



# Comparison of Zonal Neutral Winds with EPB and Plasma Drift Velocities

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# Overview

## Goal

Investigate the **F-region Dynamo** by comparing zonal neutral winds with EPB and plasma drift velocities.

## Instrumentation

FPIs : Neutral winds

Optical imaging systems: EPB velocity

Jicamarca ISR: Plasma drift

# Overview






# Overview

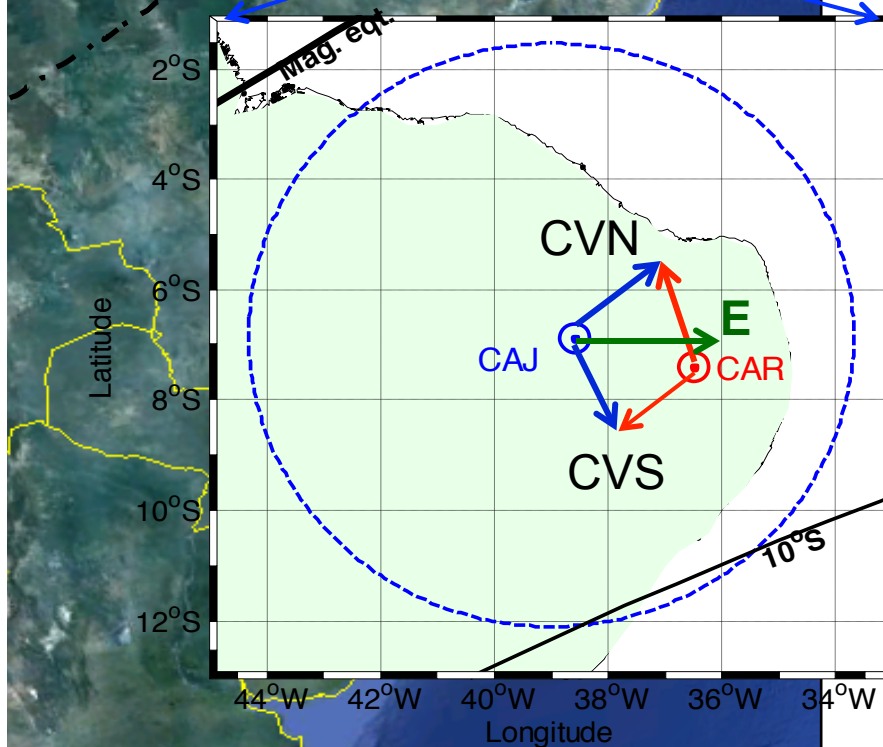
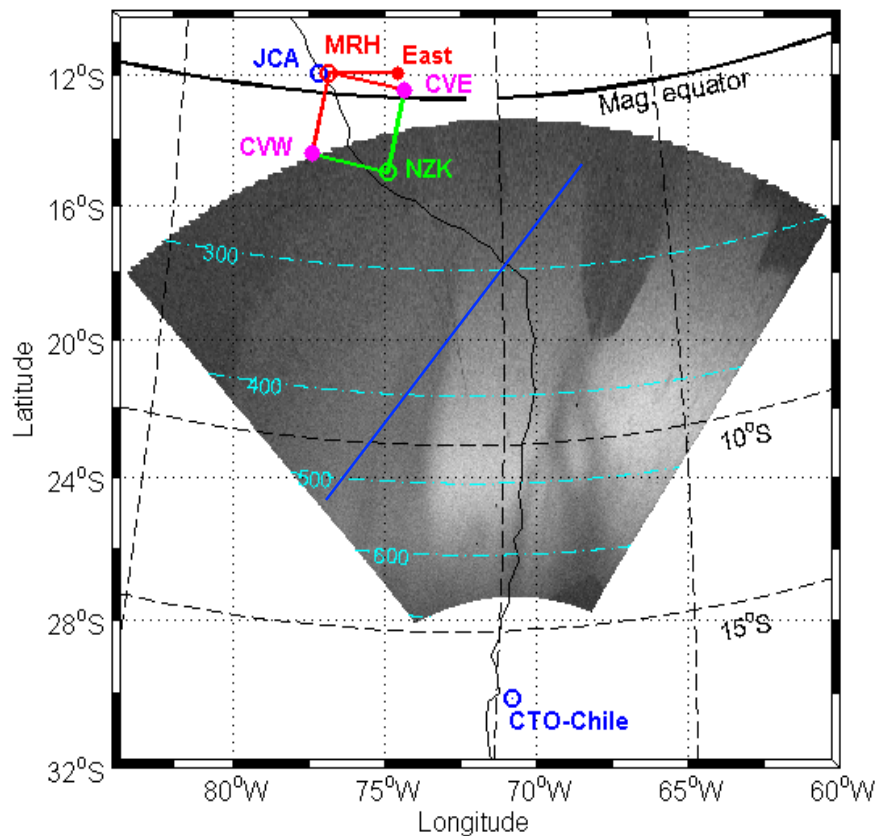


