

Latitudinal and Altitudinal Changes of Day-to-Day Variability of Electron Density in the Topside

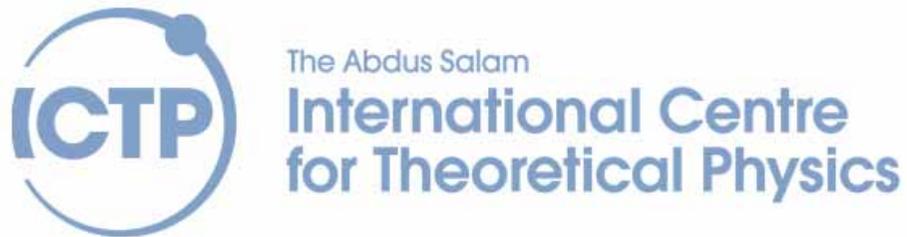
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ICTP IRI Task Force Activity

200-2004



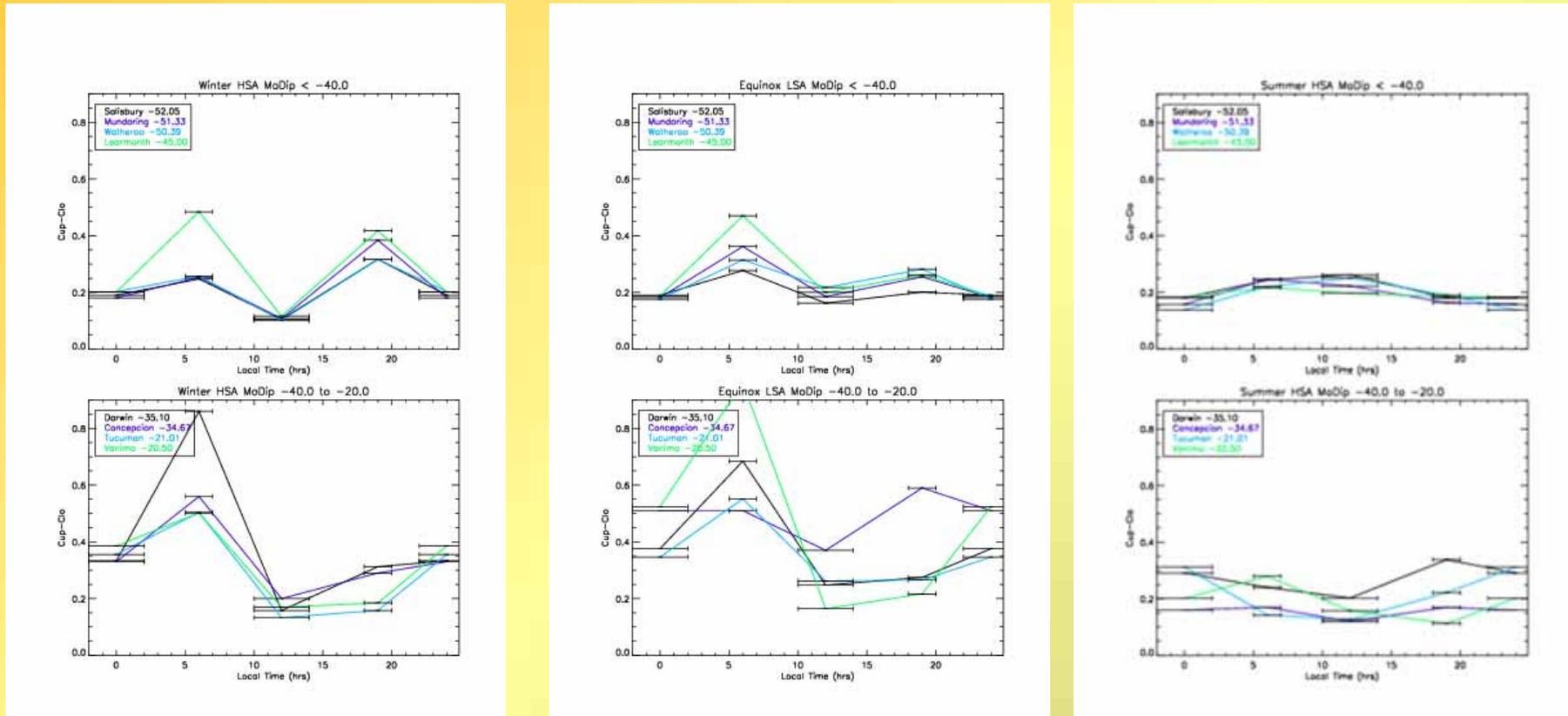
Parameters: $foF2$, $foF1$, foE , $hmF2$, $B0$, $B1$, TEC

Variability measure: *upper & lower quartiles/median*

Results: *characteristic values for day/night, 4 seasons, high/low solar activity, low/middle modip latitude*

Issues: *magnetic contribution was not resolved; large number of models; applications often require variability at various heights along the profile.*

$Cup = \text{Upper Quartile} / \text{Median}$ For Normal Distribution:
 $Clo = \text{Lower Quartile} / \text{Median}$ $Cup - Clo = 1.35 * \text{STD} / \text{Mean}$



Main trends of percentage variability:

= greater during nighttime than during daytime; largest values during sunrise and sunset.

