

# **Cross polar propagation of atmospheric gravity waves (GWs) from various sources (including deep convection, the polar vortex)**

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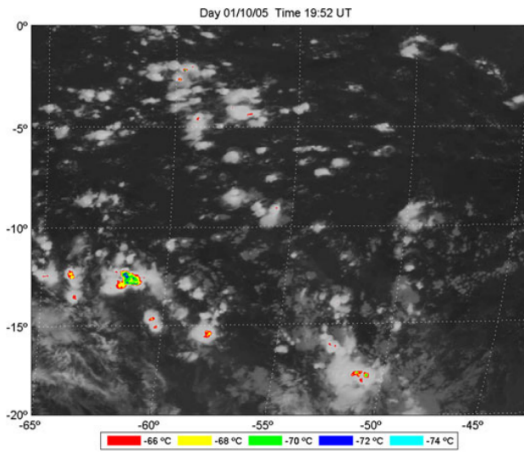
And other colleagues

Wednesday, 12 June 2024, 1:30-3:30

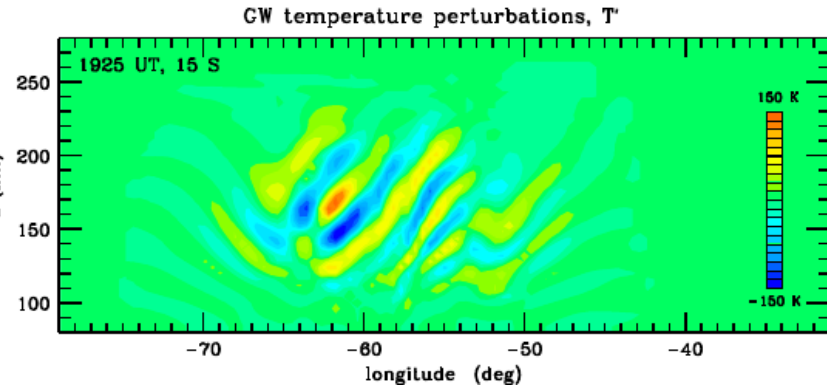
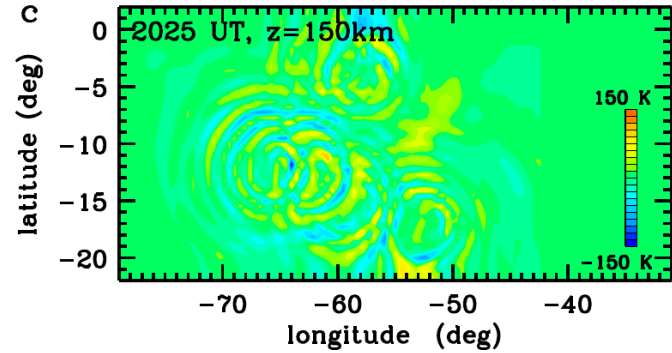
CEDAR: “What is a patch?”

# Secondary GWs from deep convection propagate over the poles

Deep convection over Brazil (near the Amazon)

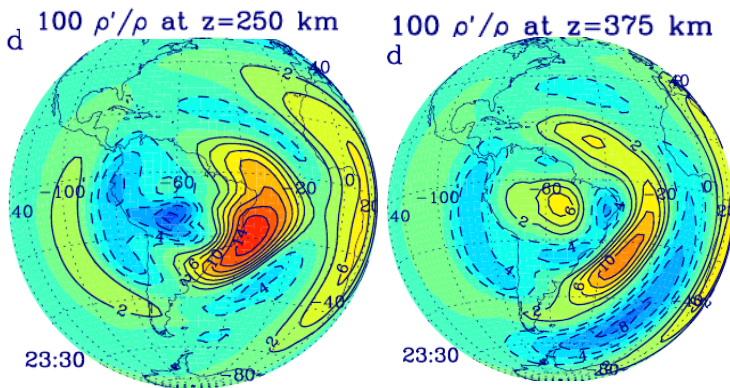


Primary GWs (modeled by MESORAC) propagate into the thermosphere and dissipate there from molecular viscosity. The atmosphere responds to being unbalanced by generating secondary GWs (modeled by the TIME-GCM)