Brazil

Cajazeiras  Cariri 

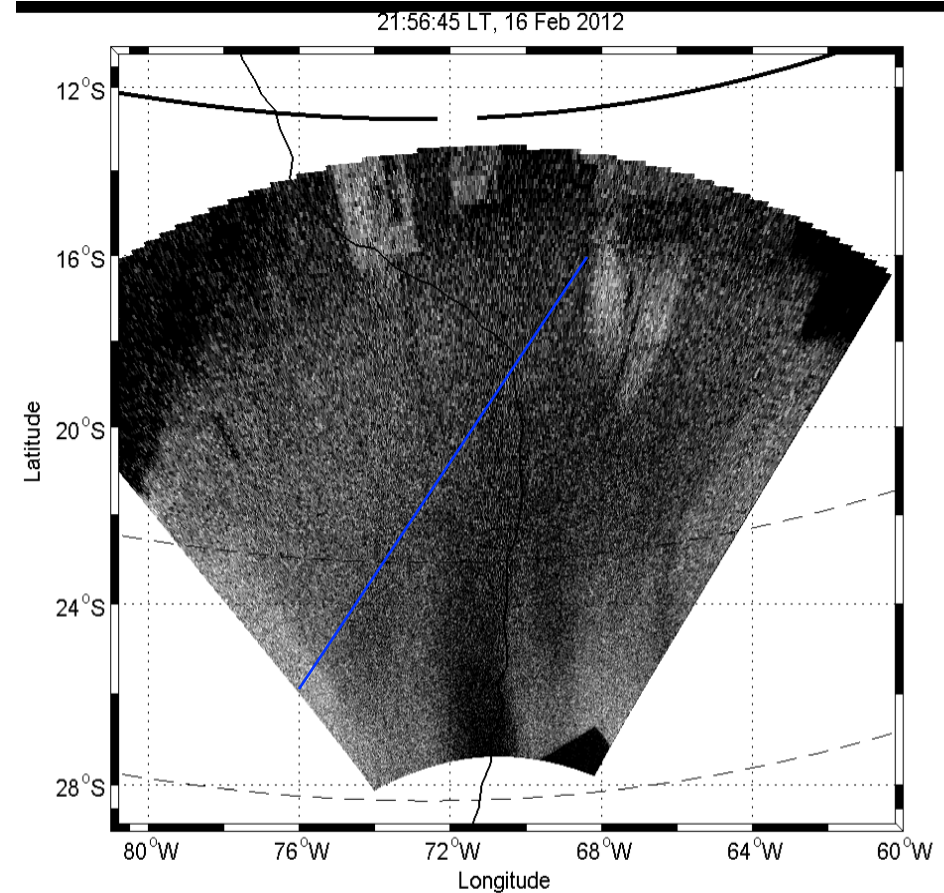
RENOIR Optical Geometries

FPI and Optical Imaging System, Peru-Chile



# EPB Drift Velocity

- Images processed to remove stars
- Images projected onto geographic coordinates at altitude of 250 km
- Intensity cut through the image along a line of constant magnetic latitude
- Data stacked in time to produce the keogram and estimate the bubble velocity.



# Database: Brazil

Month	EPB	EPB-Wind
Sept-Oct 09	21	14
Nov-Dec	30	29
Sept-Oct 10	1	0
Nov-Dec	26	24
<b>Total</b>	<b>78</b>	<b>57</b>

