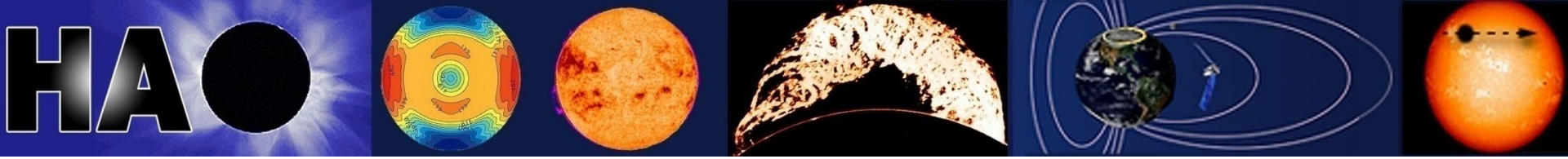

Longitudinal TEC differences during the 2010 SSW period in the observations and the TIME-GCM

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Objective:

- Asses two TIMEGCM simulations of the 2010 SSW periods
- Compare longitudinal differences of TEC in the data and the model

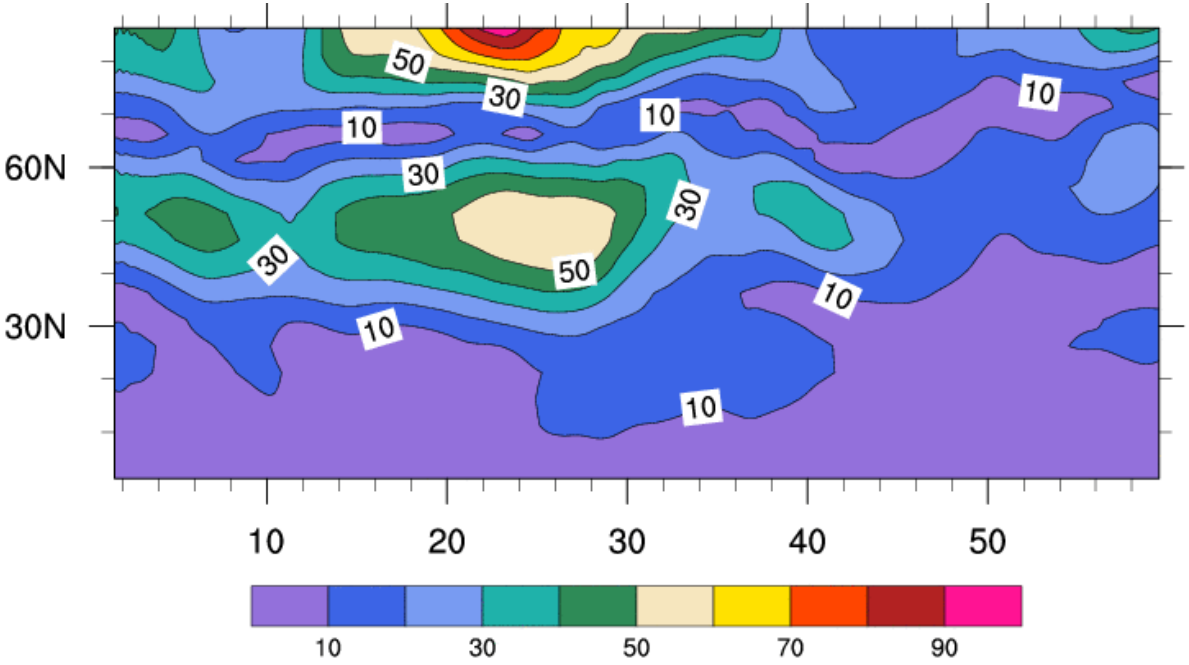
Observations: GPS TEC

2010 SSW simulations: TIMEGCM with time varying high latitude forcing

1. With daily averaged ECMWF and GSWM09 tidal climatology at lower boundary
2. Nudged TIMEGCM zonal mean with WACCM/NOGAPS results, and tidal specification from WACCM/NOGAPS simulation at the lower boundary

