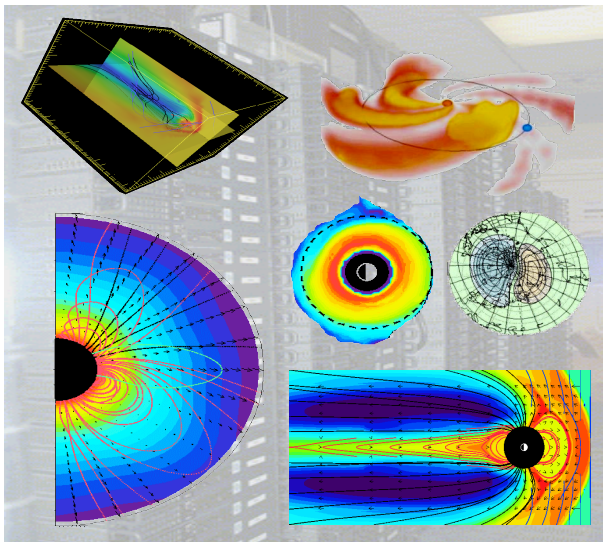


# Magnetopause standoff in 2009 GEM modeling challenge



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# Challenge setup

- **Solar wind:**

$N=5\text{cm}^{-3}$ ,  $V_x=400\text{ km/s}$ ,  $T=10^5\text{K}$

**IMF:**  $B_x=B_y=0$ ,  $B_z = -5, -10, -20, -30, -40, -50\text{ nT}$   
(each value held for 2-hour period)

- **Upstream boundary:**

$X_{\text{max}} = 33 R_E$  (60  $R_E$  for some reruns)

- **Model runs:**

1\_SWMF: 755000 cells (also for  $X_{\text{max}}=60$ )

2\_SWMF: 2 M cells (also for  $X_{\text{max}}=60$ )

3\_SWMF: 2M cells with RCM

1\_OPENGGCM: 2.21M cells, 0.3  $R_E$  res.

2\_OPENGGCM: 8.83 M cells, 0.25  $R_E$  res.

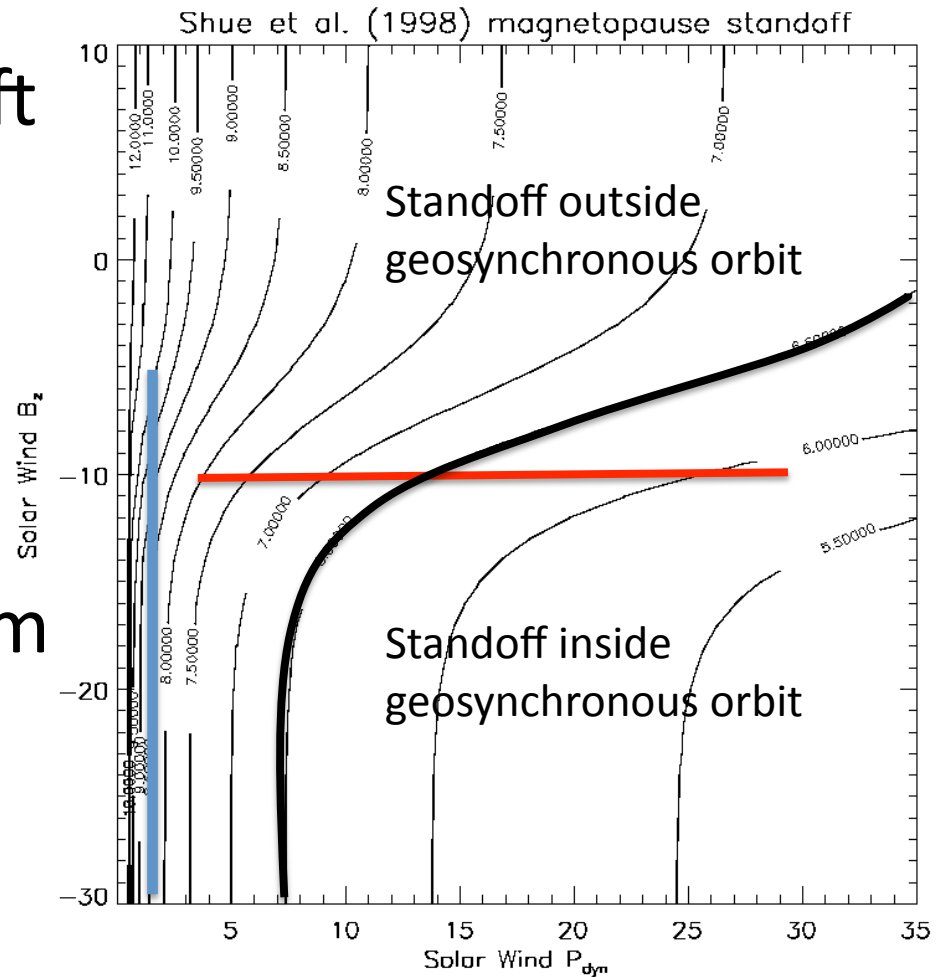
3\_OPENGGCM: 3.15 M cells, 0.3  $R_E$  res.