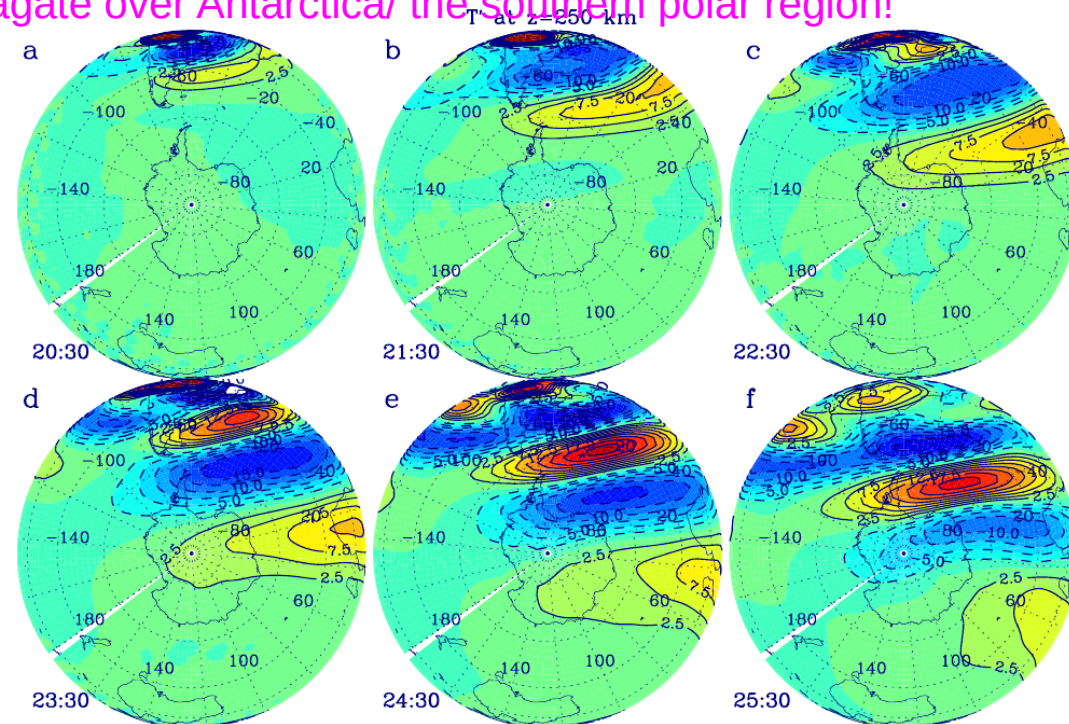


Concentric secondary GWs propagate in the thermosphere.