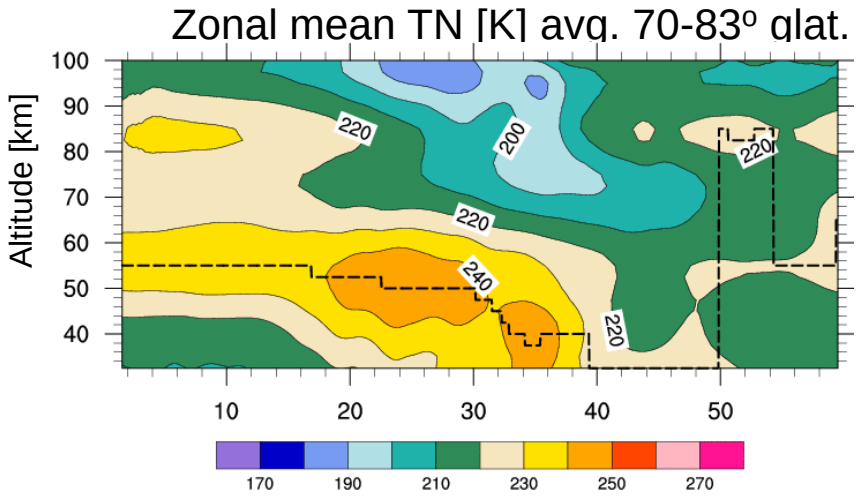
PW1 amplitude in UN during Jan/Feb 2010

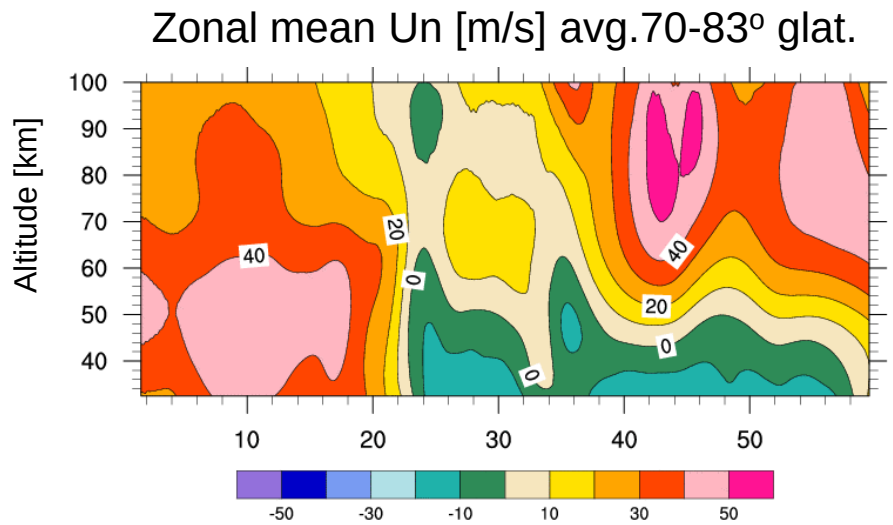
PW1 amplitude in zonal wind at 32 km



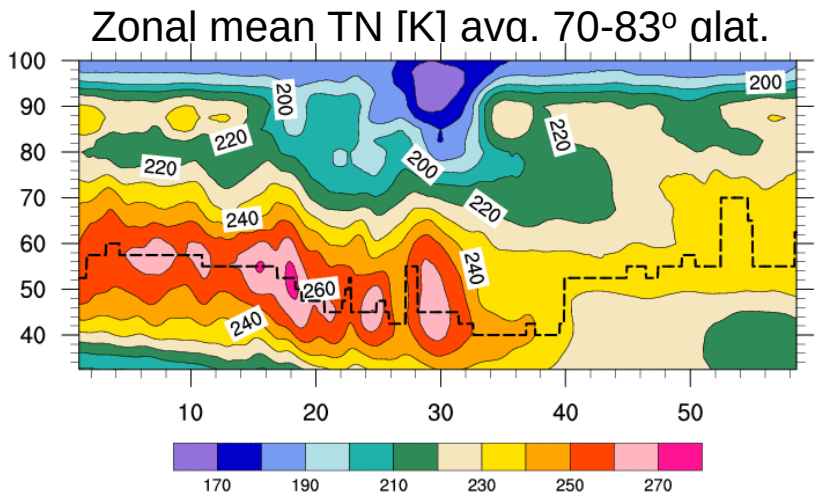
Zonal mean temperature and zonal wind at 32 km for Jan/Feb 2010