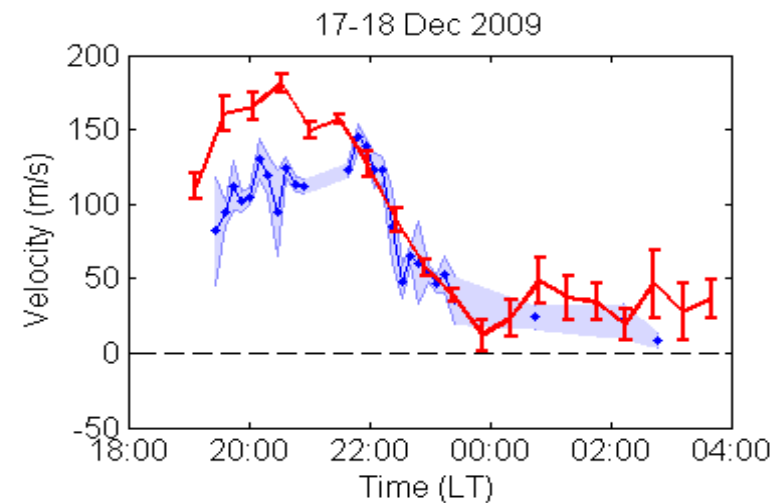
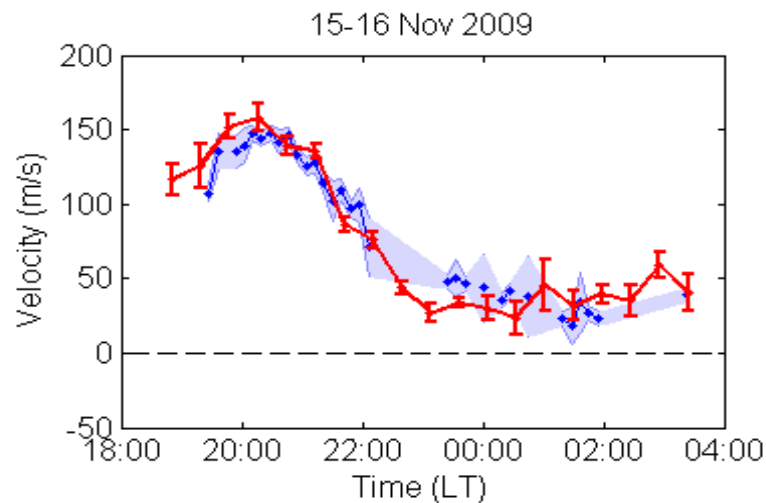
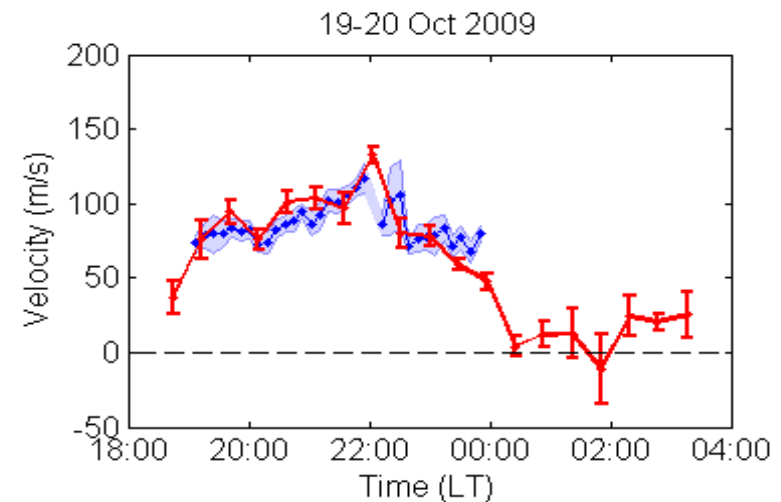
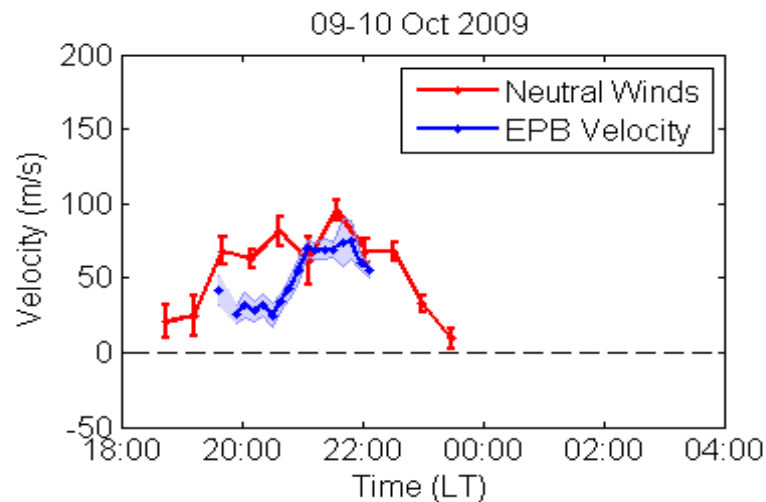
# Database: Peru-Chile

Month	Wind	EPB	Plasma	Wind_EPB	Wind_Plasma
Jan-Feb 2011	×	14	×	×	×
Mar-Apr	5	20	2	2	1
May-Aug	66	11	20	7	18
Sep-Oct	41	17	3	10	3
Nov-Dec	48	9	4	7	4
Jan-Feb 2012	59	29	×	29	×
Mar-Apr	37	20	×	13	×
<b>Total</b>	<b>256</b>	<b>120</b>	<b>29</b>	<b>68</b>	<b>26</b>