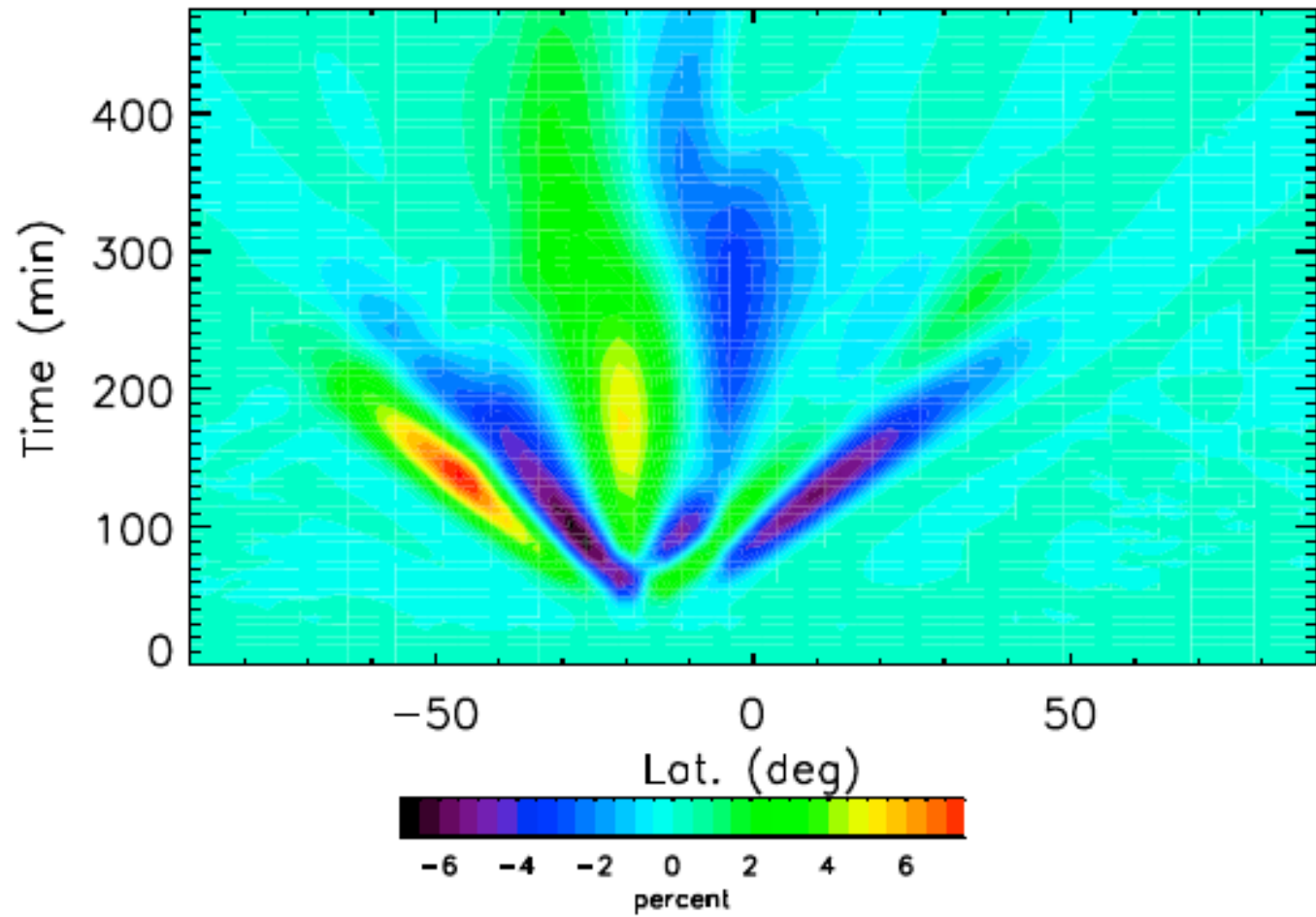
Some of the secondary GWs from deep convection propagate over Antarctica/ the southern polar region!



Vadas and Liu (2013)

