National Institute of Information and Communications Technology

DIFFERENT LOCAL TIME ASYMMETRY OF THE PC5 OCCURRENCES ON THE GROUND AND IN THE IONOSPHERE

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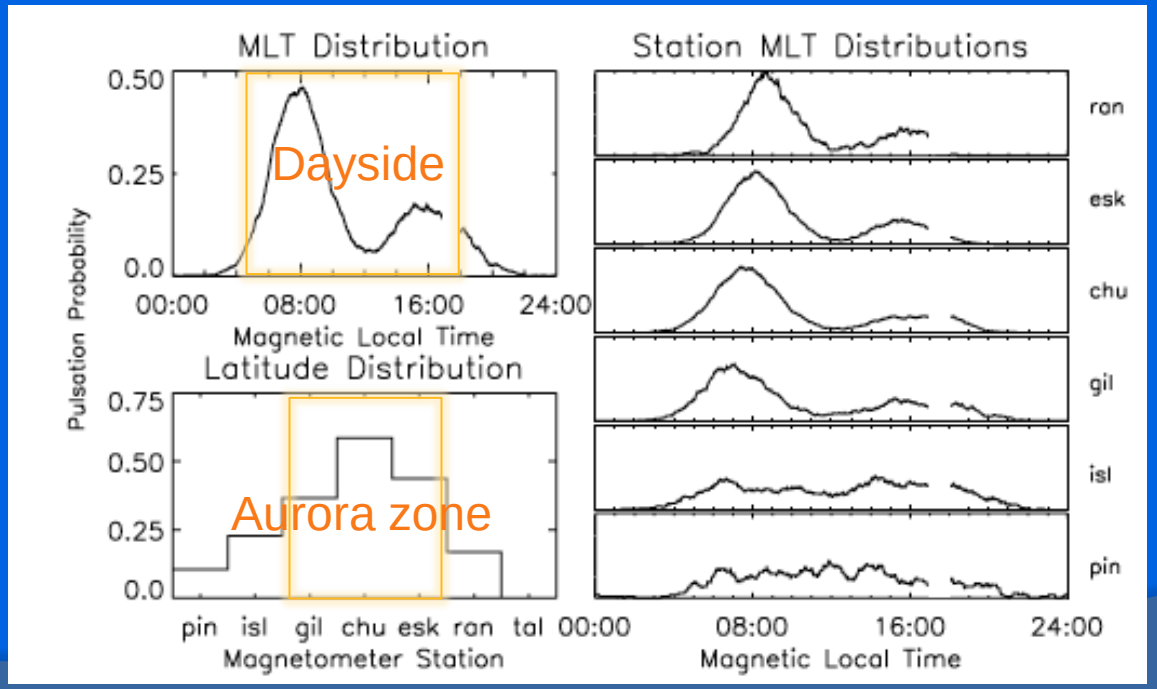
Introduction

- Pc5 is a type of magnetic pulsation at frequencies of 150-600s
- Generators of Pc5 are mainly solar wind velocity shear, dynamic pressure variation at magnetopause, and drift-bounce instability of ring current protons.

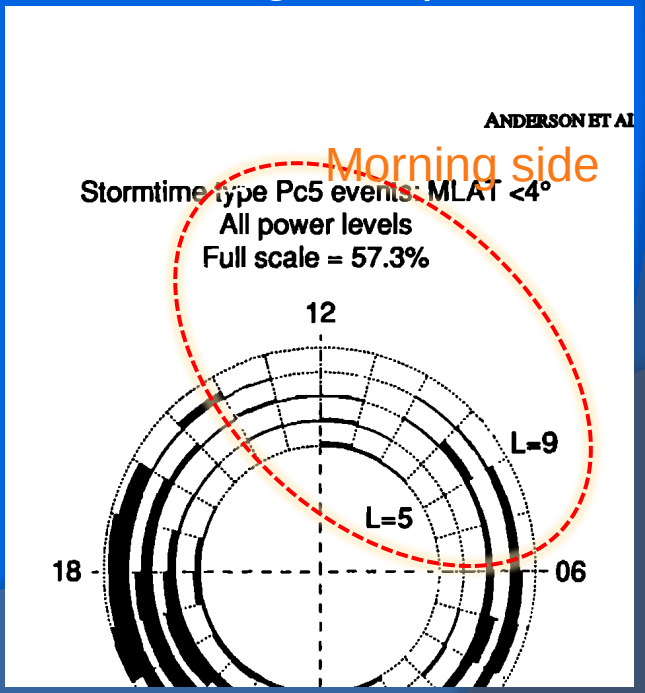
- Can we detect Pc5 Doppler oscillation by HF radars, as same as magnetometers on the ground and in the magnetosphere, below?