1\_GUMICS: 115 K cells, 0.5  $R_E$  res.

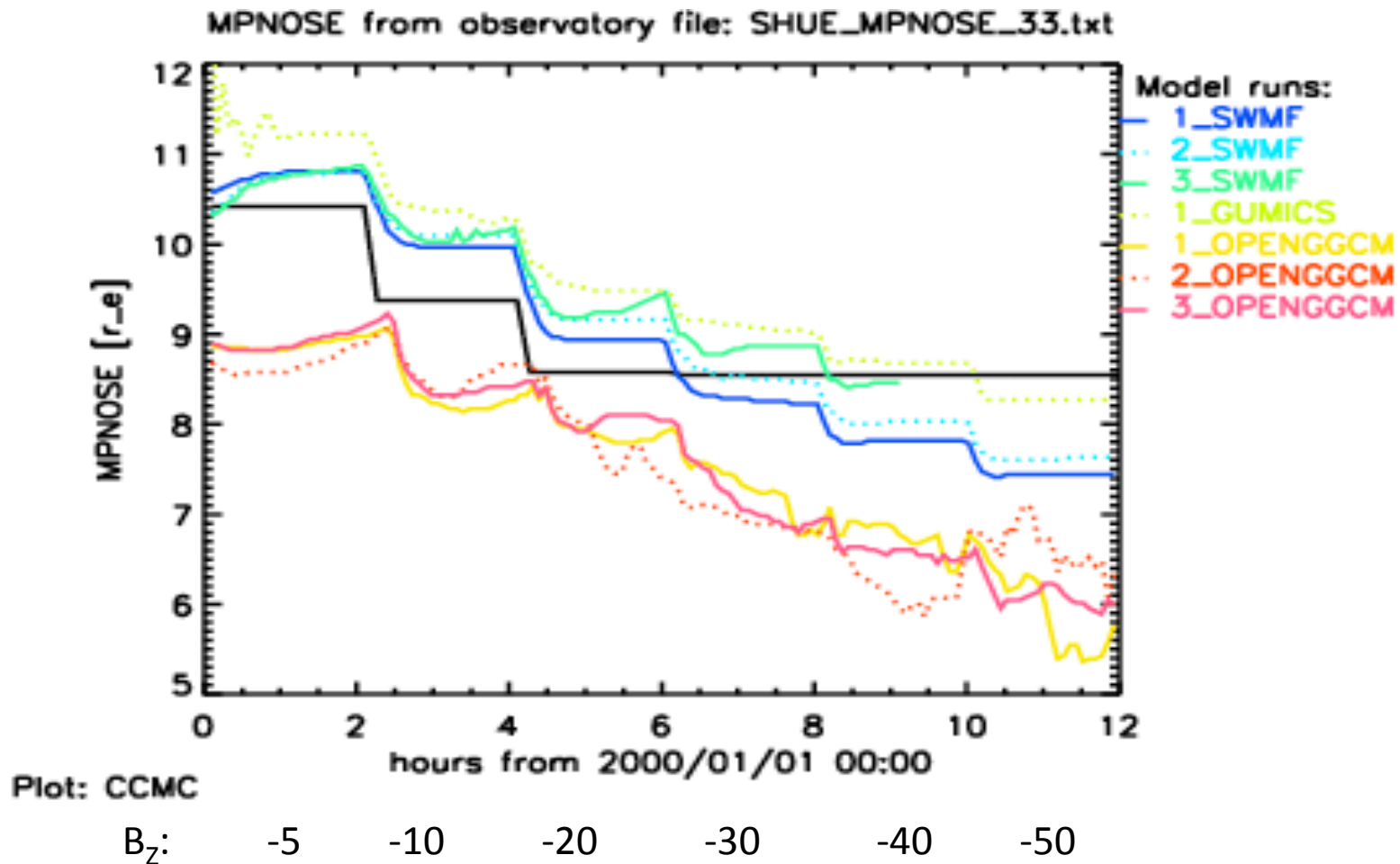
1\_LFM: 53x32x48 cells

# Reference: Shue et al. (1998)

- **$B_z$  variation** near left side of valid range ( $P_{\text{dyn}} = 1.33 \text{ nT}$ )
- **Proposed density variation** ( $V=600$ ,  $N=5 - 50$ ):  $P_{\text{dyn}}$  from 3.0 to 30.