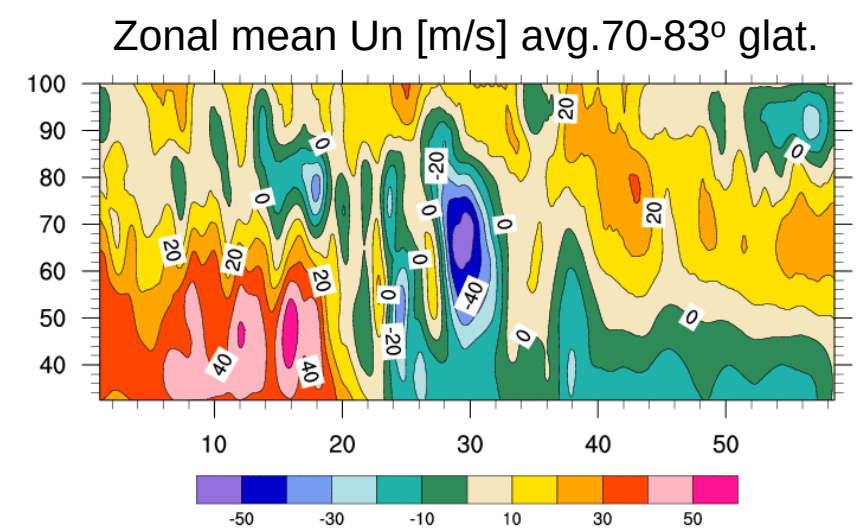
TIMEGCM with ECMWF and GSWM09 tidal climatology