Wind\_EPB\_Plasma: 2 Nights

# Comparison of Winds and EPB Velocities

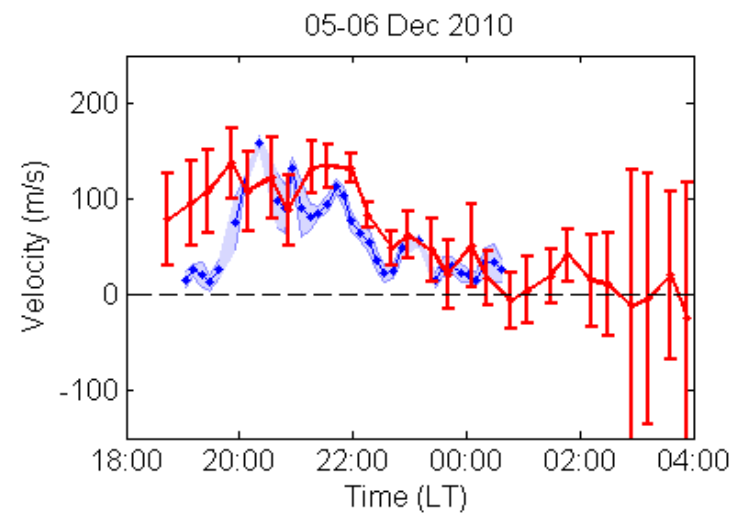
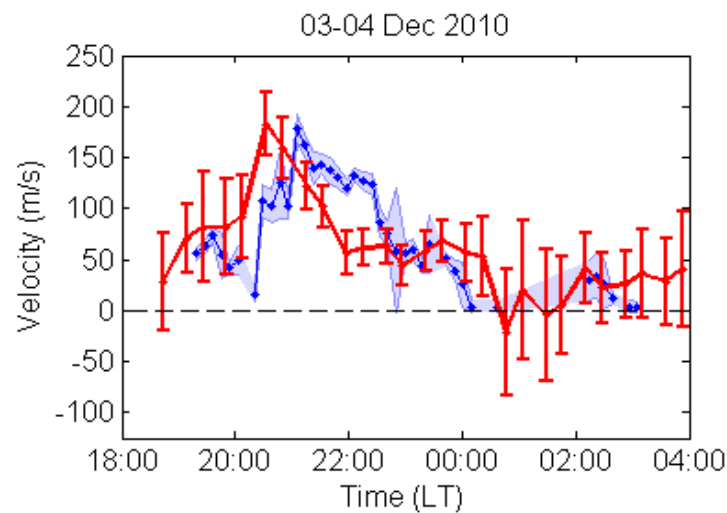
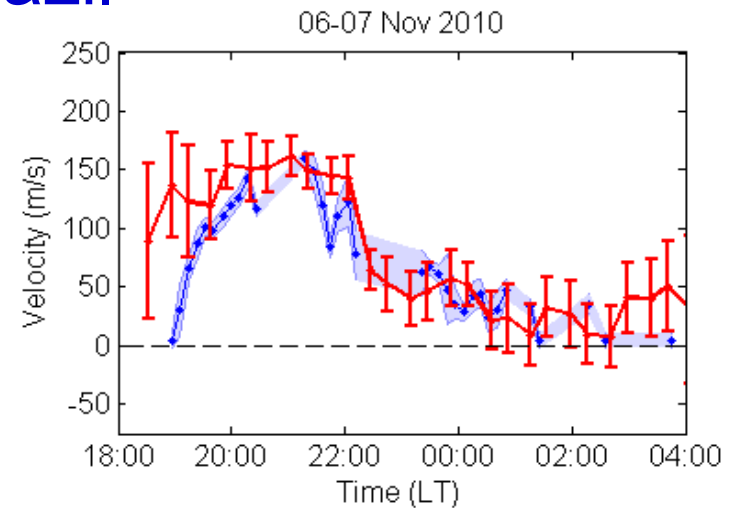
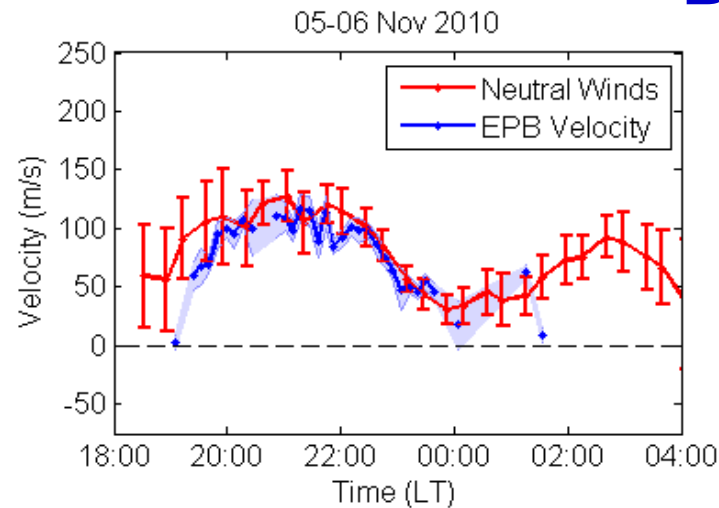
## Brazil





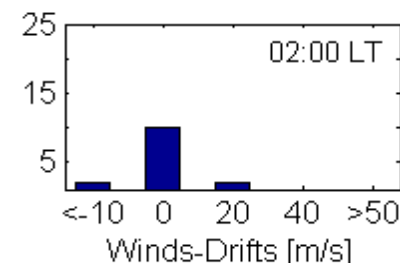
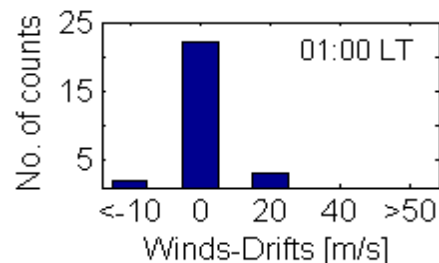
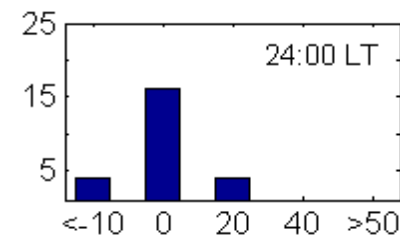
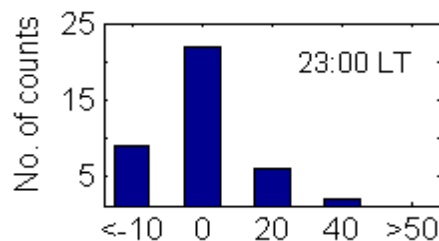
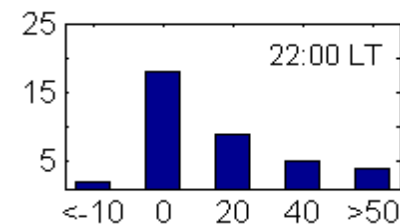
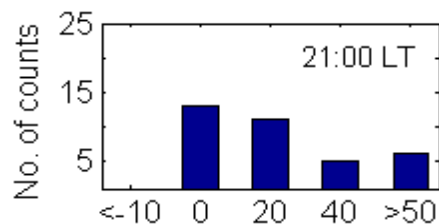
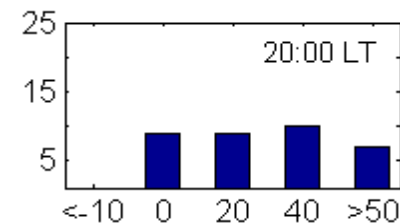
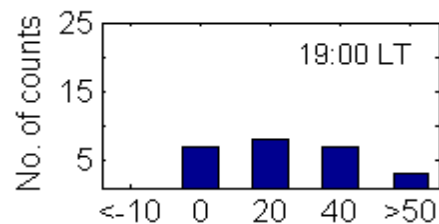
# Comparison of Winds and EPB Velocities

