

The comparison between CHAMP data and GAIA model about electron density in the ionosphere

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1. Introduction

Motivation

If we understand electron density(Ne) in the ionosphere more deeply, we can develop physical understanding of ionosphere and confirm model's reproducibility.

Purpose

To understand Ne in the ionosphere more deeply, I want to know seasonal changes of Ne and how that has time and location trends.

2. Methods

Approach : Comparison CHAMP data with GAIA model

GAIA (**G**round-to-topside model of **A**tmosphere and **I**onosphere for **A**eronomy)

• Atmosphere-Ionosphere coupled model for aeronomy

Ionosphere
Shinagawa et al. (2007)

Jin et al. (2011)
J.G.R., A01316

Electrodynamics
Jin et al. (2008)

neutral atmosphere (GCM)
Miyoshi and Fujiwara (2003)

Courtesy of Dr. Y.Miyoshi

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CHAMP(Challenging Mini-Satellite Payload)



Its orbital plane proceeds through all local times every 4 months and through all longitudes at a fixed local time every 24 h.

[Gunter's Space Page(http://space.skyrocket.de/doc_sdat/champ.htm)]

Data set

Year:2002(solar maximum)

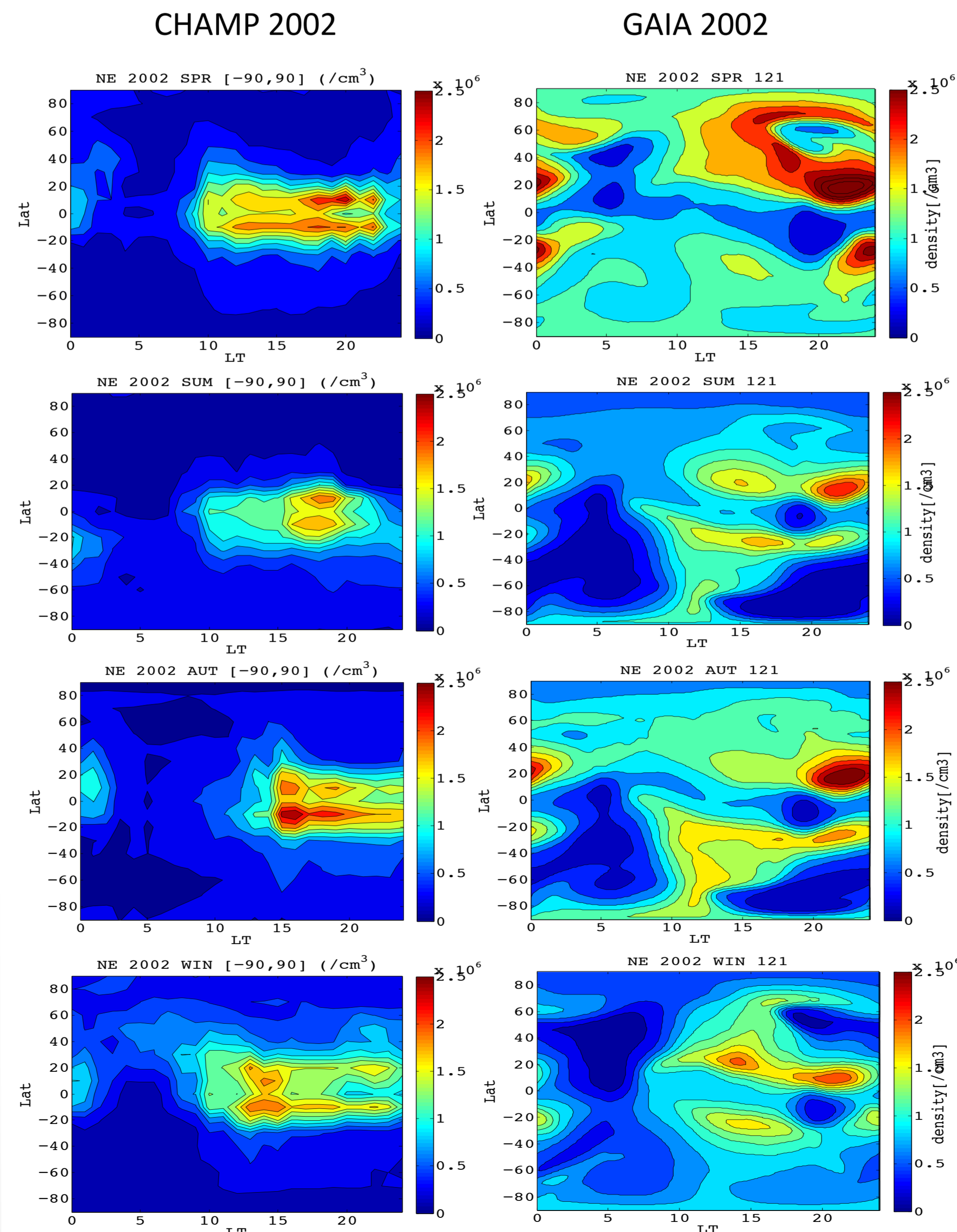
Altitude: about 400km

Two-dimensional contour map about Ne by CHAMP and GAIA model;

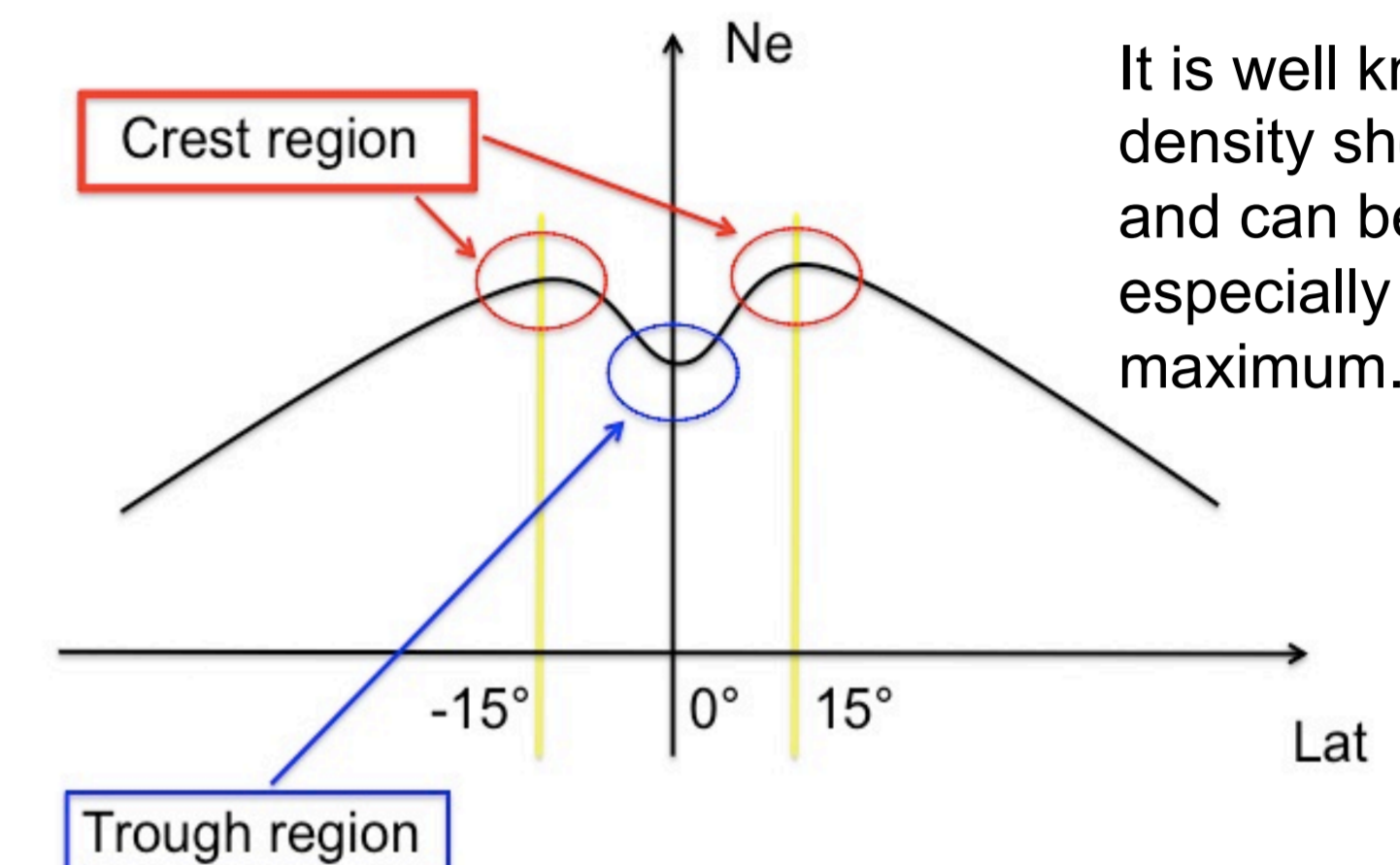
SPR: 121day(center 3/21), SUM:121day(center 6/21)