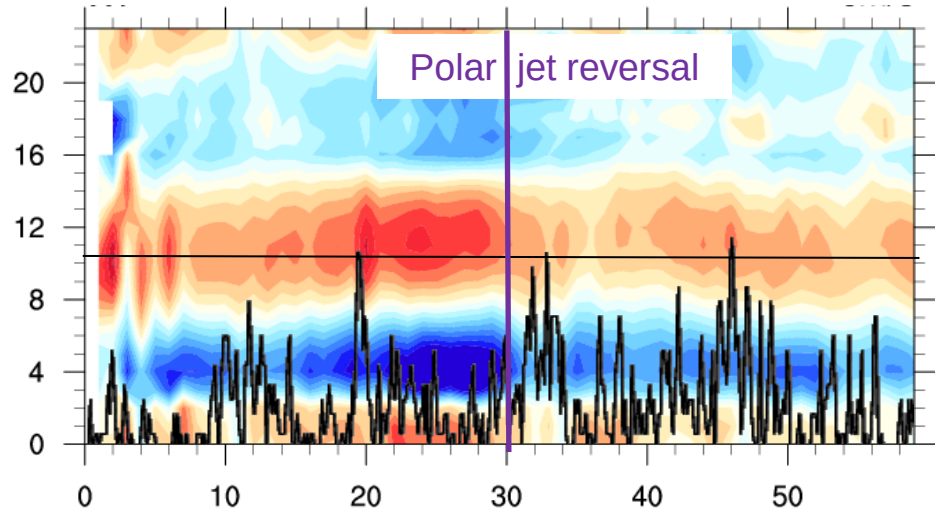
TIMEGCM nudged by WACCM/NOGAPS



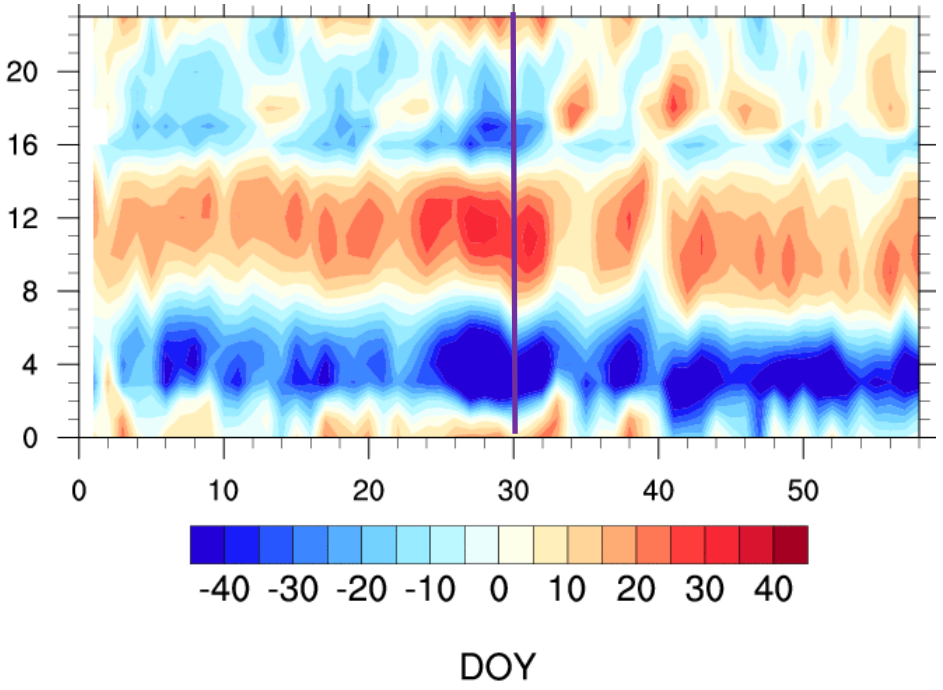


Vertical drift at Jicamarca for January 2010

TIMEGCM with ECMWF and GSWM09 tidal climatology



TIMEGCM nudged by WACCM/NOGAPS

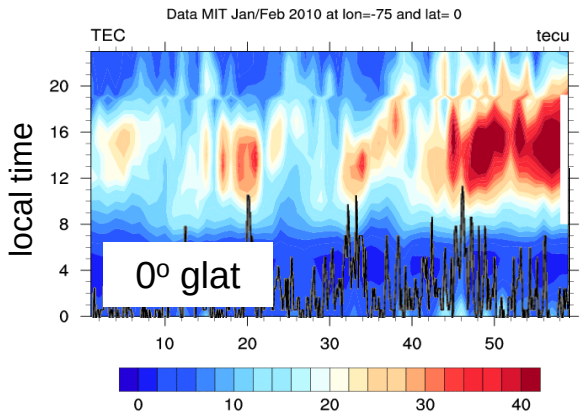


- Increased day-to-day variability in TIMEGCM/WACCM
- Decrease in vertical drift after day 30
- After day 40 daytime peak moves to earlier local times
- Effects from geomagnetic activity and/or SSW?