## Brazil



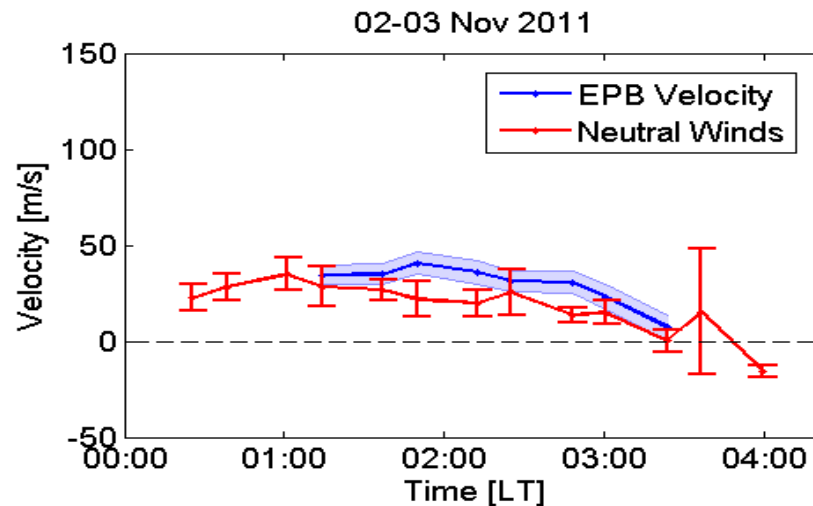
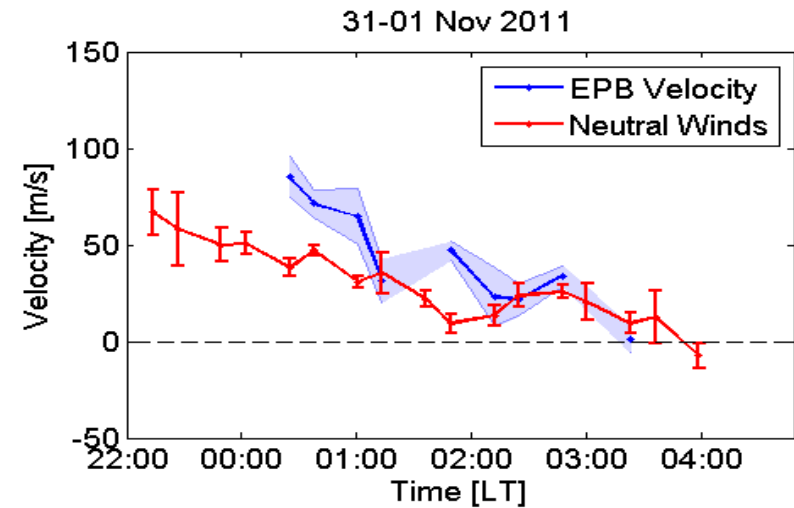
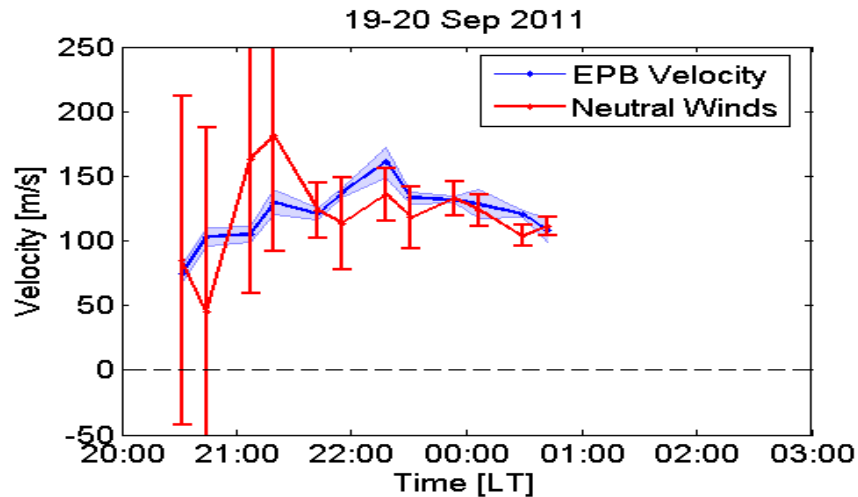
# Differences in Winds and EPB Velocities

- Early evening discrepancy (at  $\sim 20$  LT,  $\sim 70\%$  of total observations).
- Especially during the development phase of EPB the zonal velocity lags behind the neutral winds.
- Excellent agreement after  $\sim 22$  LT (up to 80%) i.e. F-region dynamo fully activated.