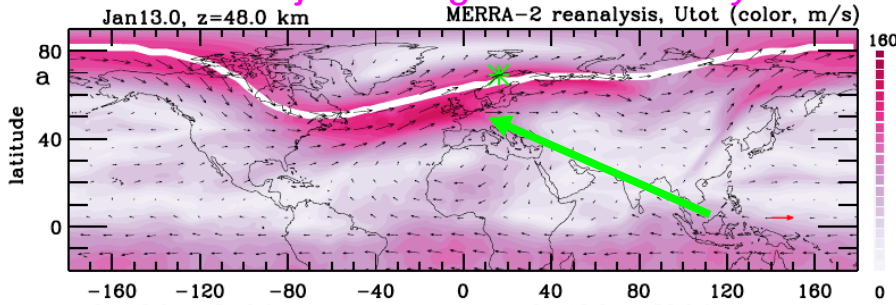


Relative TEC pert. 52.5W

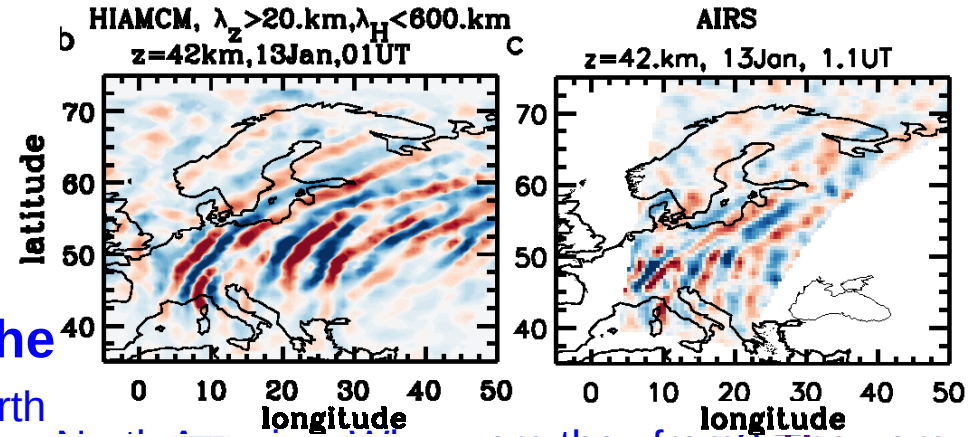


# Higher-order GWs from the northern polar vortex jet propagate over the poles

Polar vortex jet during 11-14 January 2016

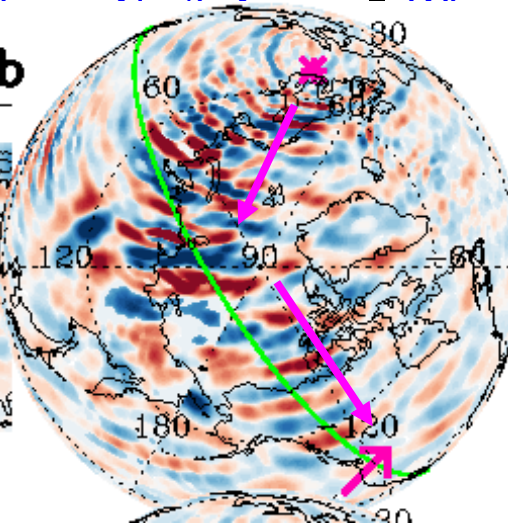
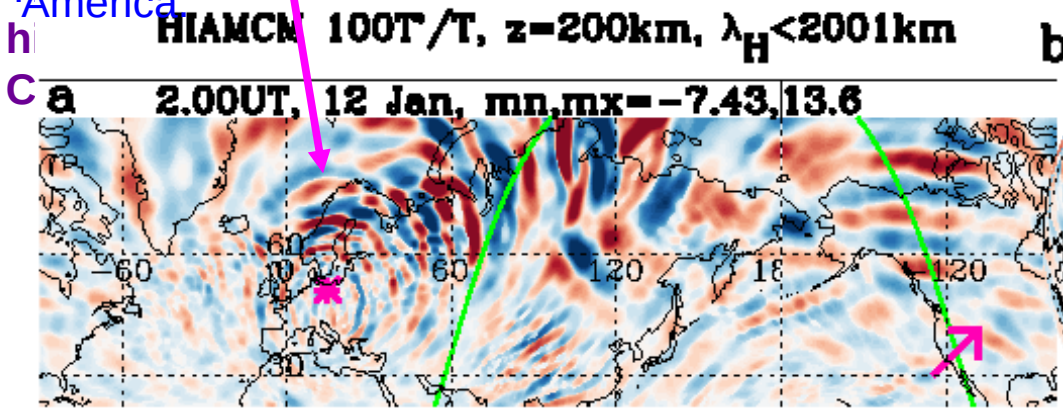


Primary GWs generated/amplified by the polar vortex jet (modeled by the HIAMCM)

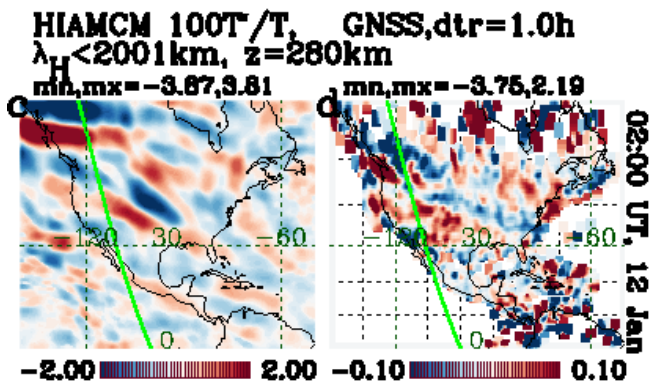


Higher-order GWs propagate away from Europe, **over the Arctic region** and then south/southwestward over North America

Where are they from? They are on then southward over



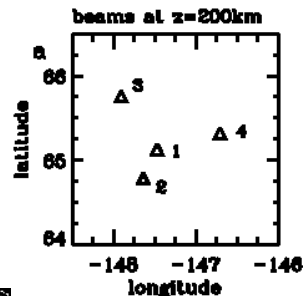
Vadas et al, JGR Space Physics, to be submitted