Distribution of Pc5 pulsation on the ground



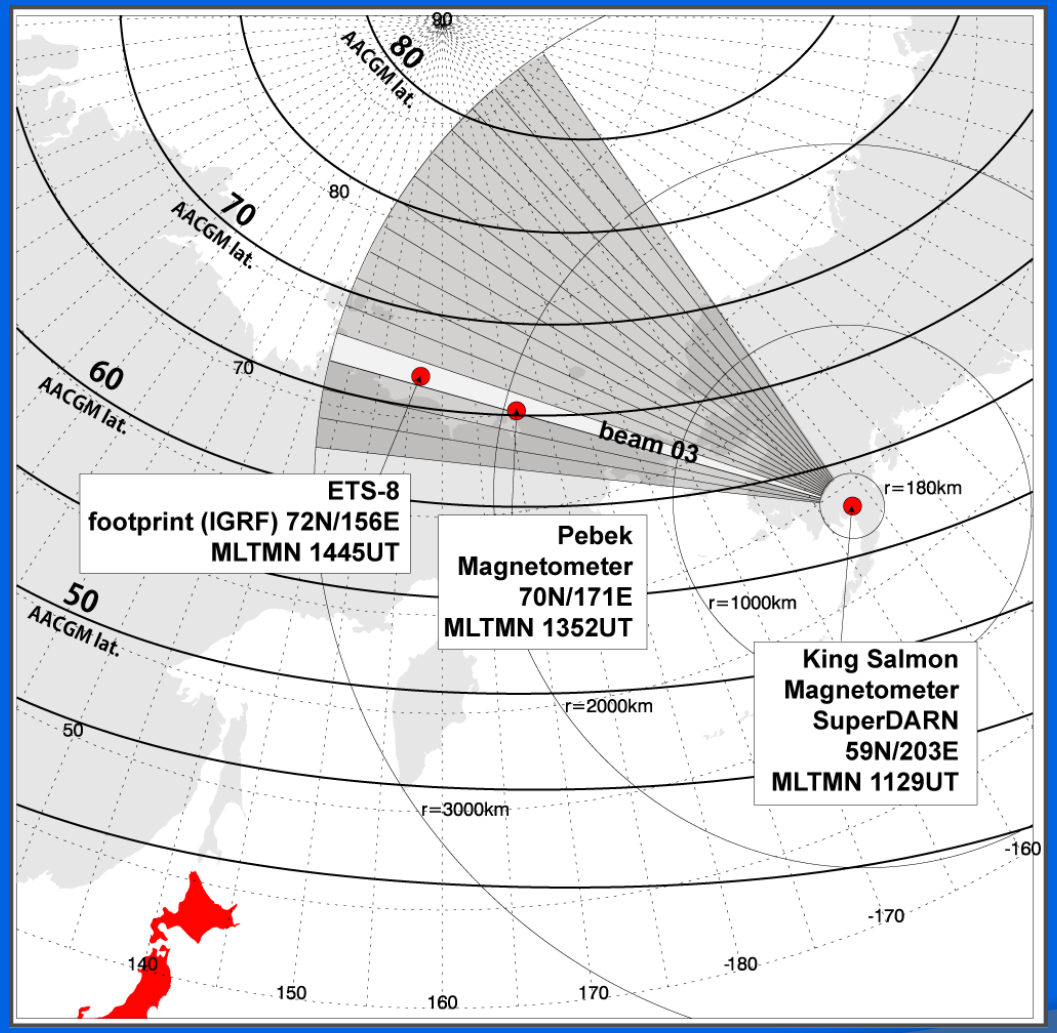
Baker et al., 2003

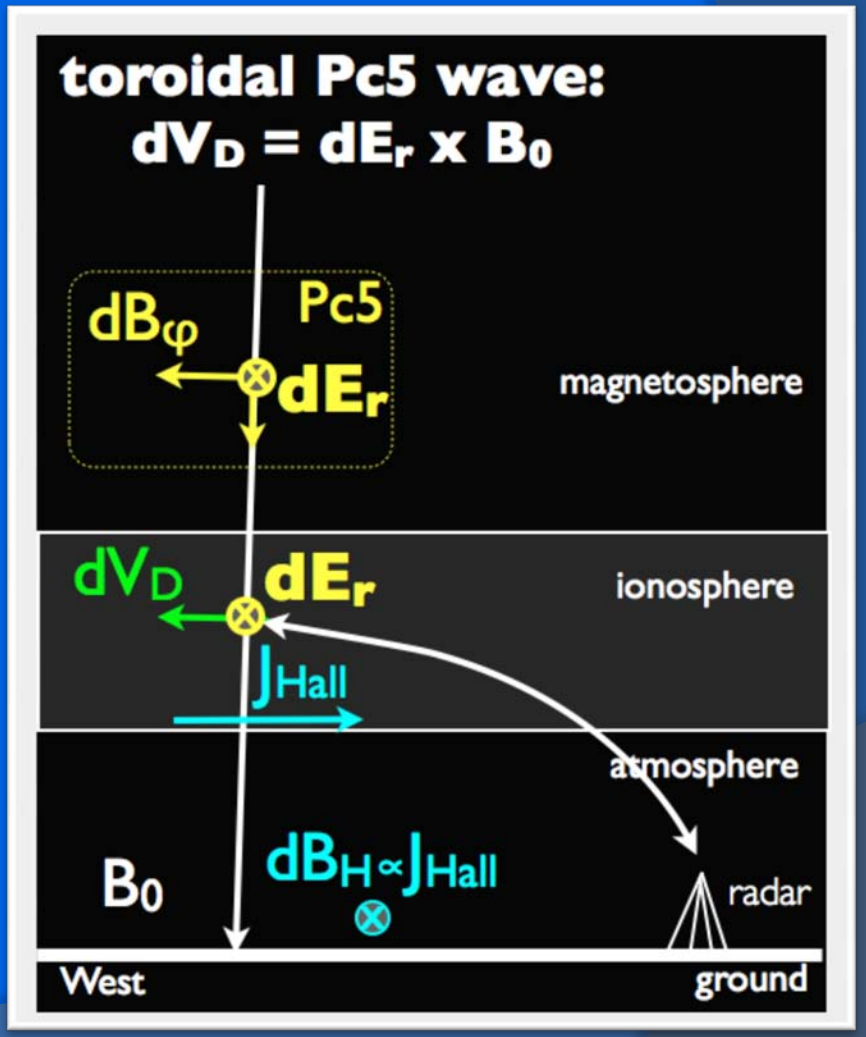
in the magnetosphere



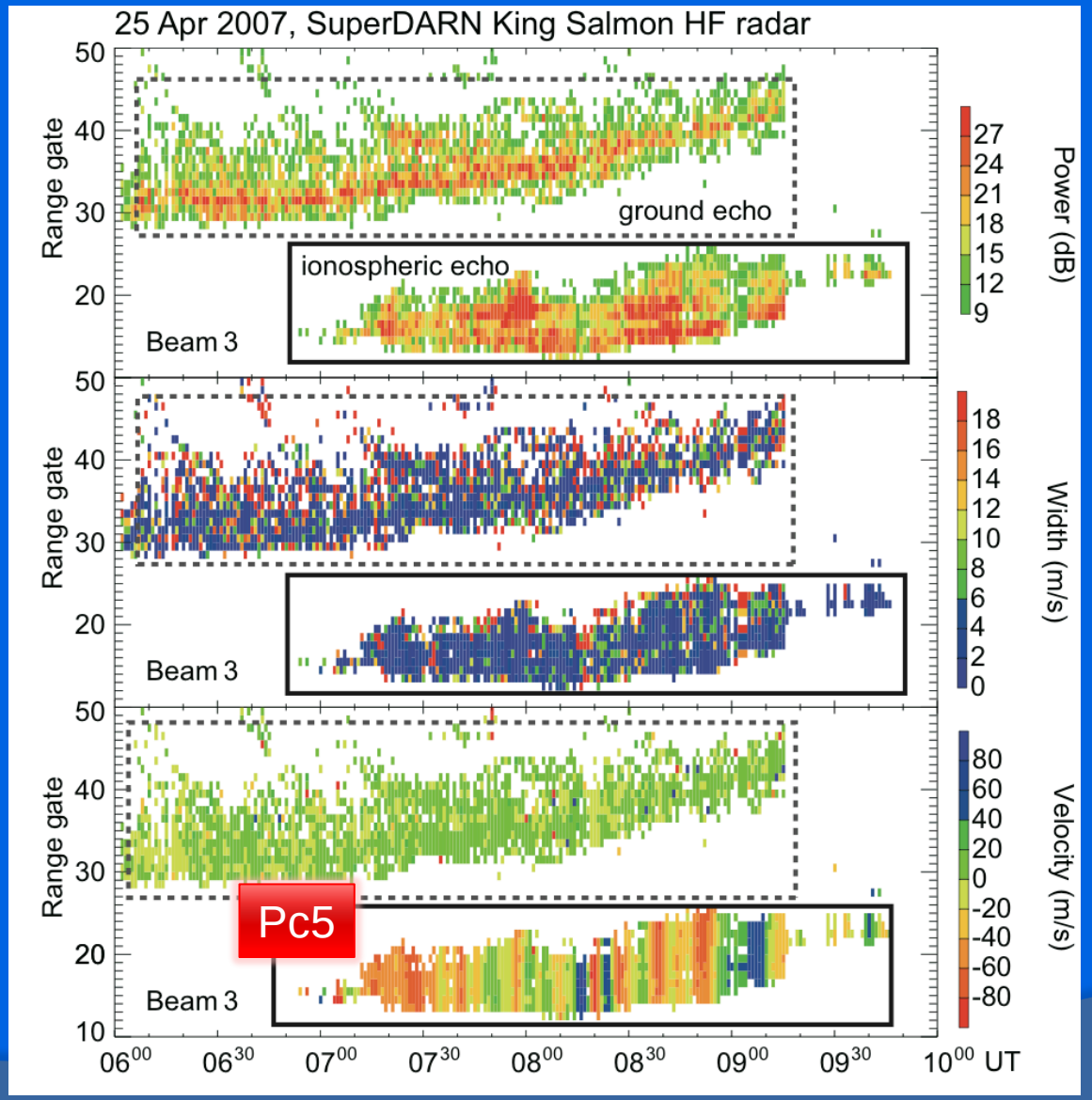