# Comparison of Winds and EPB Velocities

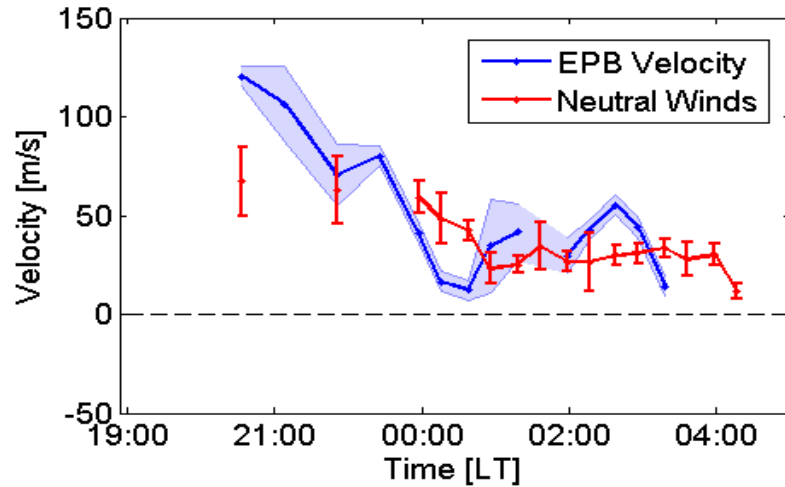
## Peru-Chile



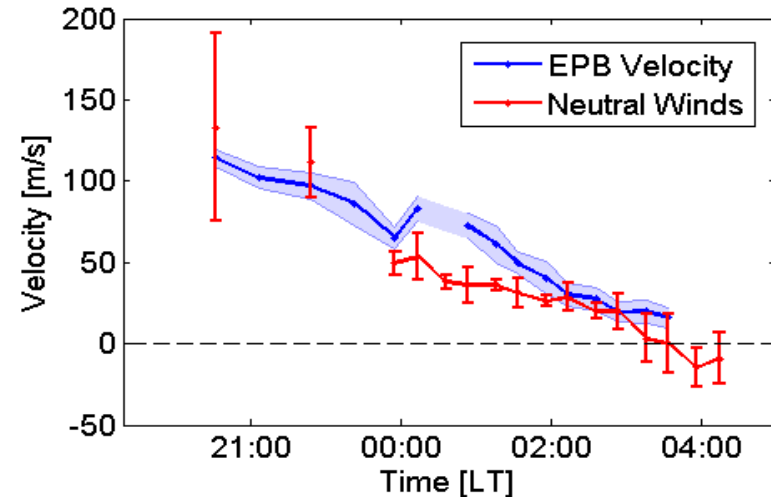
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## Peru-Chile