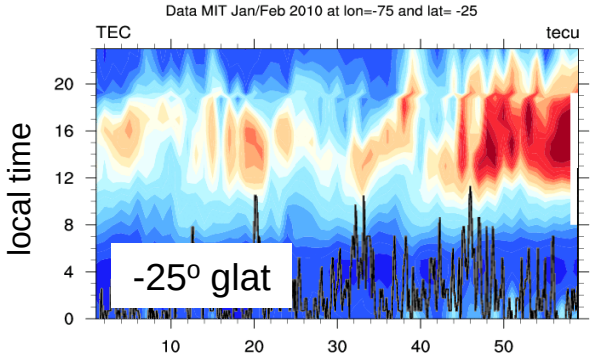
EIA TEC at -75º glon. for Jan/Feb 2010

NH

SH

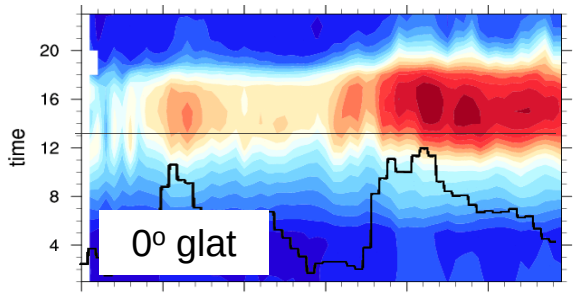


GPS TEC observations



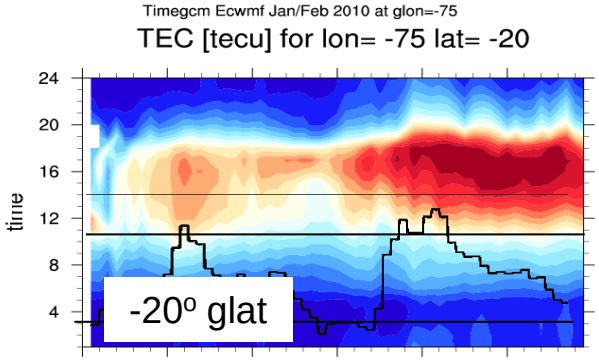
Kp

Kp



TIMEGCM with ECMWF and GSWM09 tidal climatology

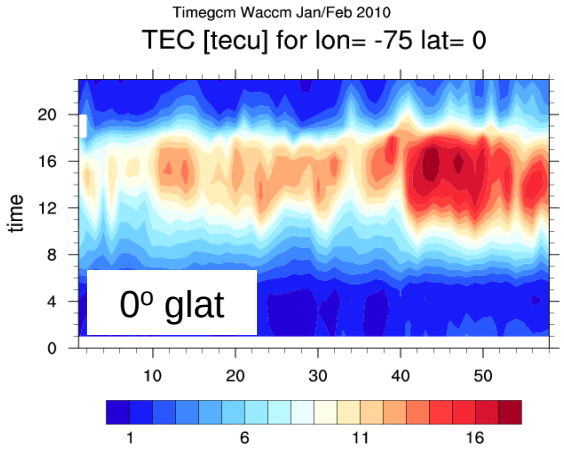
F10.7



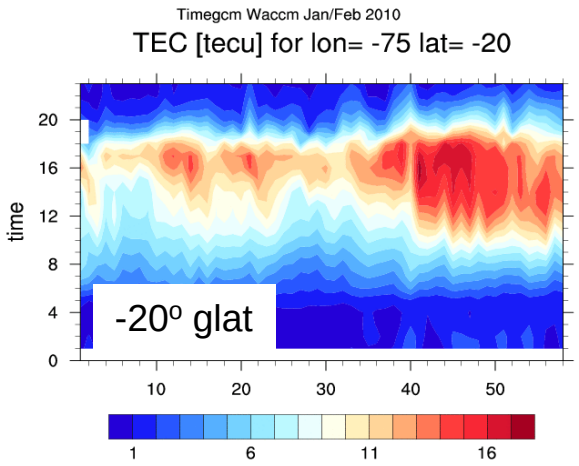
F10.7

90sfu

70sfu



TIMEGCM nudged by WACCM/NOGAPS



Average EIA TEC at 40º glon. for Jan/Feb 2010

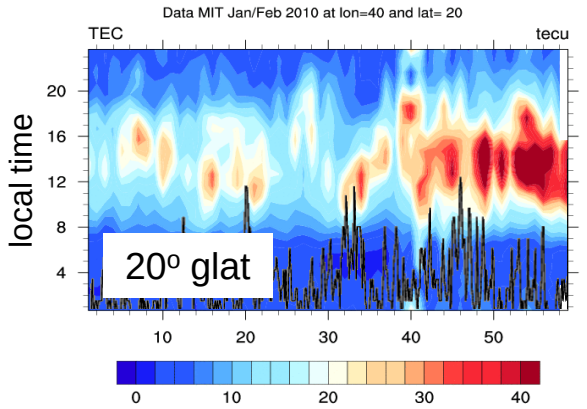
NH

SH

GPS TEC observations

TIMEGCM with ECMWF and GSWM09 tidal climatology

TIMEGCM nudged by WACCM/NOGAPS



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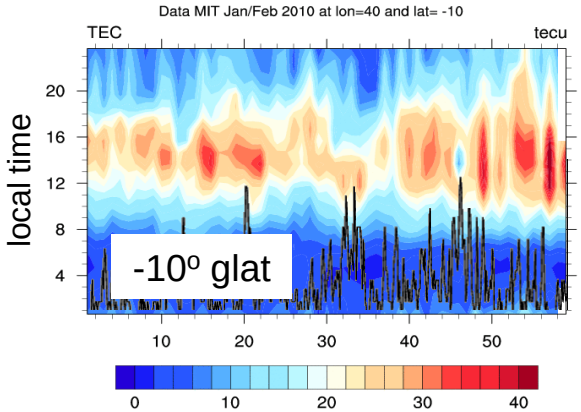