Anderson et al., 1990

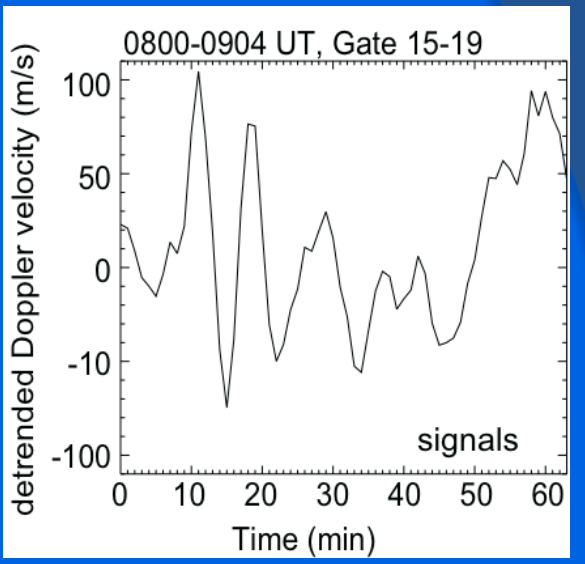
SuperDARN King Salmon HF radar

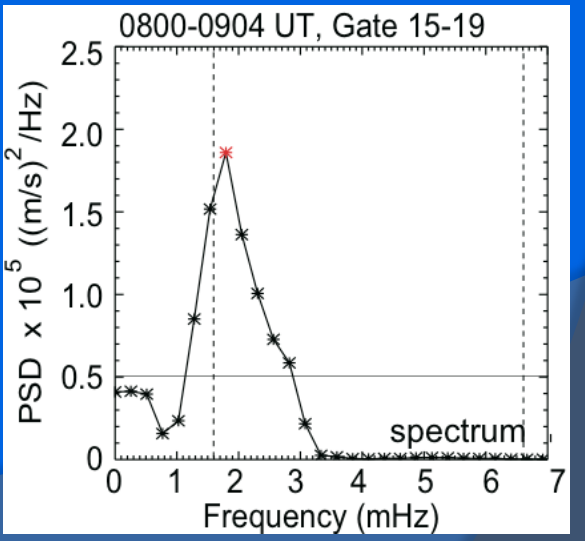




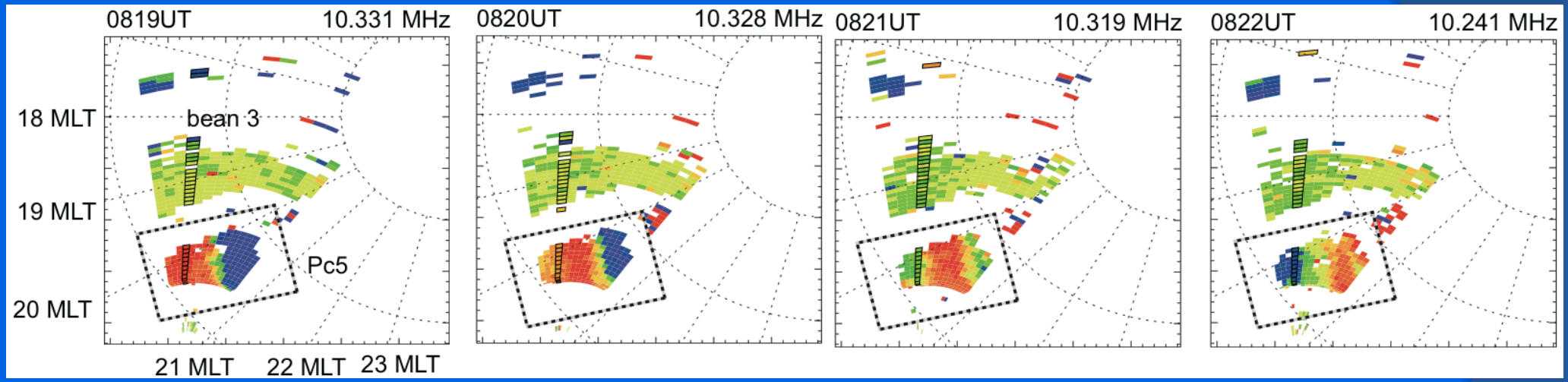
