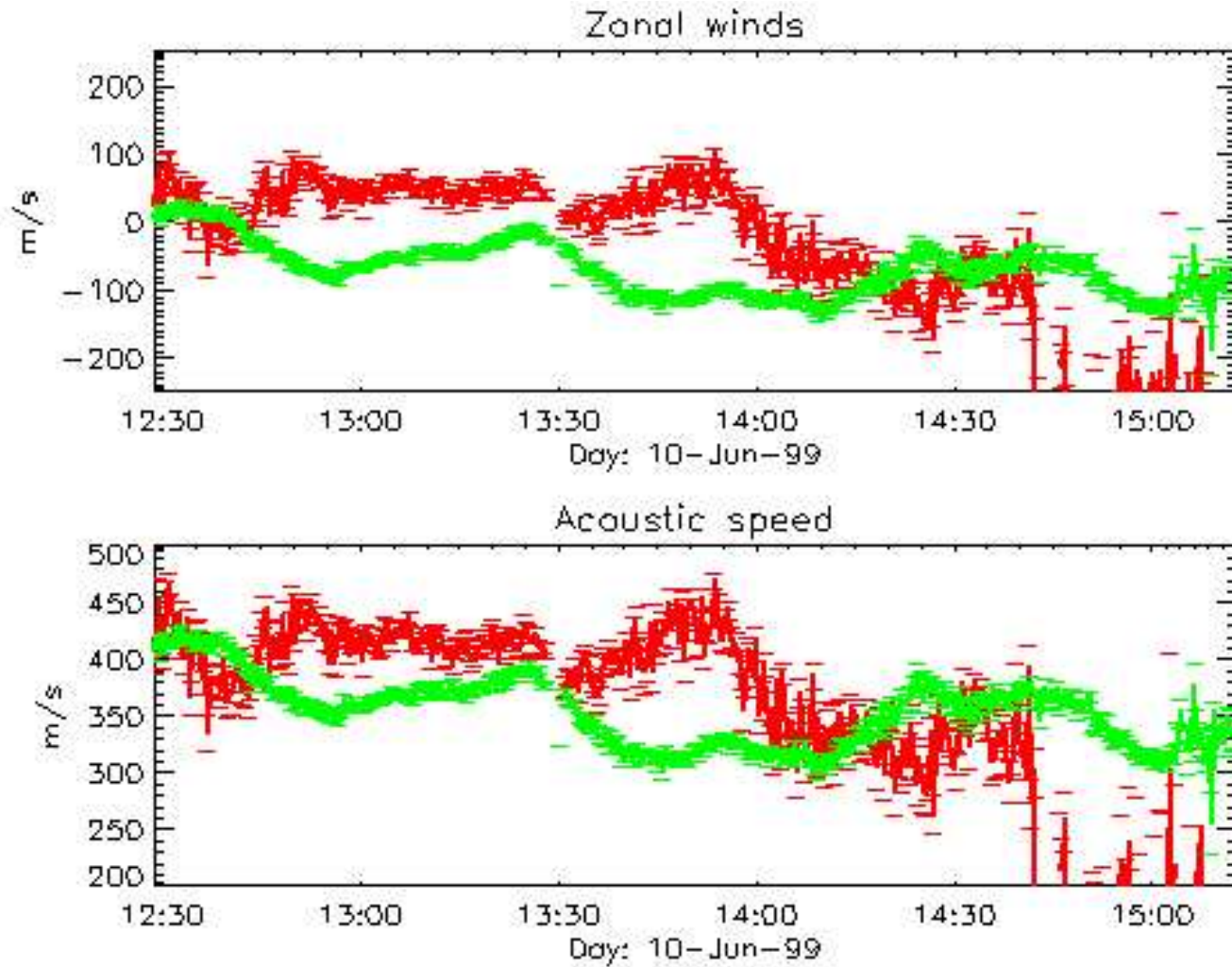
- Can we identify and understand spread F precursor waves?
- How does radar plume morphology relate to the underlying plasma depletion?
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- How should we interpret Doppler spectra due to pure two-stream turbulence in the electrojet?
- How does the radar backscatter depend on frequency?

East-west asymmetry

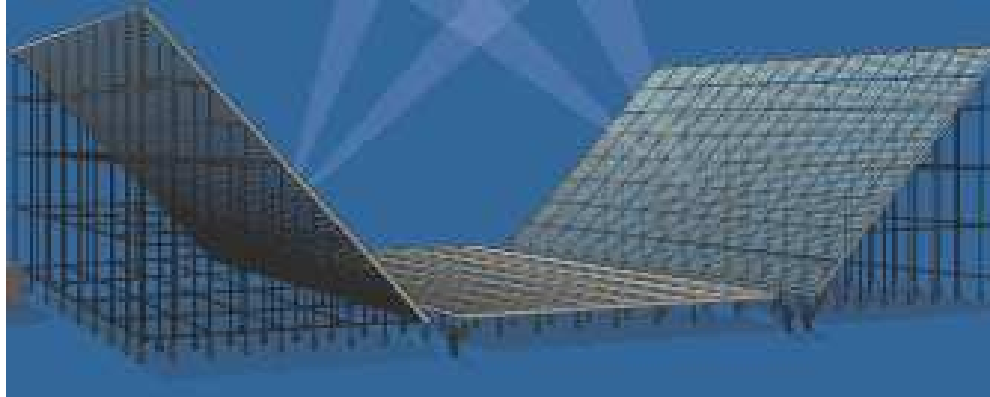


6-400-99 (218) 11:18:57

Acoustic speeds and winds



AMISR investigation



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- How should we interpret the Doppler spectrum of F region plasma irregularities?
- How should we interpret Doppler spectra due to pure two-stream turbulence in the electrojet?
- How does the radar backscatter depend on frequency?
- What causes the east-west asymmetry?