GITM Validation Studies

Using CCMC Events
Bad Results – Better Results

Eiscat NMF2
Good Results – Worse Results

CHAMP Mass Densities
What did you do?

• F10.7 driven
  – Produced some of the worst results
• FISM
  – Produced great CHAMP results (most of the time)
  – Horrible electron density (GITM way to high!)
• When arguing about how to model Titan and Mars, we found a bug in the code in the molecular diffusion rates. This changed the diffusion significantly.
  – Had to compensate by adding more Eddy diffusion.
• This greatly improved the electron densities, but has cooled off the atmosphere too much
  – Not sure why, still investigating
  – Reduced the NO cooling
  – Increased the solar efficiency from 5% to 7%
  – Discovered that Eddy cooling was turned off by accident, which served to then cause the atmosphere to be even cooler. Crap.
  – Playing with the molecular conduction
  – Perhaps gravity wave heating?
Prediction Efficiency

density

0->CCMC.f107/score
1->CCMC.fism/score
2->CCMC.newfric_e=0.07/score
3->CCMC.cond=0.9/score
4->CCMC/score
Old on Left, New on Right
Old and New

![Graphs showing mass density comparison between CHAMP and GITM models.](image)
CHAMP Electron Density
NMF2 from Radars (stations averaged)
NMF2 by station (events averaged)
HMF2 for Radars

0->CCMC.f107/score
1->CCMC.fism/score
2->CCMC.newfric_e=0.07/score
3->CCMC.cond=0.9/score
4->CCMC/score
August 2001

Weimer driven

AMIE Driven

August 30 to Sep 01, 2001 Universal Time

Aug 30 to 31, 2001 UT Hours
December 2006

Weimer Driven

AMIE Driven (something wrong...)

Dec 13 to 15, 2006 Universal Time

Dec 13 to 15, 2006 Universal Time
August 2005

Weimer Driven

AMIE Driven

Mass Density (10^-9 Kg/m^3)

Aug 31 to Sep 01, 2005 Universal Time
Conclusions

• Fixing the diffusion in GITM has dramatically helped the electron density
• It has also caused the atmosphere to be a little to cool (or, have to little mass density at 400 km altitude)
• But, the prediction efficiencies of the NMF2 have increased dramatically!
  – GITM seems to have a real ionosphere now....
  – Although, the low latitude electrodynamics are now a bit to strong (which is why the CHAMP electron densities did not improve dramatically).
• Using AMIE sometimes is better and sometimes is worse. Need to explore more events.