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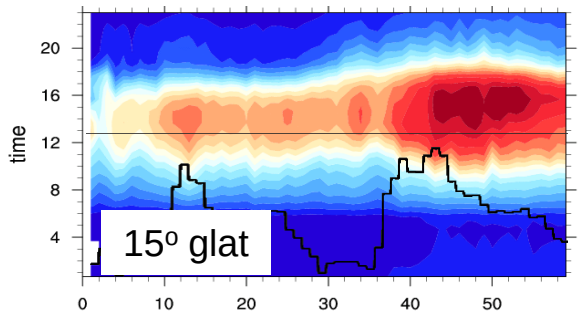

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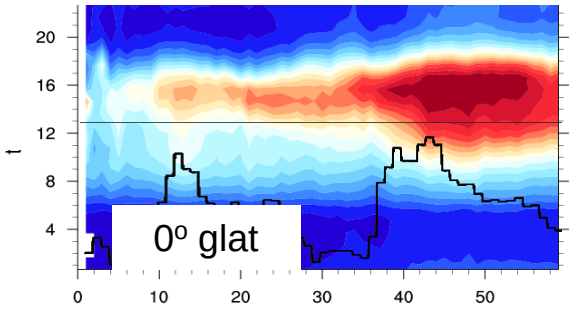
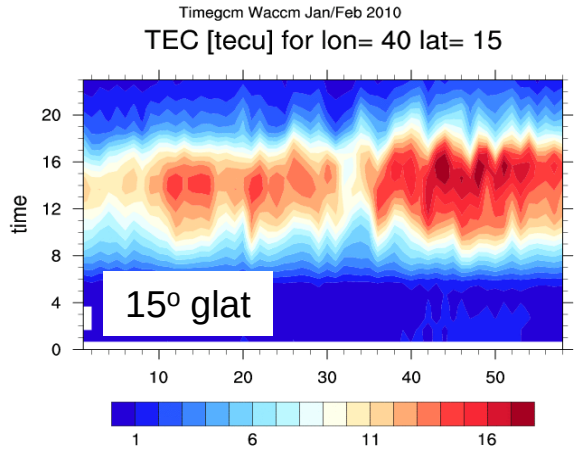
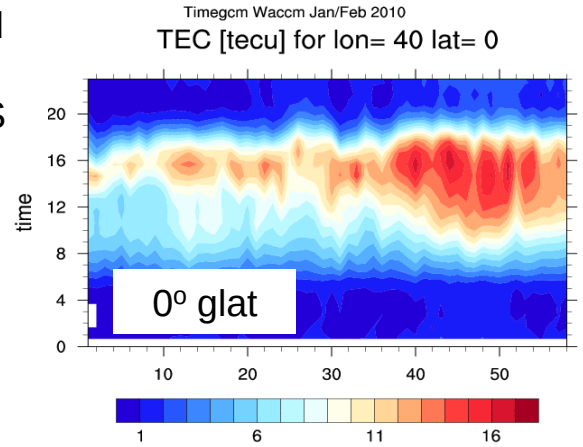