Example for Pc5 event







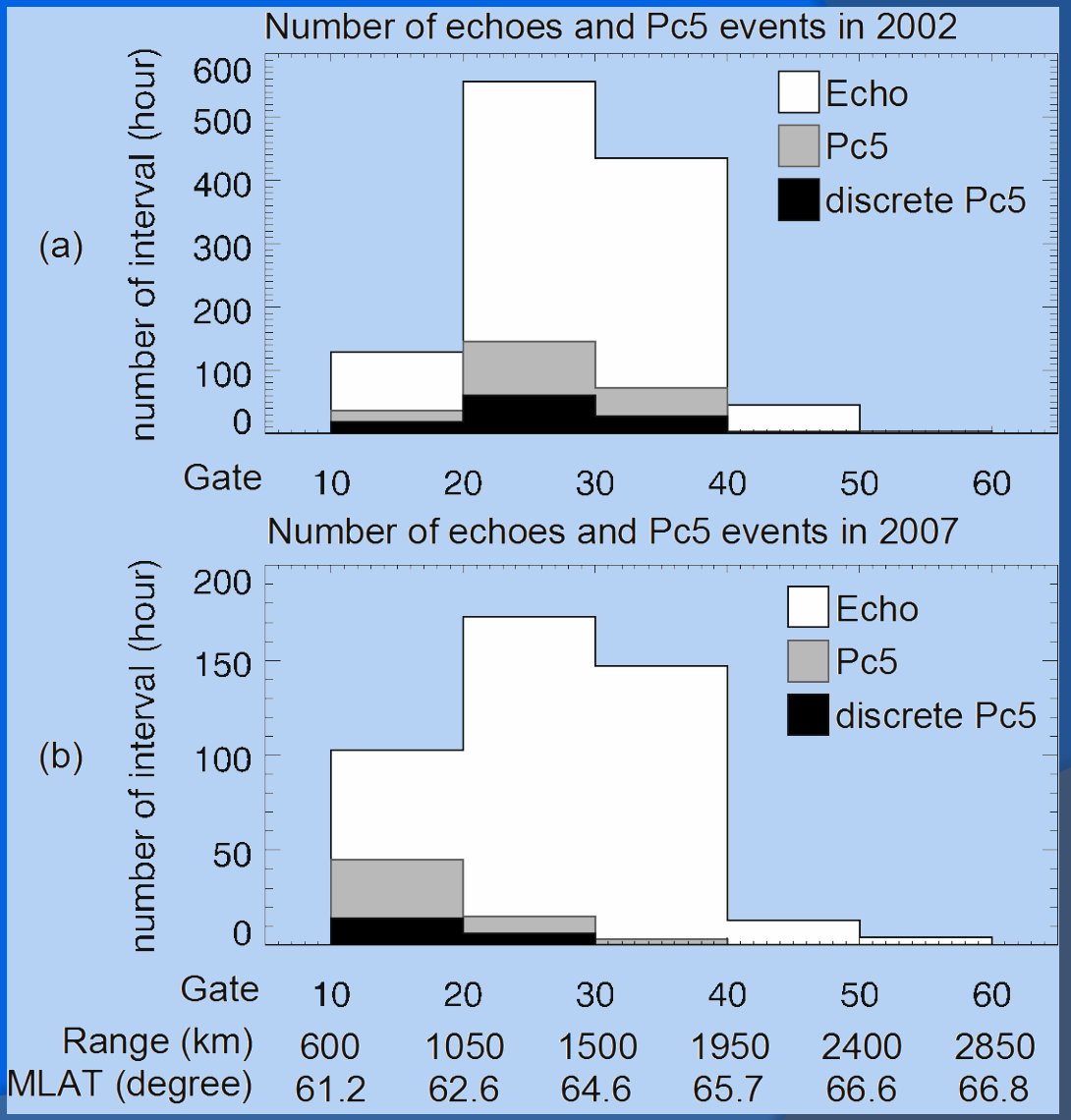
Example for Pc5 event



- Duration ~2 hours at 19-22 MLT
- Wavelength ~2000 km (m number ~20)
- Phase velocity ~ 4 km/s