= increase towards higher latitudes; largest near anomaly crests.

= seasonal variation changes with latitude, LT, and solar activity; smaller at low latitudes



November | 21 | 22 | 23 | 2012
CONICET - CCT / La Plata
Argentina



Argentine Network for Upper Atmosphere Research

Participants Variability Study: D. Altadil, D. Bilitza, C. Brunini, D. Buresova, F. Conde, R. Ezquer, E. Gularte, M. Mosert (Project Lead), B. Opperman (PLEASE CONTACT MARTA OR ME IF YOU ARE INTERESTED TO JOIN).

Differences to Prior IRI Variability Study:

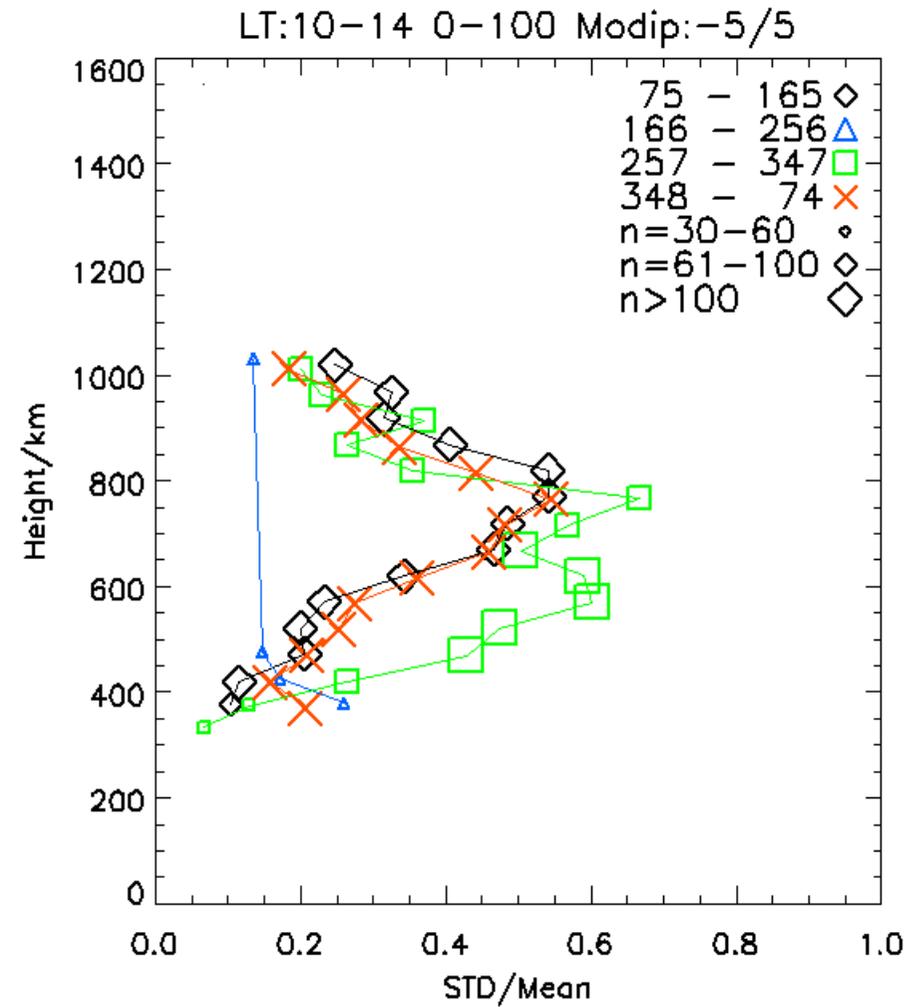
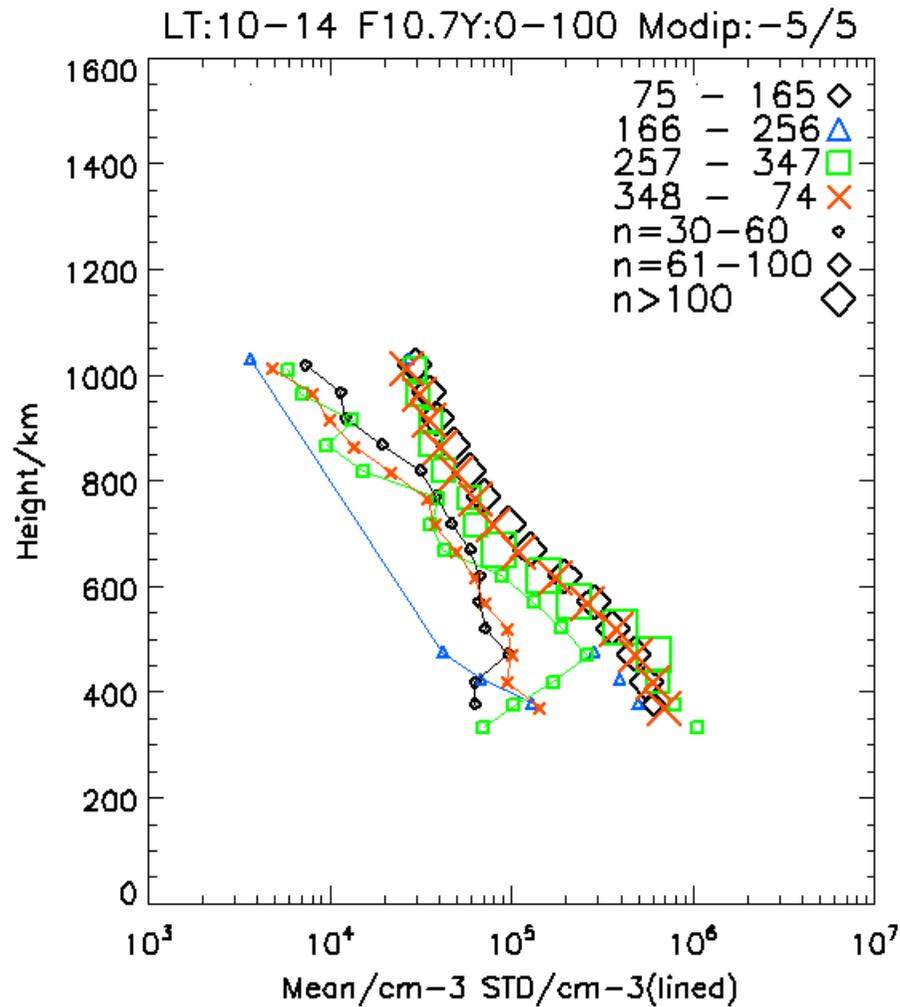
- ❖ Excluding storm effects focusing on variability of quiet-time ionosphere (daily $ap \leq 15$, $kp \leq 3$).
- ❖ Use mean and standard deviation instead of median and quartiles; differences between these measures of variability are small compared to station-to-station differences. The parameter used is $PV = \text{STD} / \text{Mean} \approx (C_{up} - C_{lo}) / 1.35$.
- ❖ Use satellite data for a better representation of global changes in variability (COSMIC, ISIS/Alouette).