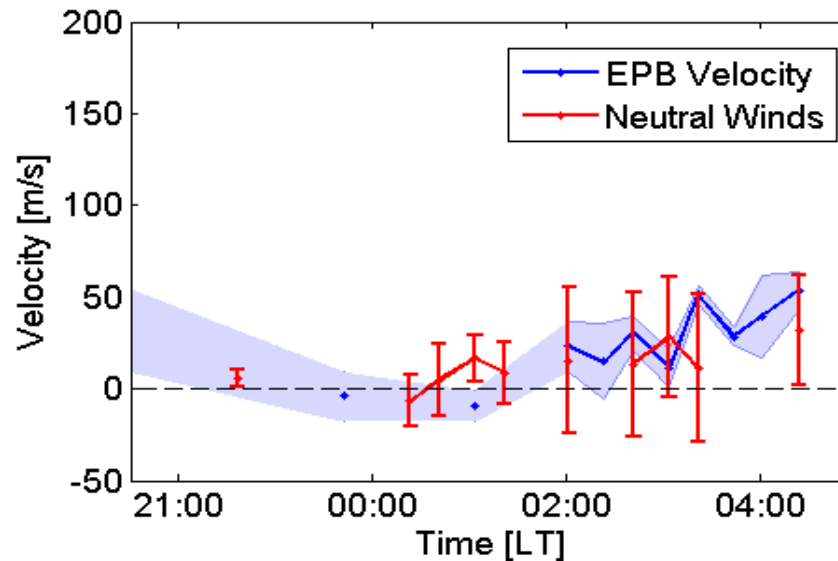
20-21 Feb 2012



25-26 Feb 2012



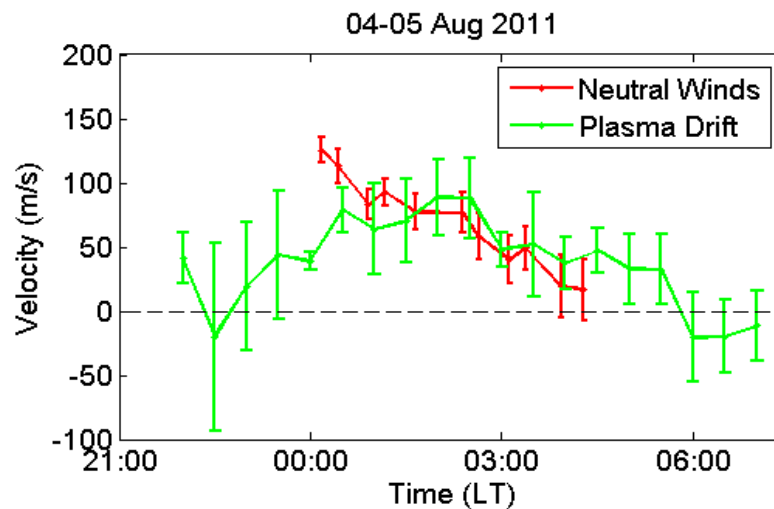
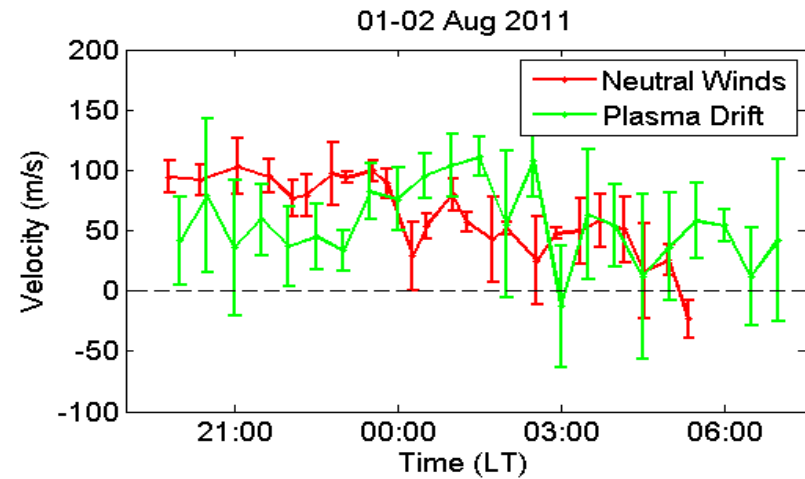
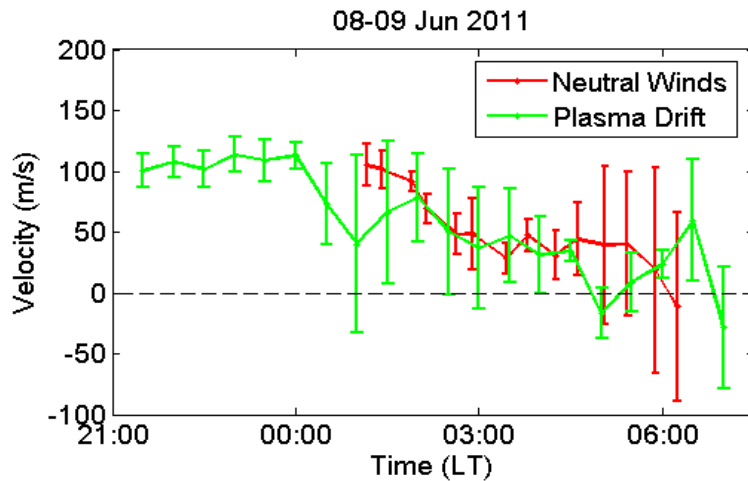
22-23 Mar 2012