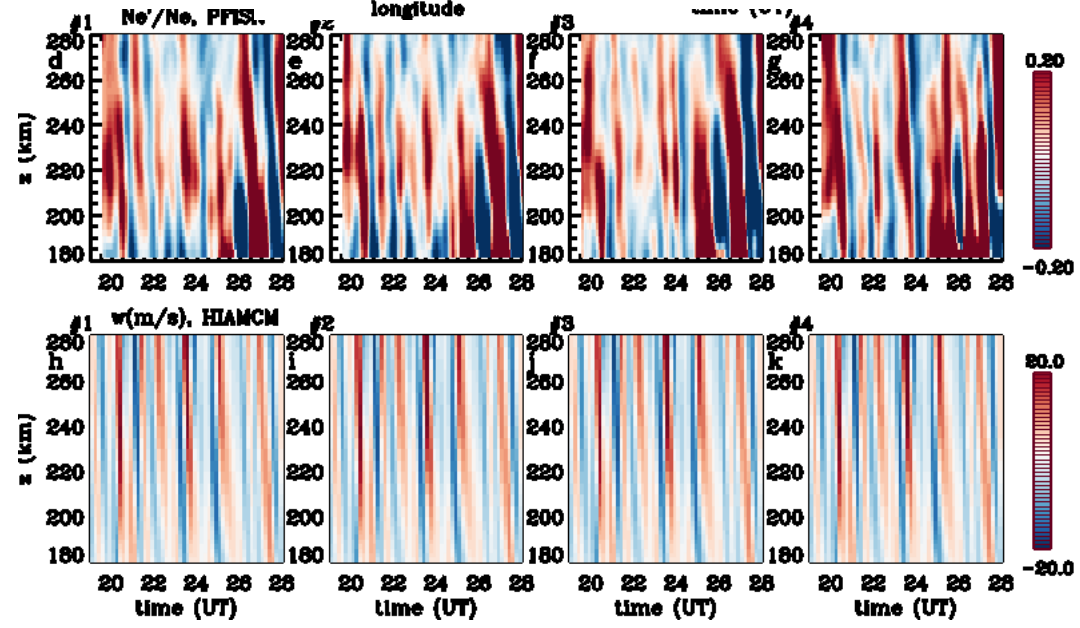
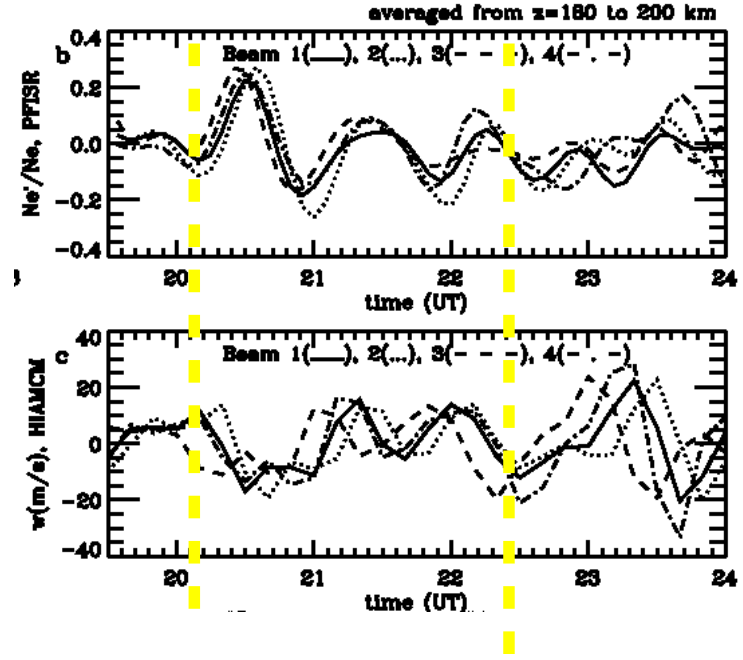
Southwestward-propagating GWs over North America agree well with the TIDs from GNSS observations at same time, thereby showing that our model simulation of x-polar GW propagation is good.

Electron density measurements over Alaska from Poker Flat ISR and comparison with simulated GWs