**Alouette 1, 2, ISIS 1, 2 Topside
Sounder Data
~170,000 profiles**

**Study of the day-to-day
variability of electron density
(PV) in the topside ionosphere**

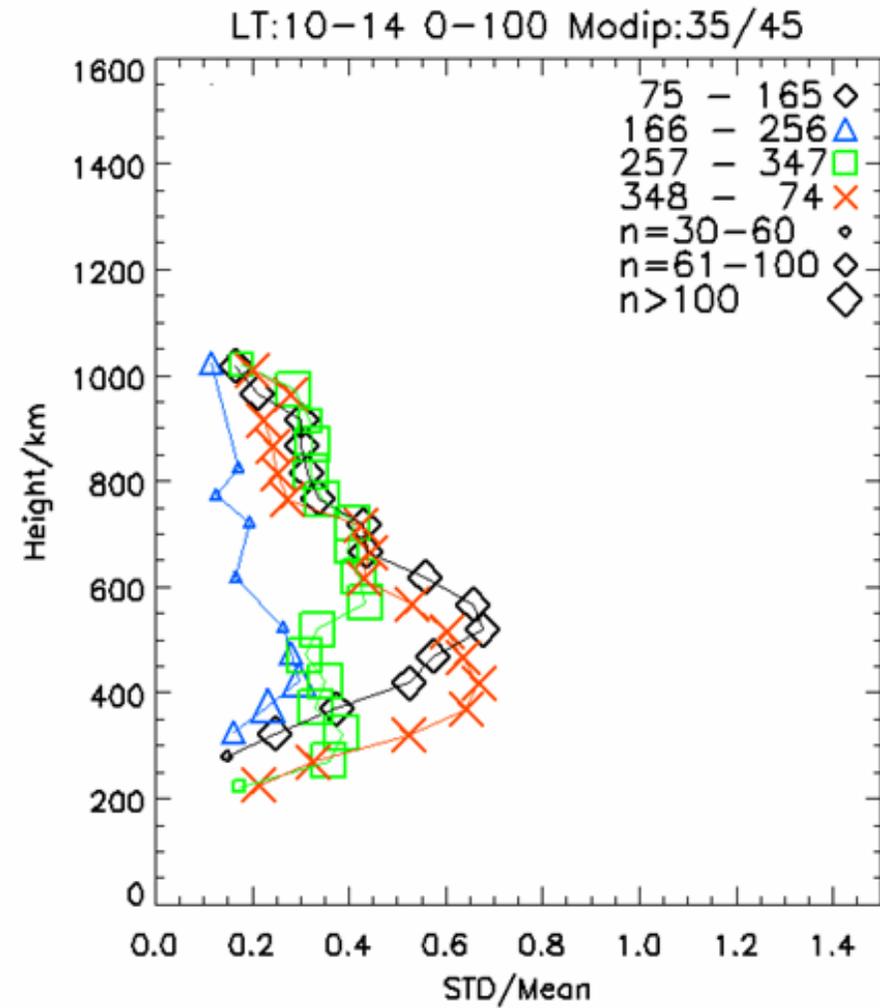
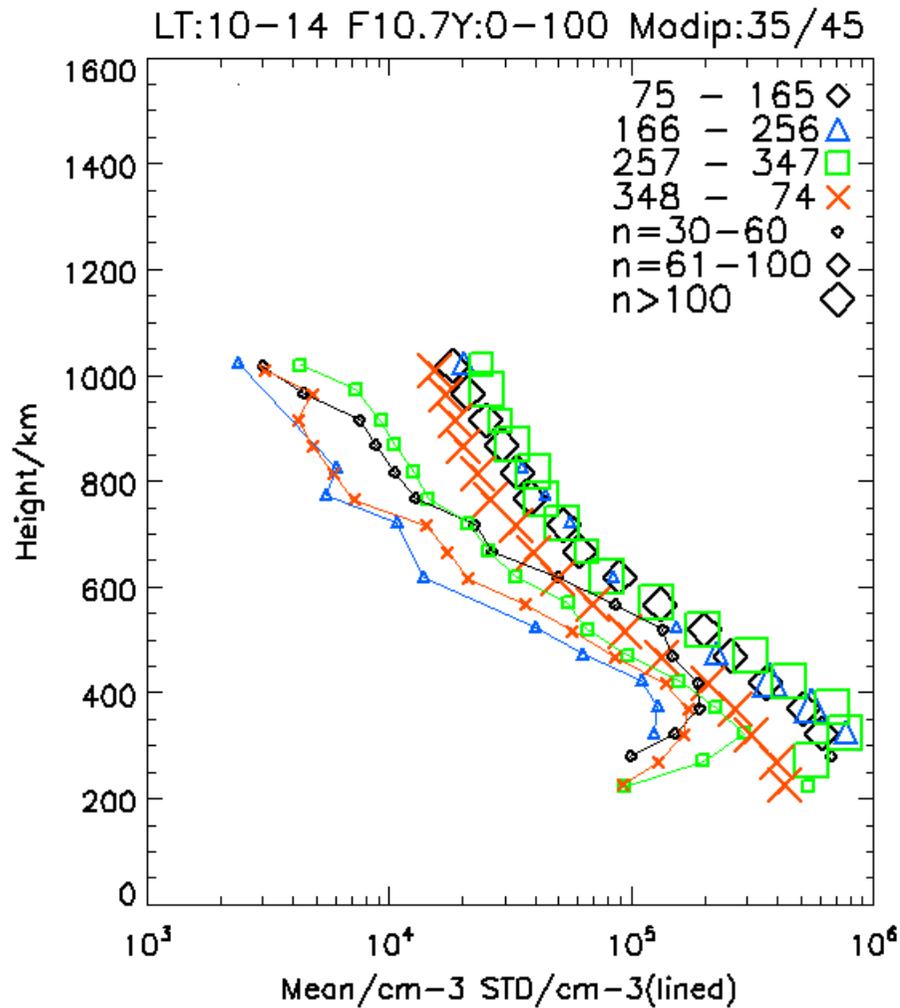
Altitudinal Variation of Day-to-Day Variability