# Comparison of Winds and Plasma Drifts

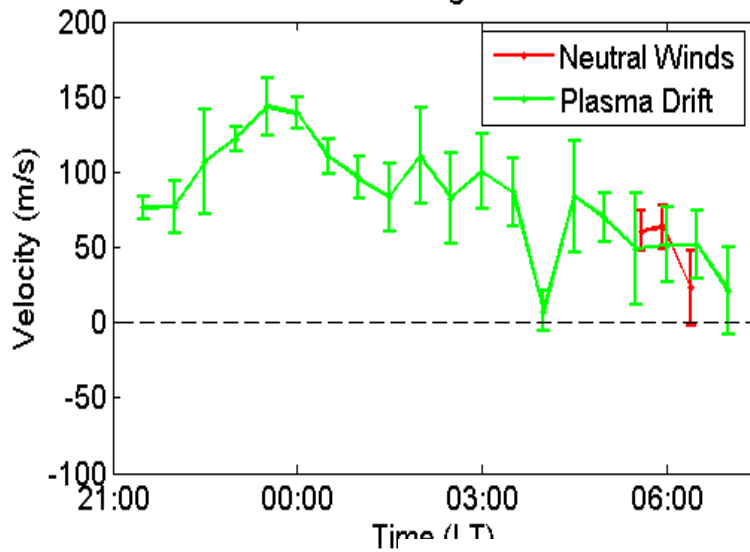
## Peru



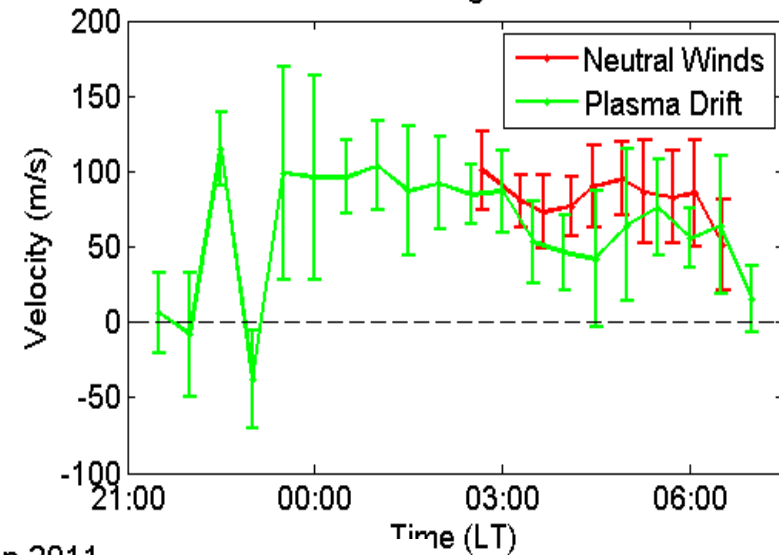
# Comparison of Winds and Plasma Drifts

## Peru

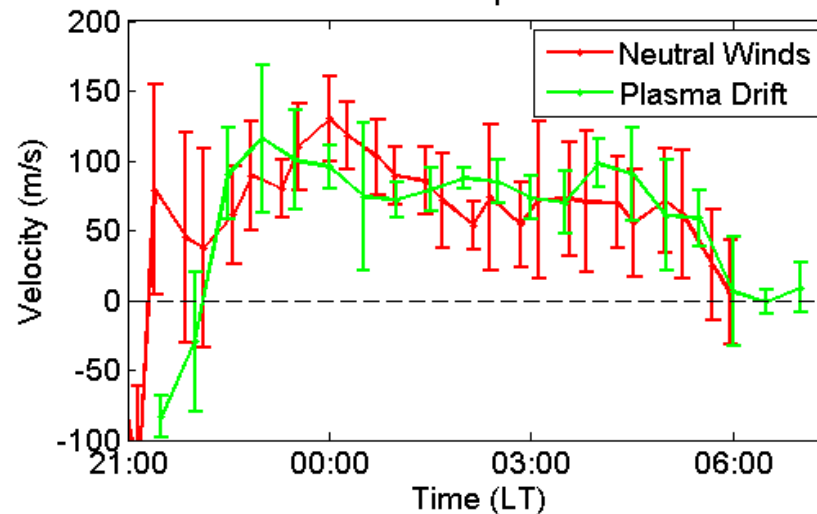
10-11 Aug 2011



07-08 Aug 2011

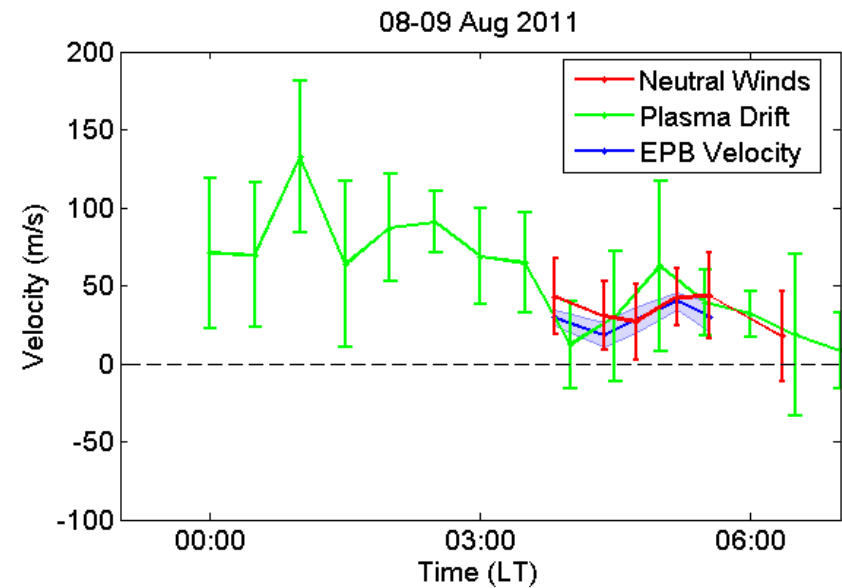
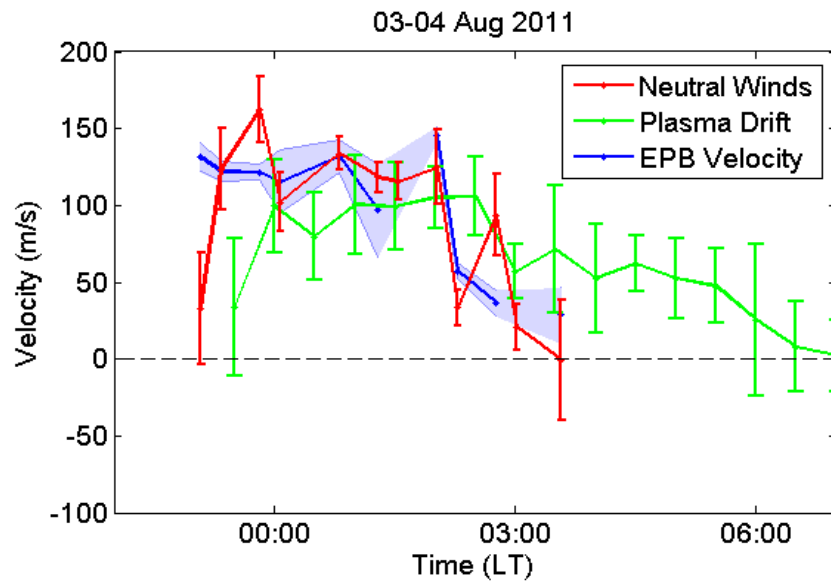


21-22 Sep 2011



# Comparison of Winds with EPB and Plasma Drifts

## Wind-Plasma-EPB



# Summary

- Caveats: The EPB velocity as a function of the assumed emission altitude (250 km) and velocity from Chile at higher latitude (i.e. apex height of  $\sim 300$ -600 km) and plasma drift measurements from different longitudes ( $\sim 250$  km).
- Brazil results show excellent agreement between zonal neutral winds and EPB velocities (  $\sim 80\%$  of total events).
  - In the early evening hour, most often ( $\sim 70\%$ ) the bubble velocity being slower than the neutral winds.
- The neutral winds and plasma drift velocity from Peru show coherence variability with EPB velocity from Chile.





**Thanks**