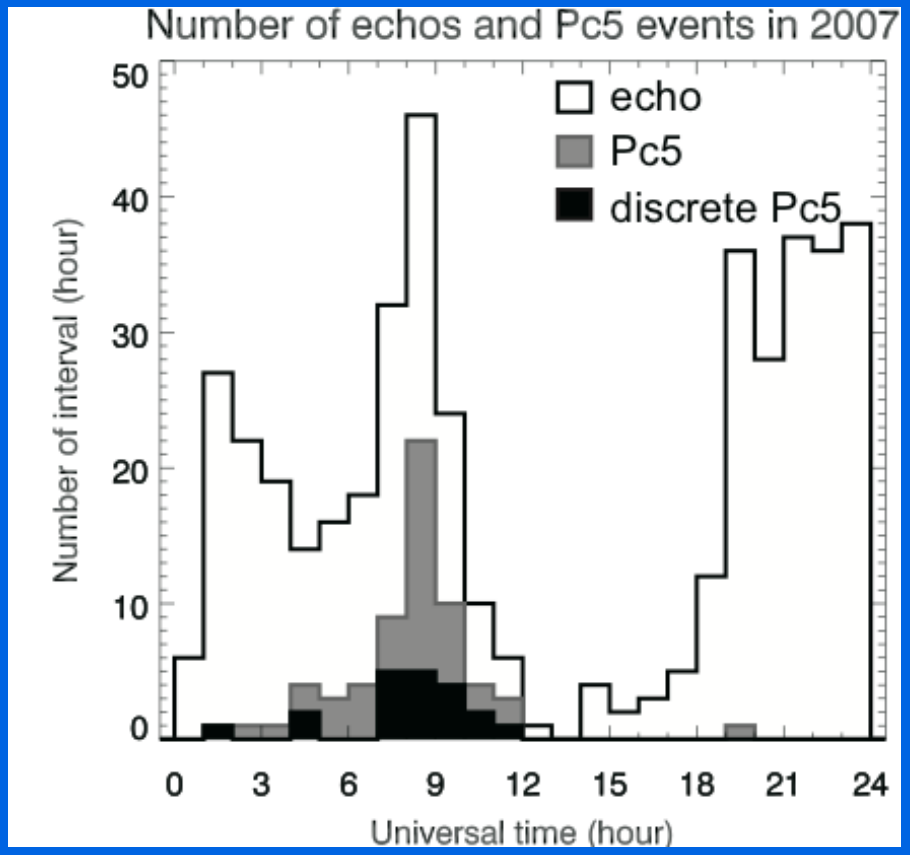
Statistical analysis

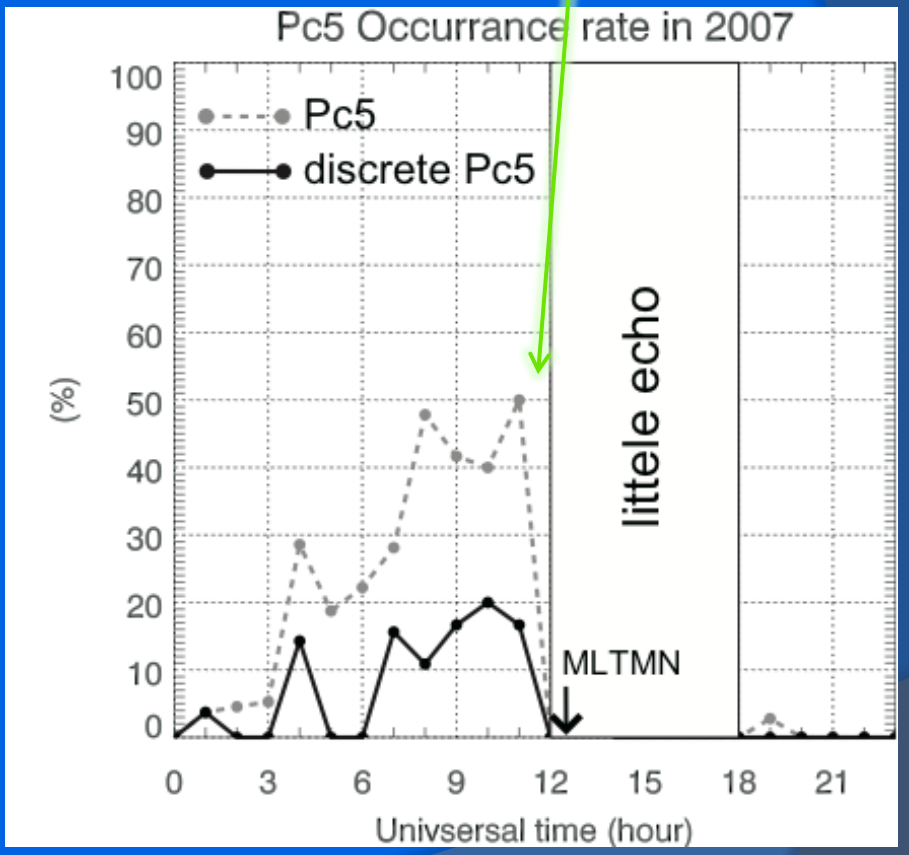
- Solar minimum 2002
  - Total number of Pc5 (discrete Pc5) events
    - **260 (110)/1172**
  - Occurrence rate [max]
    - **22 %/Gate**
- Solar maximum 2007
  - Total number of Pc5 (discrete Pc5) events
    - **59 (20)/408**
  - Occurrence rate [max]
    - **44 %/Gate**