LT: 10-14, LSA, modip=-5 to +5

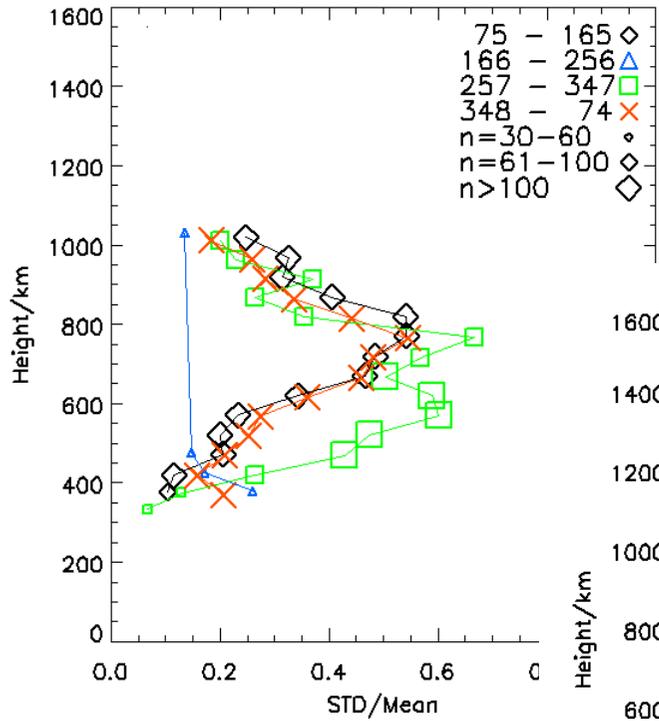


Altitudinal Variation of Day-to-Day Variability

LT: 10-14, LSA, modip=35-45

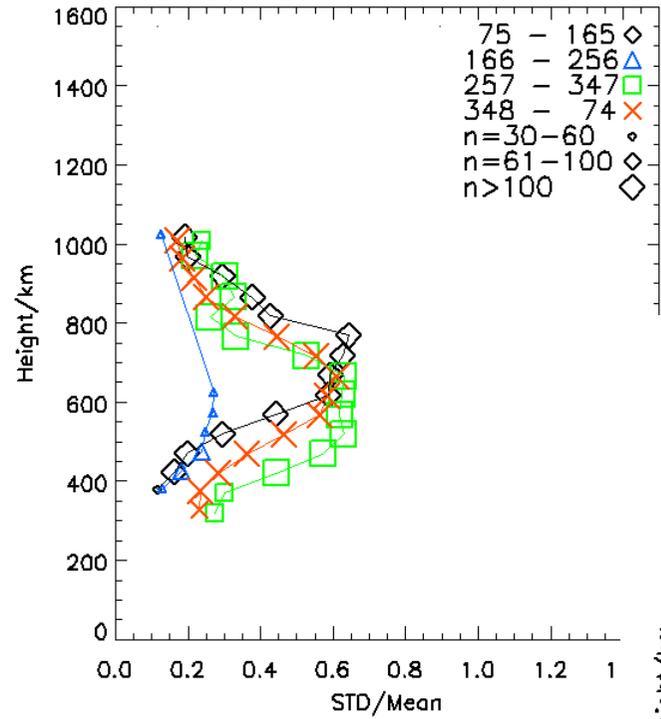


LT:10-14 0-100 Modip:-5/5



Modip = -5 to +5

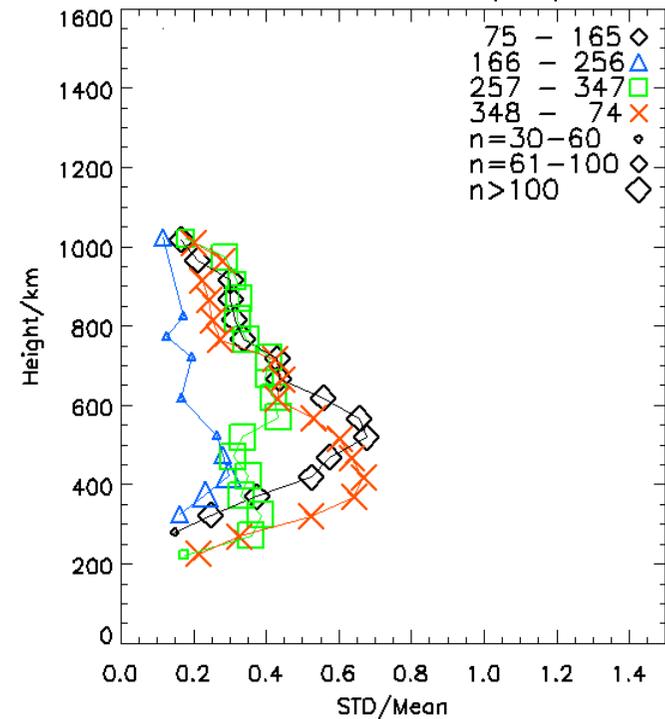