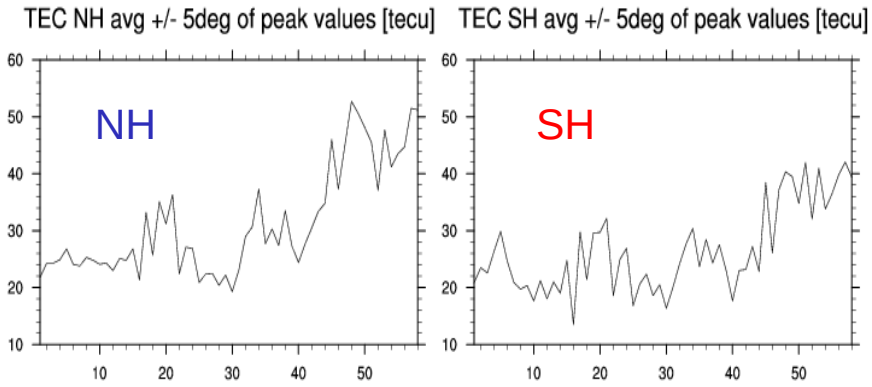
F10.7



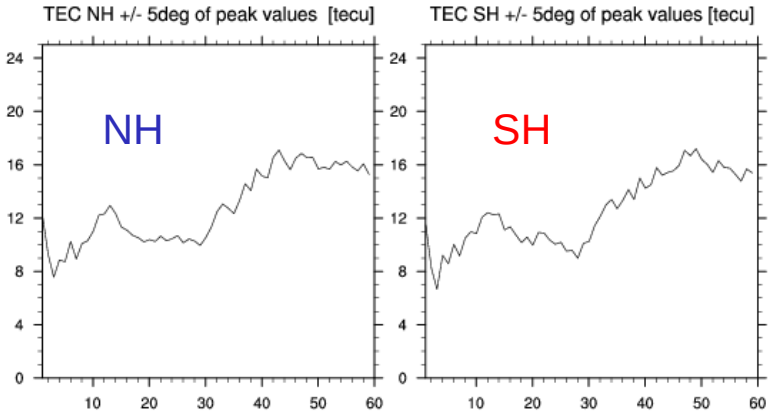


Peak TEC at -75^{o} geog. longitude for January 2010

GPS TEC

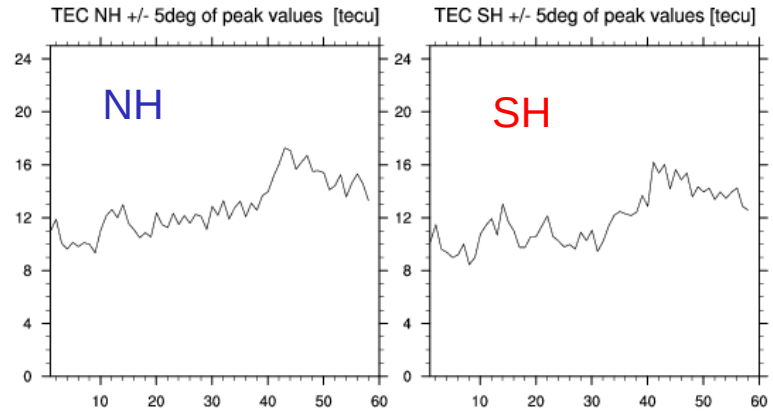


TIMEGCM with ECMWF and GSWM09 tidal climatology



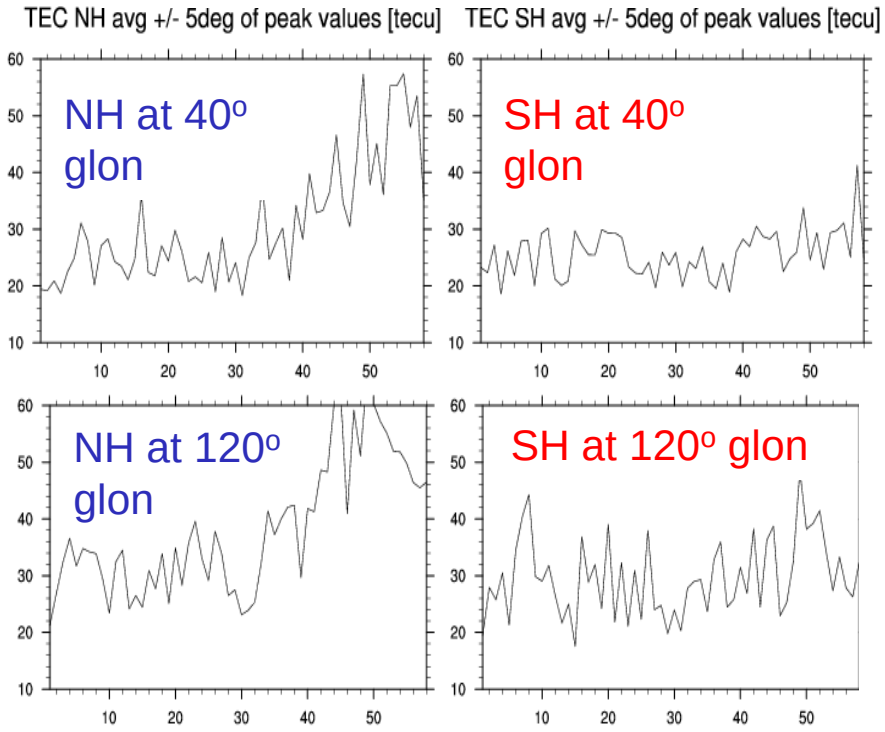
- Observations show a stronger response in NH TEC than SH TEC.
- TEC increase in observation is larger (~50% after day 40) than in simulations (~30% after day 40).
- In the simulations the magnitude of the TEC response seems to be more hemispherically symmetric.