Local time distribution in 2007

High occurrence near midnight

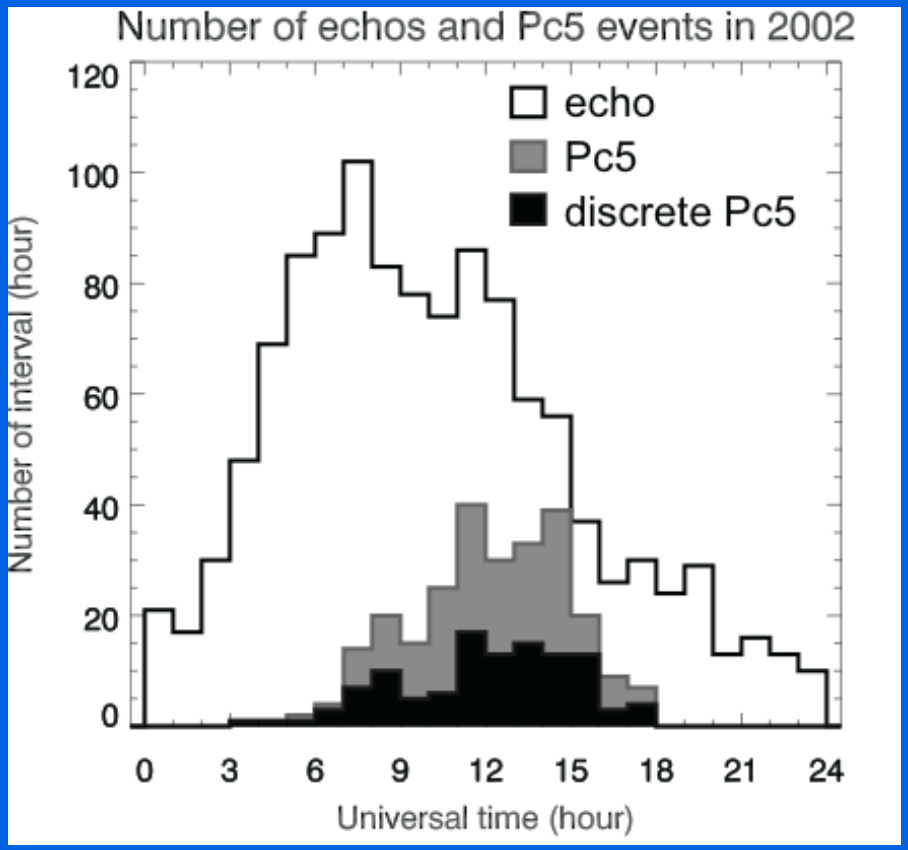


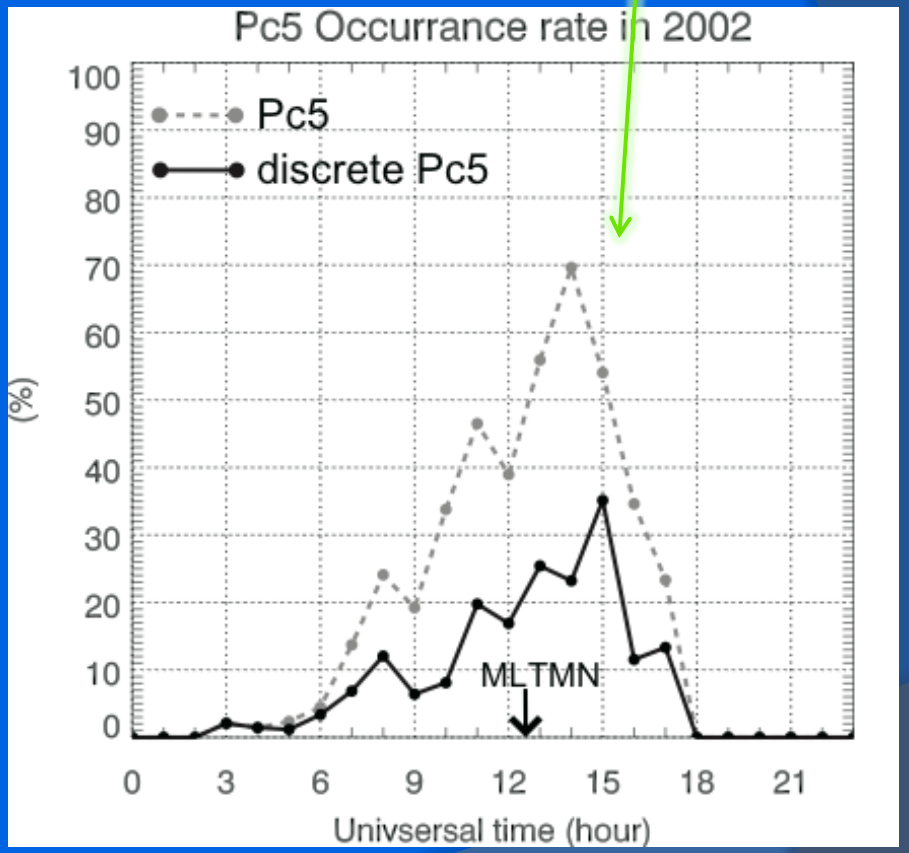


※ discrete Pc5 ≡ FWHM < 2 mHz

Local time distribution in 2002

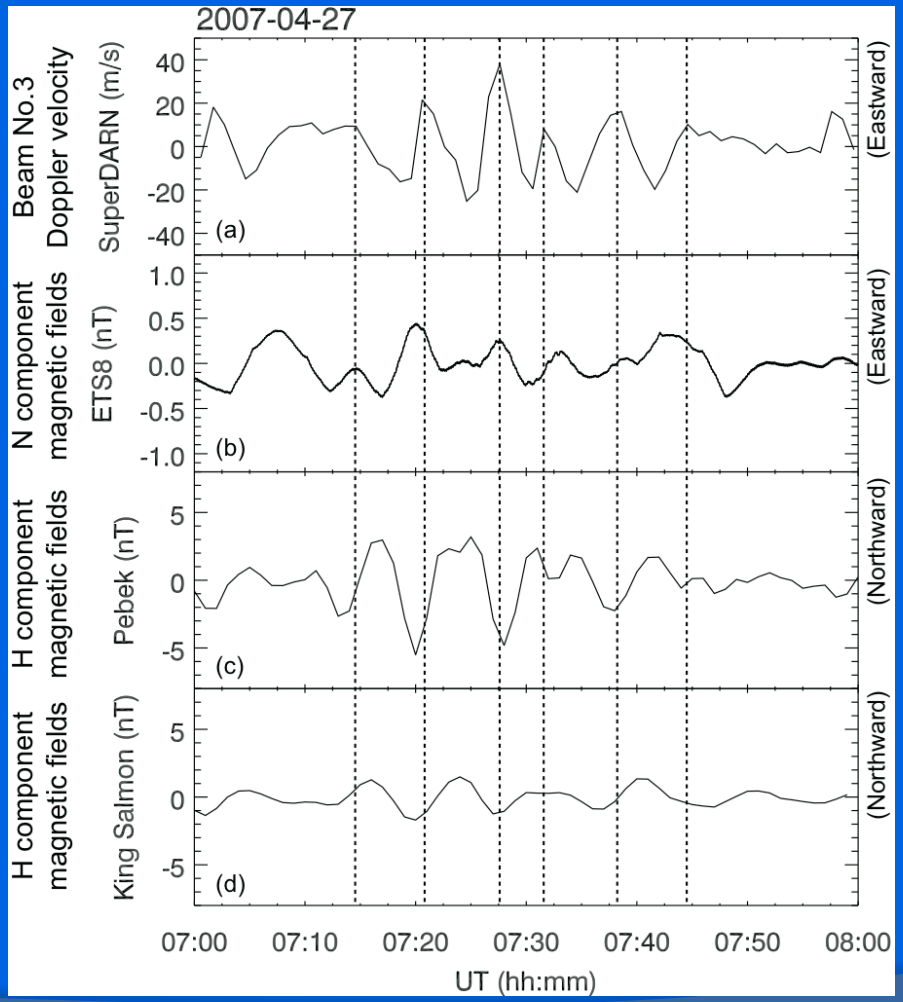
High occurrence near midnight