LT:10-14 0-100 Modip:15/25



Modip = 15 to 25

Modip = 35 to 45

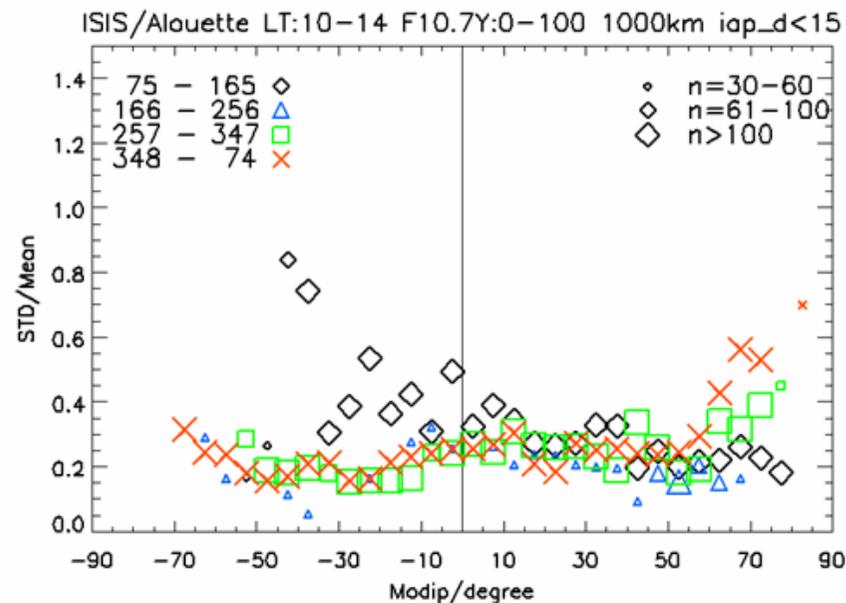
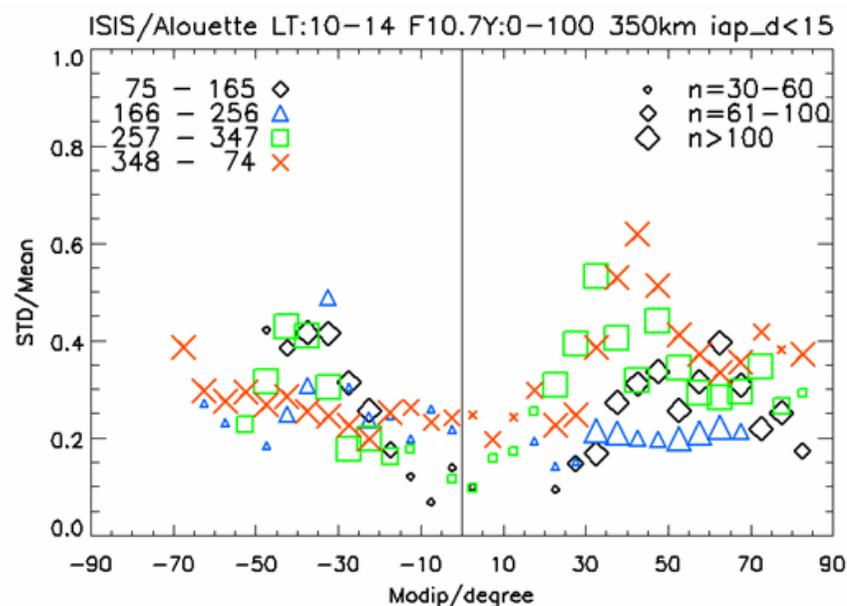
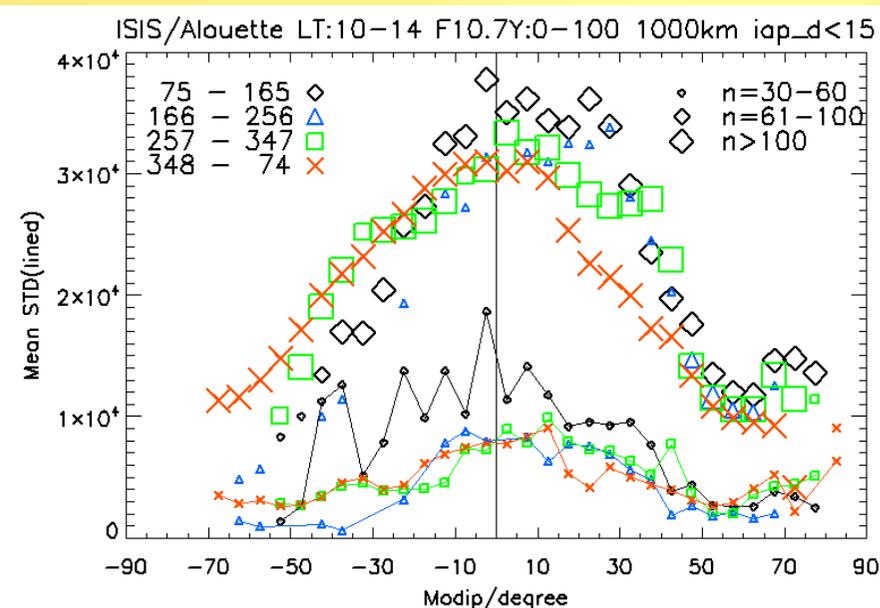
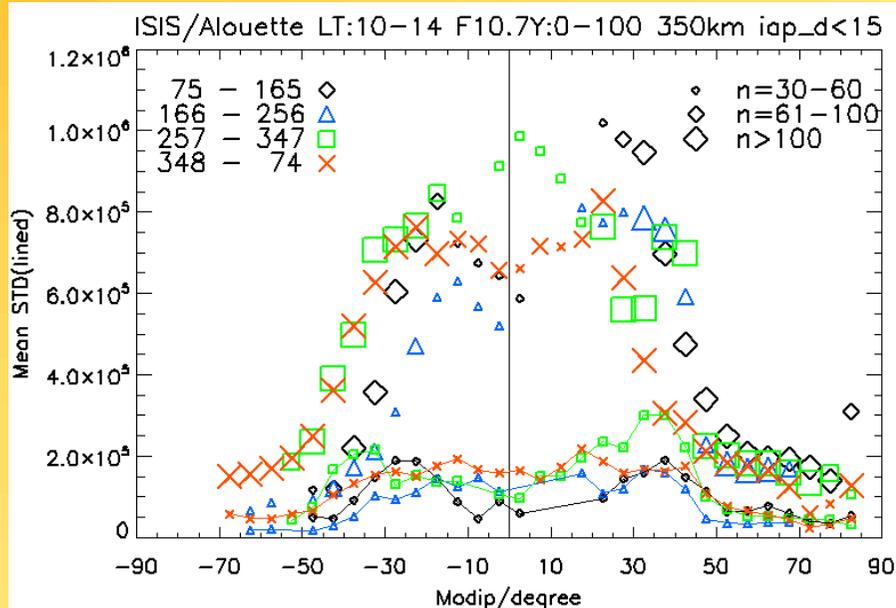
LT:10-14 0-100 Modip:35/45