TIMEGCM nudged by WACCM/NOGAPS

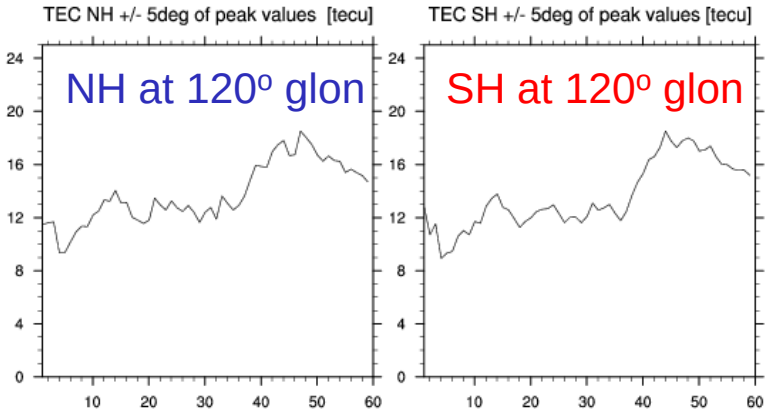


EIA peak TEC at 40º & 120º geog. longitude for January 2010

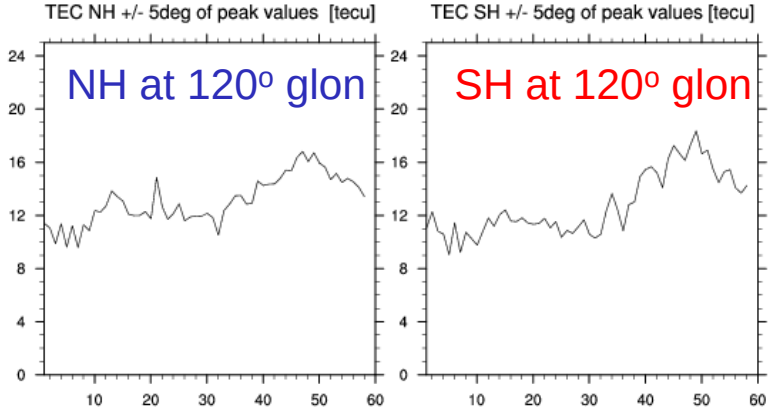
GPS TEC



TIMEGCM with ECMWF and GSWM09 tidal climatology



TIMEGCM nudged by WACCM/NOGAPS



- As for -75º geog.lon. the observed NH TEC is stronger than in the SH. There is no significant increase in observed TEC in the SH.
- The simulations show similar TEC variation at 120º, 40º and -75º geog. longitude with a similar TEC increase after day 40 in the NH and SH.

Summary

- In 2010 the SSW signal in the simulation is not very obvious which might be due to the underlying changes in solar radio flux and geomagnetic activity.
- Interestingly, for 2010 the simulation shows a decrease in low latitude vertical drift after day 30, but an increase in NmF2.
- Although for the 2010 simulations the forcing at the lower boundary, and the background atmosphere is very different between the ECMWF/GSWM09 and the WACCM/NOGAPS, but it seems that in the ionosphere the differences are smaller.
- The NH EIA peak of GPS TEC observations in 2010 show an increase after day 40. The magnitude of this increase is largest at -75^{o} and 120^{o} geog. Longitude, and smaller at 40^{o} geog. longitude.
- The NH EIA peak in the GPS TEC is larger than the SH peak, especially at 40^{o} geog. Longitude.
- The simulated EIA TEC peaks do not show the hemispherically asymmetry and the strong longitudinal differences.