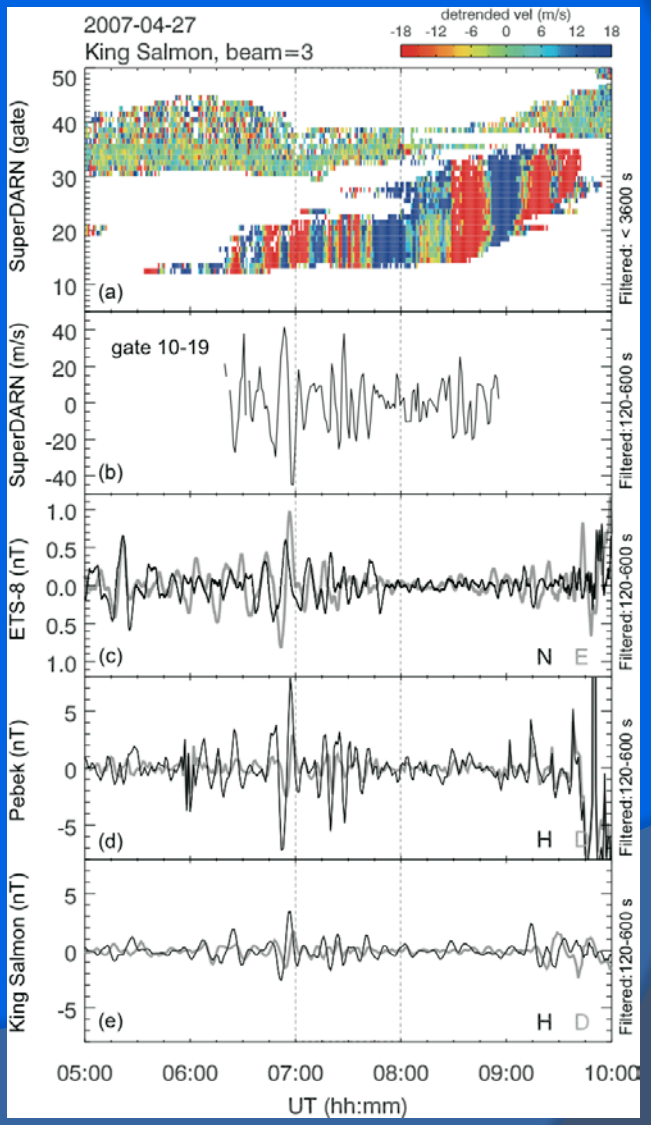




Ground, geostationary, and radar comparison; case 1

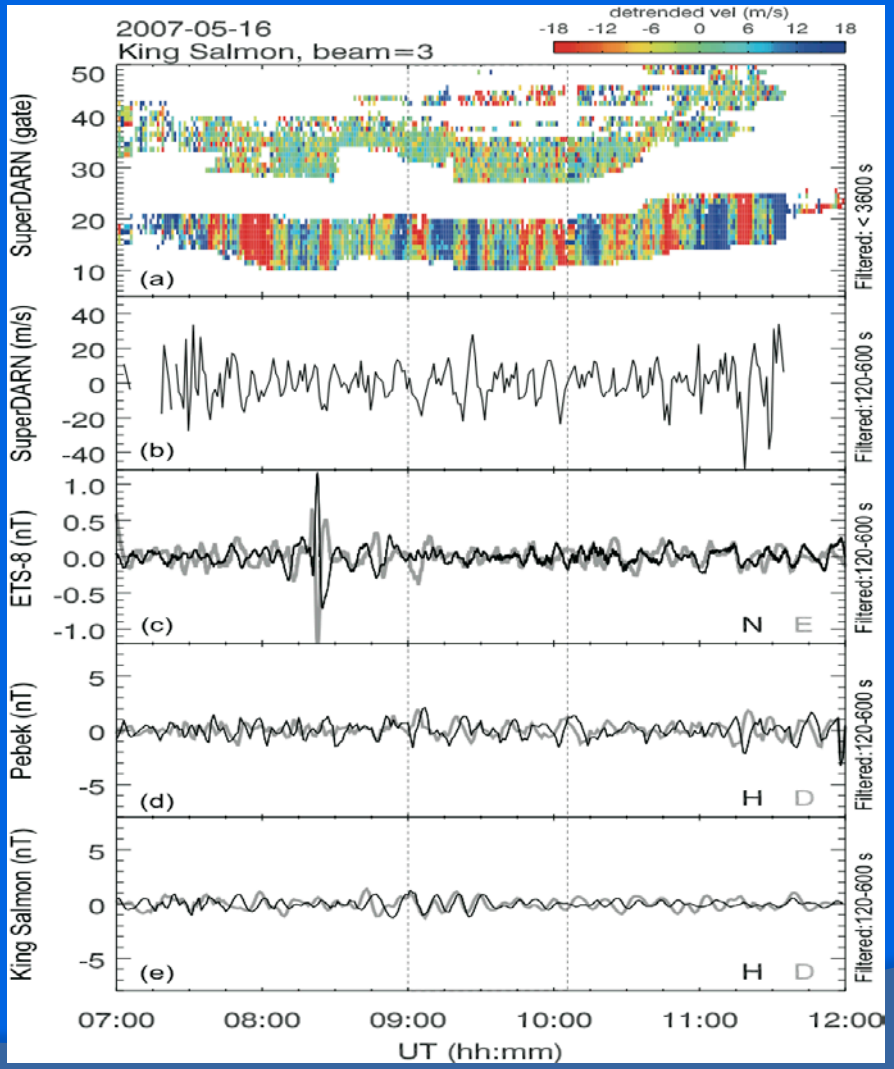
Good agreements!! This is rare.





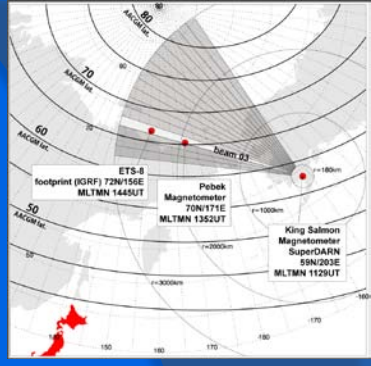
Ground, geostationary, and radar comparison; case 2