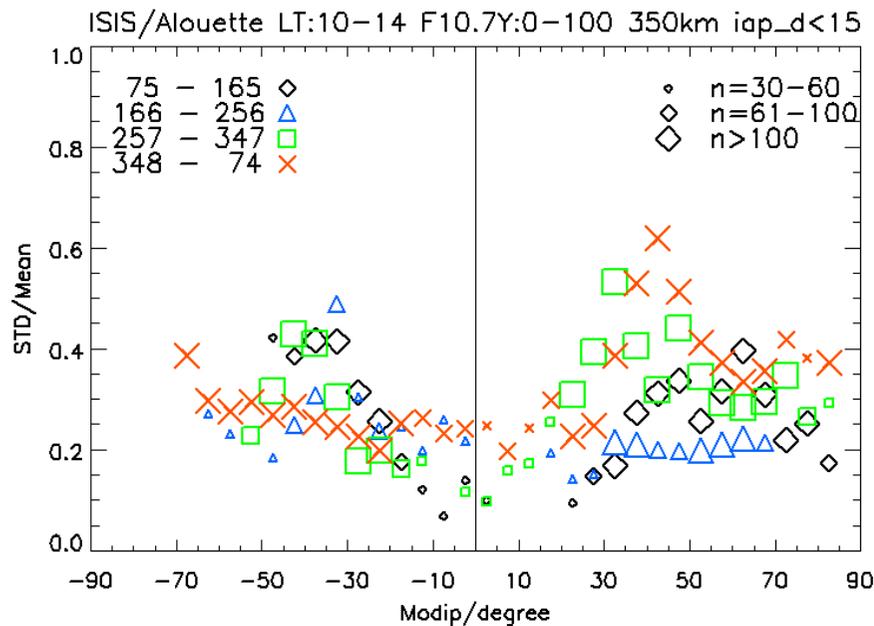


PV = STD/Mean

Latitudinal Variation of Day-to-Day Variability, LT: 10-14, LSA, h=325-375 km

h=900-1100 km

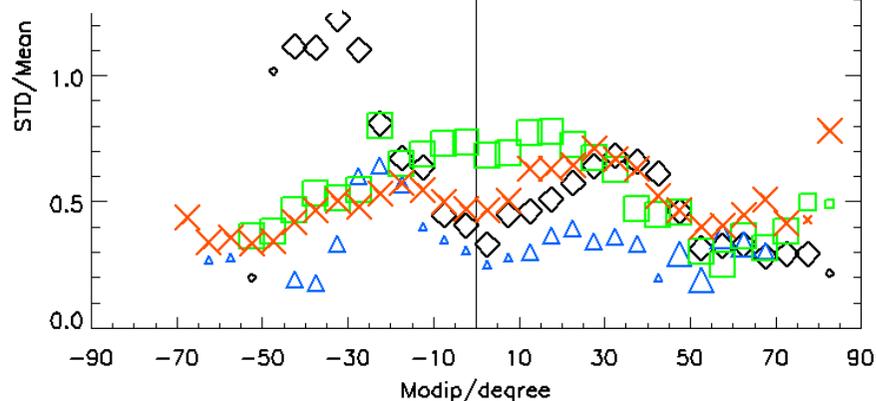




h = 325-375 km

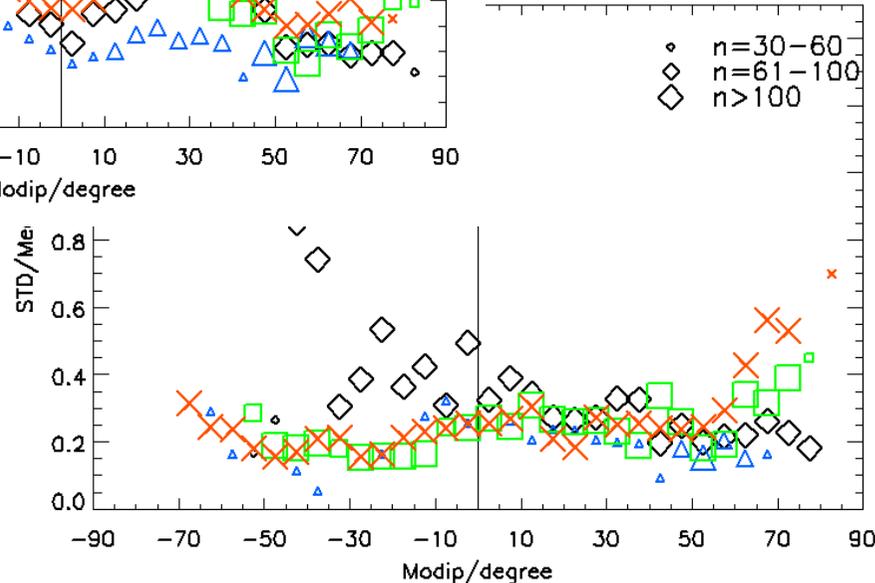
h = 550-650 km

)-14 F10.7Y:0-100 600km iap_d<15



h = 900-1100 km

Y:0-100 1000km iap_d<15

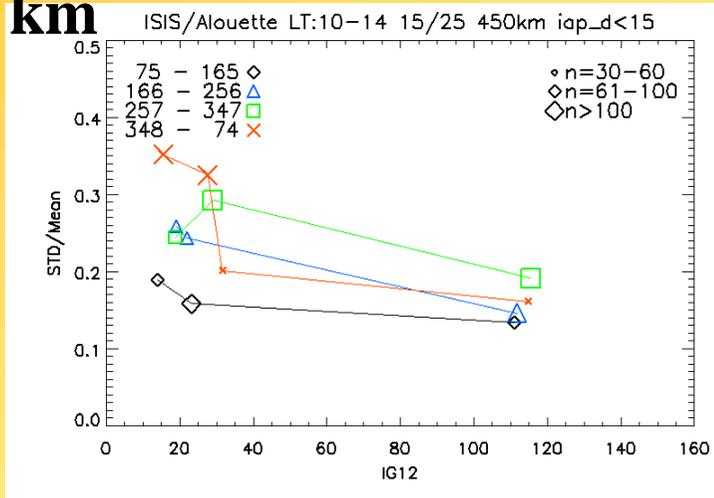


**PV variation
with modip**

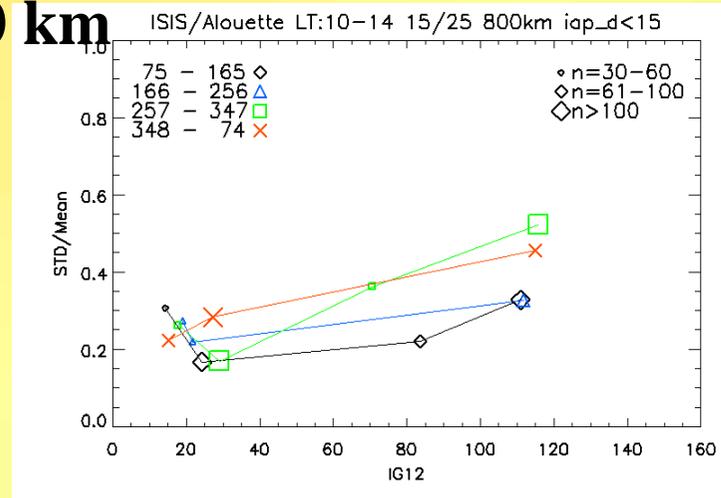
PG Variation with solar activity (IG-12)

LT: 10-14, LSA, modip=15-25

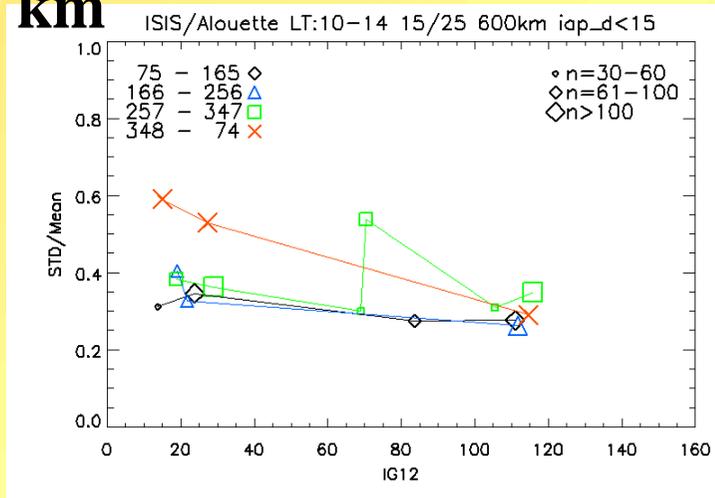
450 km



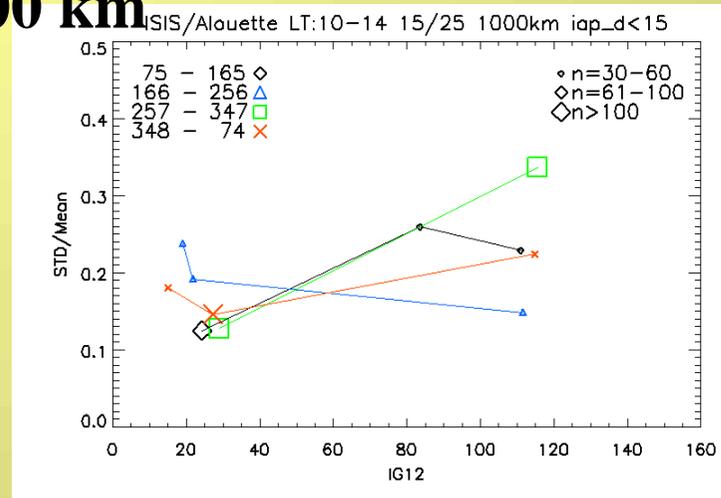
800 km



600 km



1000 km



SUMMARY

In the topside ionosphere the day-to-day variability (STD/Mean) of electron density →

- **reaches a maximum at 400-800 km and decreases to higher and lower altitudes.**
- **the height of this maximum decreases from 800km to 400 km from the magnetic equator to middle latitudes.**
- **the latitudinal distribution in the F-region shows maximal day-to-day variability at the flanks of the equatorial anomaly. Higher up the latitudinal variations is almost constant.**
- **Percentage variability decreases for lower altitudes**
- **(< 700 km) and increase for higher altitudes.**