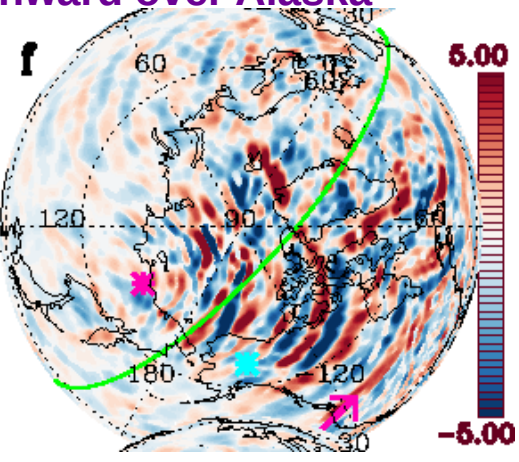
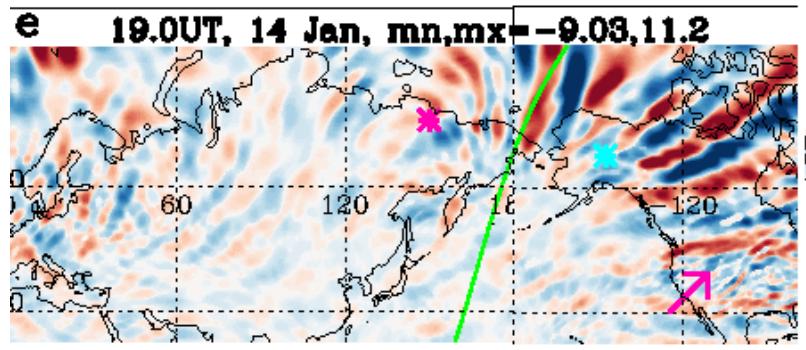
These TIDs are propagating southward over Alaska at 20-22 UT. Good agreement between periods and vertical properties of TIDs and GWs at 20-22 UT



Southward-propagating GWs



Higher-order GWs generated over the exit region of the polar vortex jet (northern Asian continent) propagate over the Arctic region then southward over Alaska