AUT:121day(center 9/21), WIN:121day(center 12/21)

3. Data and Results

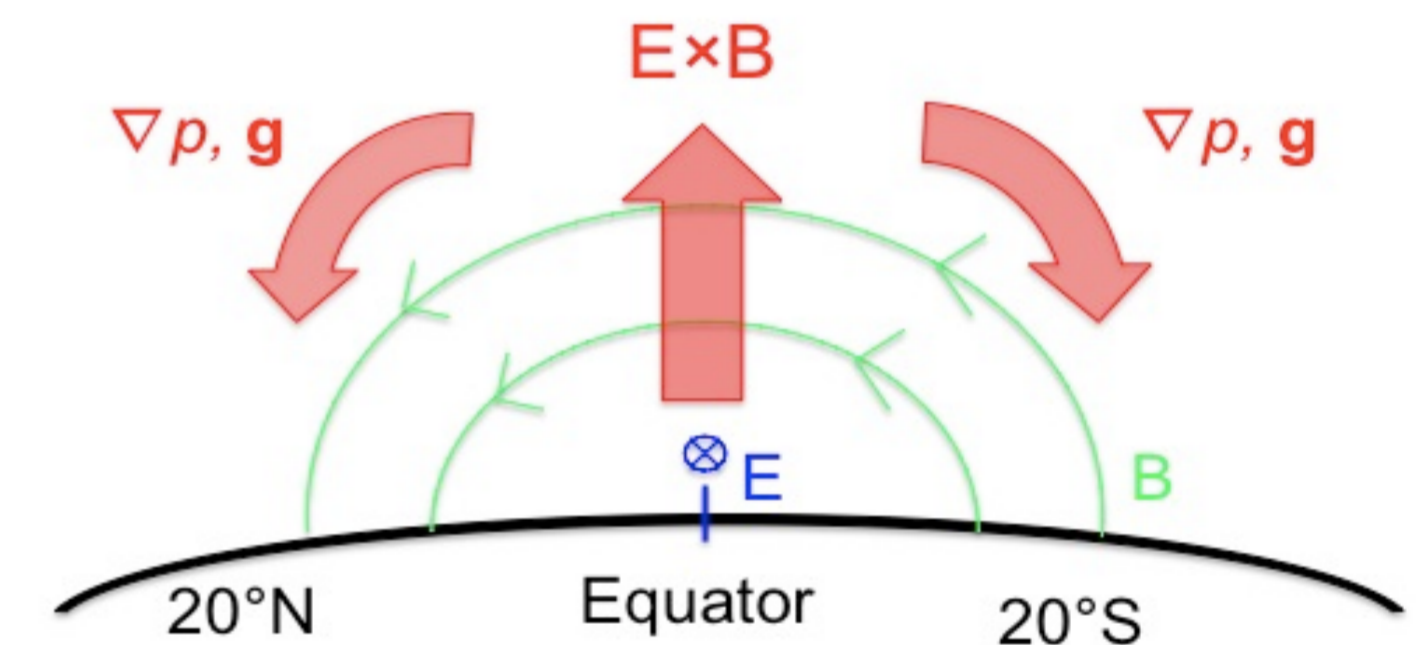


EIA(equatorial ionization anomaly) structure



It is well known that electron density shows this structure, and can be observed clearly especially during solar maximum.

Equatorial fountain



At low latitudes the Equatorial Ionization Anomaly (EIA) is an ionospheric region with high-electron density peaks, observed around 15 degrees north and south of the magnetic equator. This electron density increase in low latitudes has its origin in the upward vertical $E \times B$ plasma drift of the equatorial F layer.

4. Conclusion and Future Work

Conclusion

- CHAMP and GAIA generally show similar structures.
 - EIA(equatorial ionization anomaly) structure
- CHAMP and GAIA show similar seasonal variations.
 - spring and autumn show higher values than summer and winter.

Future work

- Investigate further the Ne seasonal variation.
 - I will examine specially the difference between spring and autumn, because both are often referred as 'equinox'.
- Investigate Ne seasonal variations of spring and autumn by using of CHAMP data and compare it with GAIA model.
 - I will investigate using solar minimum (2009) data.