No agreements

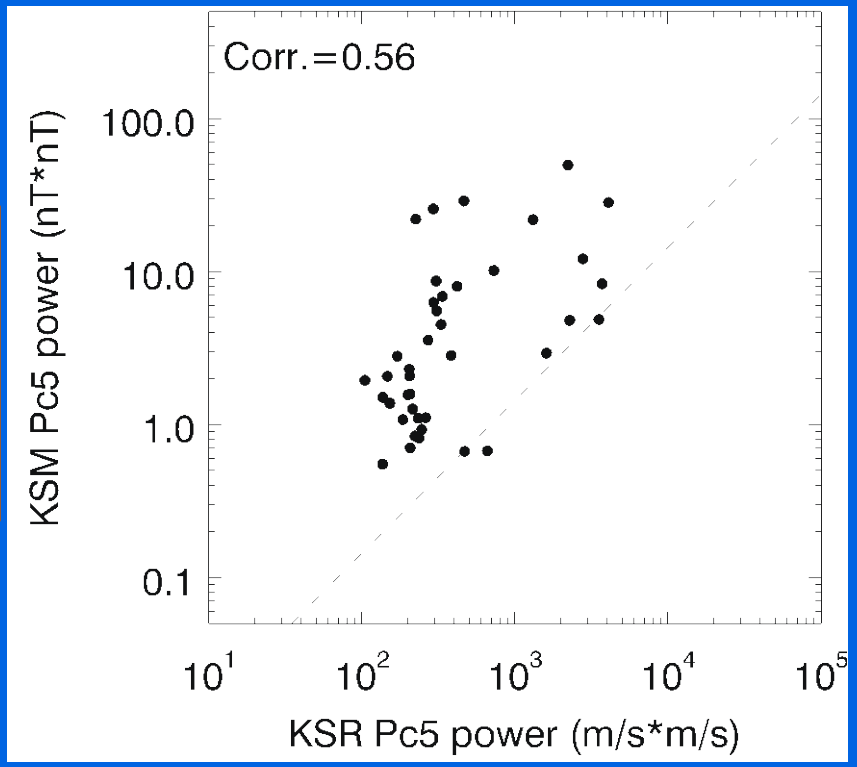


Pc5 plasma oscillation in the ionosphere

Correlations between Pc5 powers

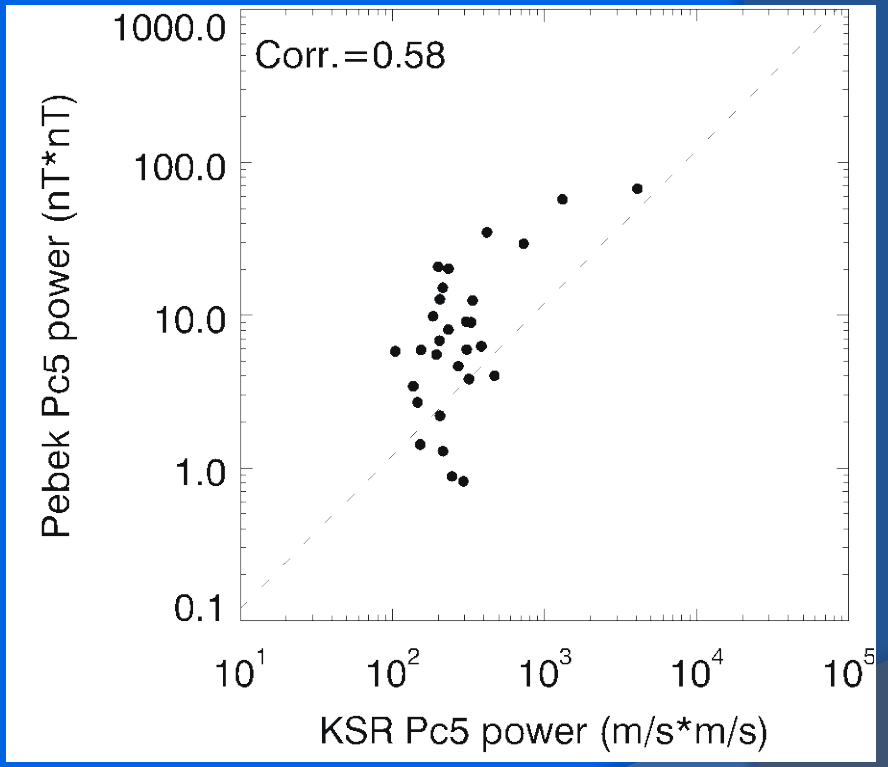


King Salmon



Log10 average dB^2 ~ 5 nT^2

Pebek



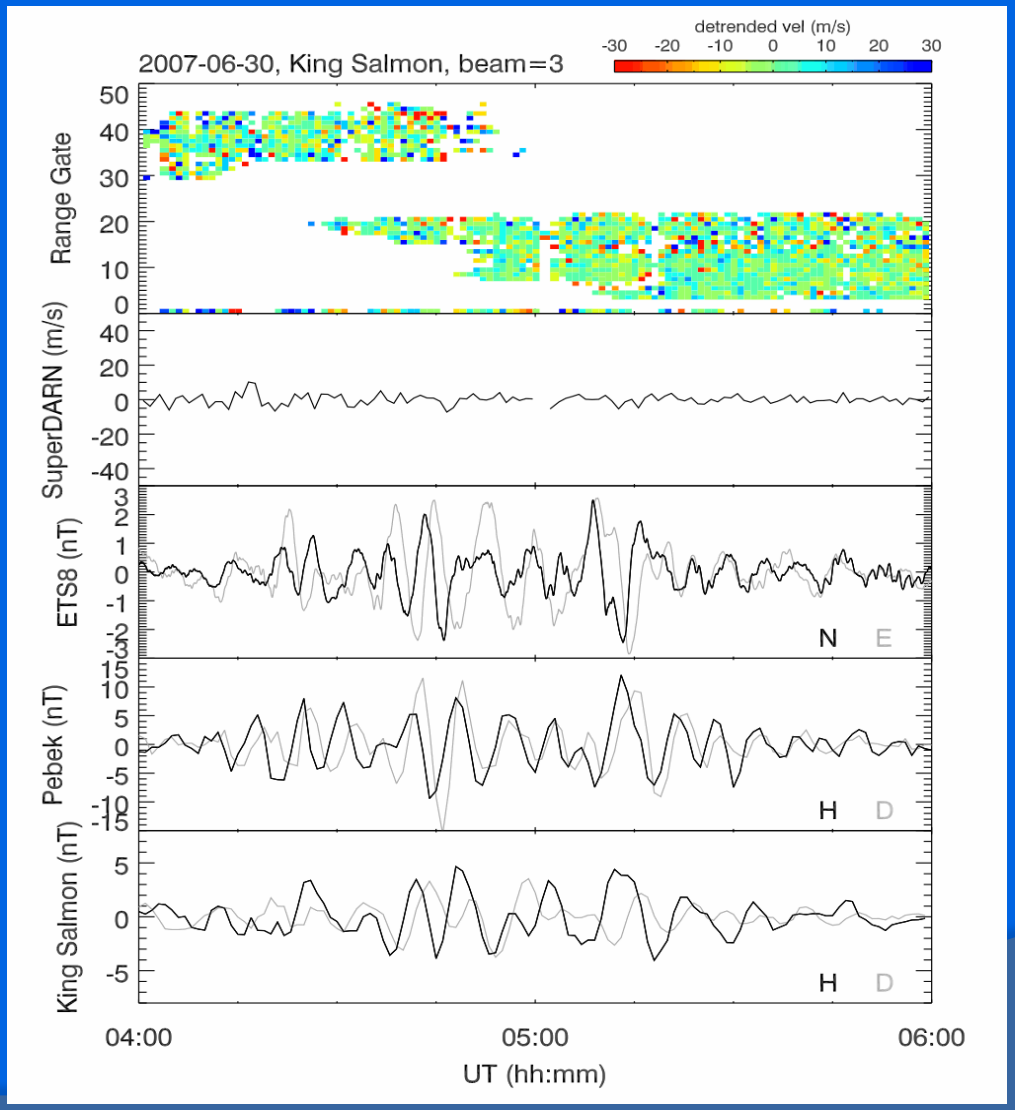
Log10 average dB^2 ~ 10 nT^2

Positive correlation

But extremely low amplitudes for Pc5 magnetic field

Ground, geostationary, and radar comparison; case 2

No agreements



Pc5 magnetic field pulsation at dusk

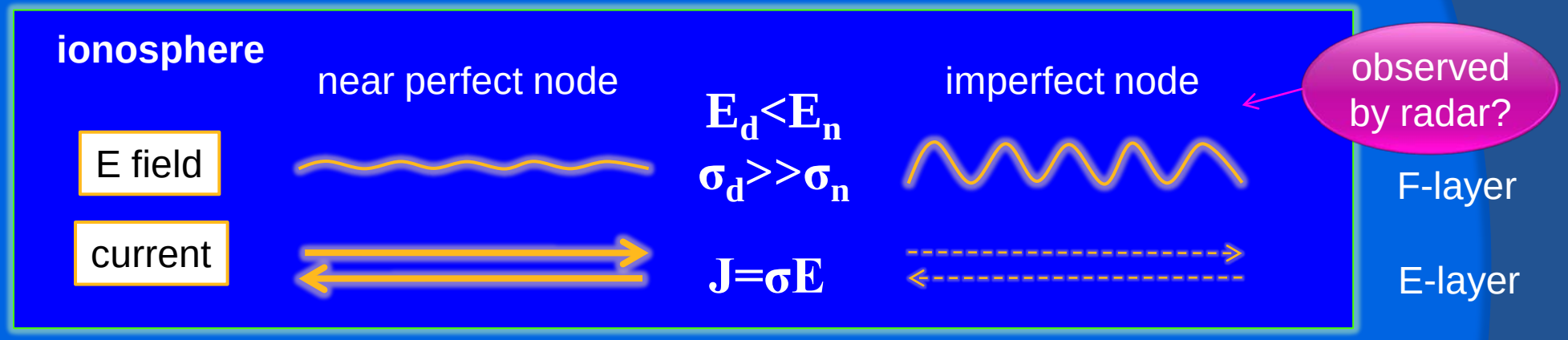
Summary and discussion

- Probability of the Pc5 plasma oscillation in the ionosphere is maximum near the magnetic midnight.
- SuperDARN radar observations provide the local time distributions different from magnetic field observations

Occurrence probability	day	night
Pc5 plasma oscillation	low	high
Pc5 magnetic pulsation	high	low

Summary and Discussion

Day: high conductivity (σ_d) **Night:** low conductivity (σ_n)



$B \propto J=\sigma E$

Thank you