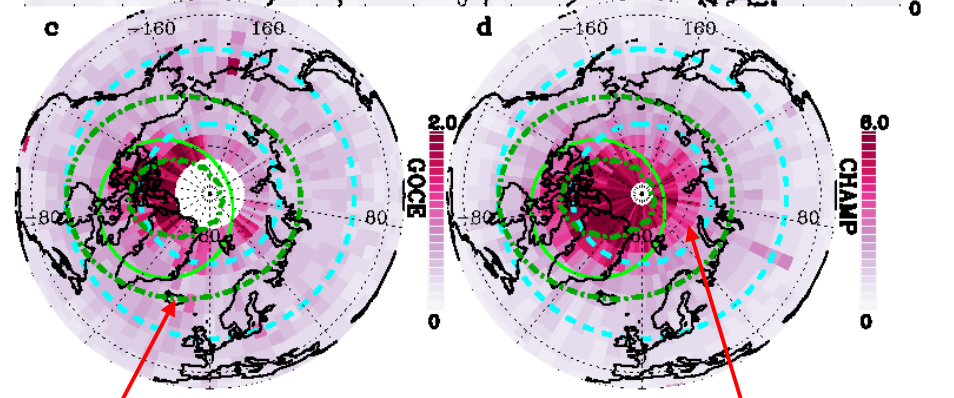
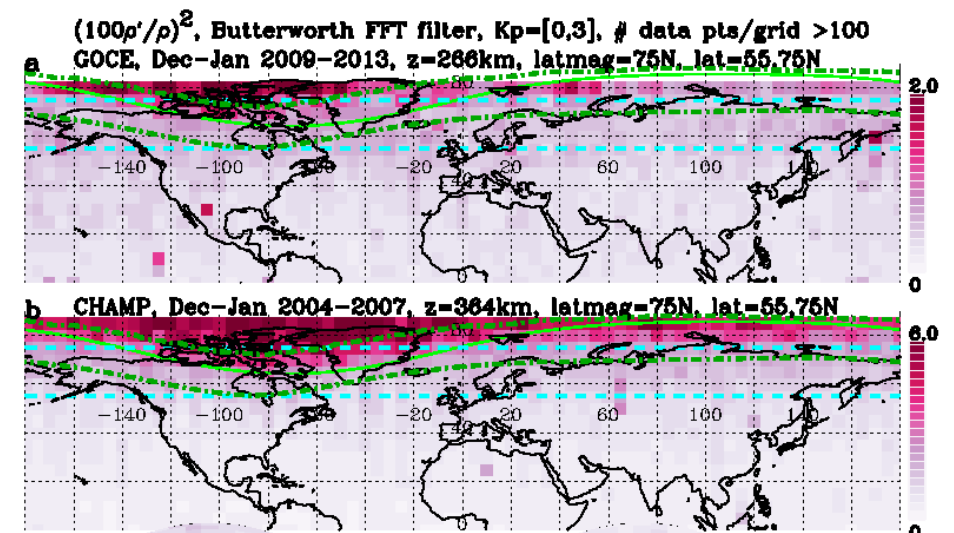
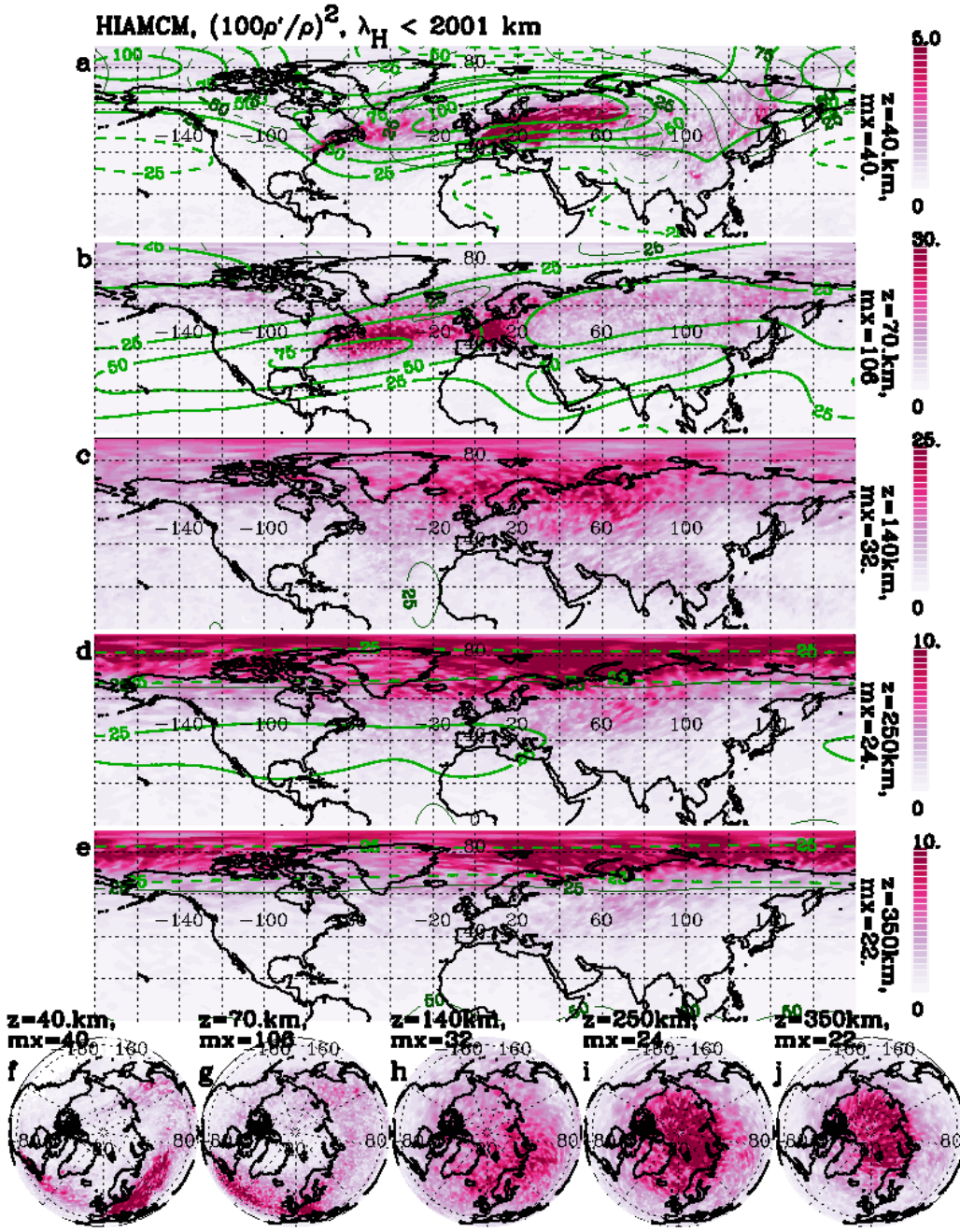


\* = (150E, 70N)  
 \* = PFISR

Vadas et al, JGR Space Physics, to be submitted

Extra slide

$|\rho'/\rho|^2$  peaks at midlatitudes over the polar vortex at  $z=40$  km, but peaks at the highest latitudes at  $z=250-400$  km due to the larger background wind at high latitudes. This agrees with the “background” GOCE & CHAMP quiettime measurements



Azimuthally-symmetric GWs

auroral occurrence rate of 50%