# Comparison with model runs



Most models predict smaller standoff than Shue for  $B_z < -40$  nT

OpenGGCM always lower than Shue

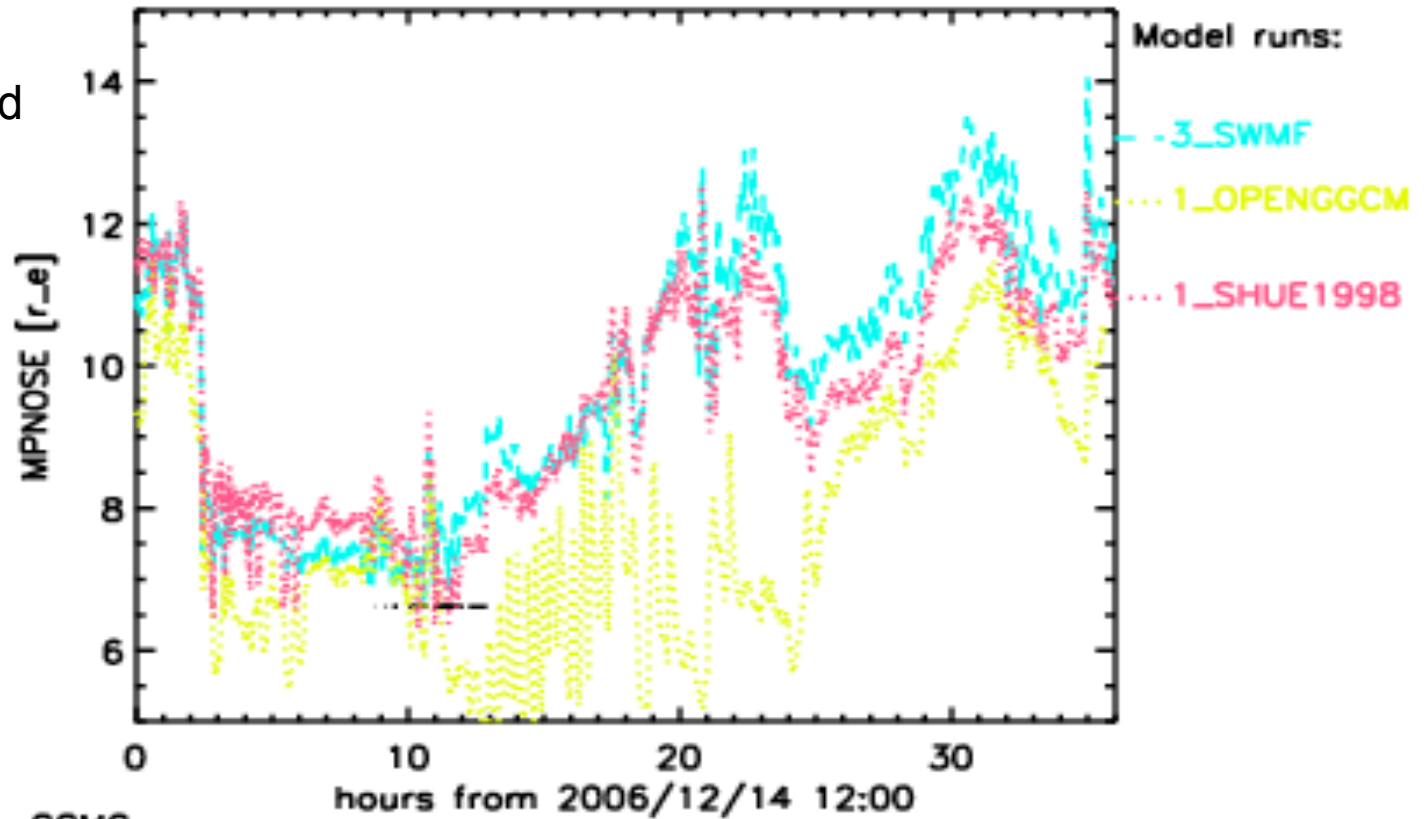
SWMF (high resolution, with RCM) and GUMICS show larger standoff for  $B_z \geq -30$

# What is “Ground Truth”?

## GEM2008 Challenge Event 2 (AGU storm)

boundary  
between closed  
and open-field  
lines

MPNOSE from observatory file: MPNOSE\_LANL\_in\_or\_out.txt

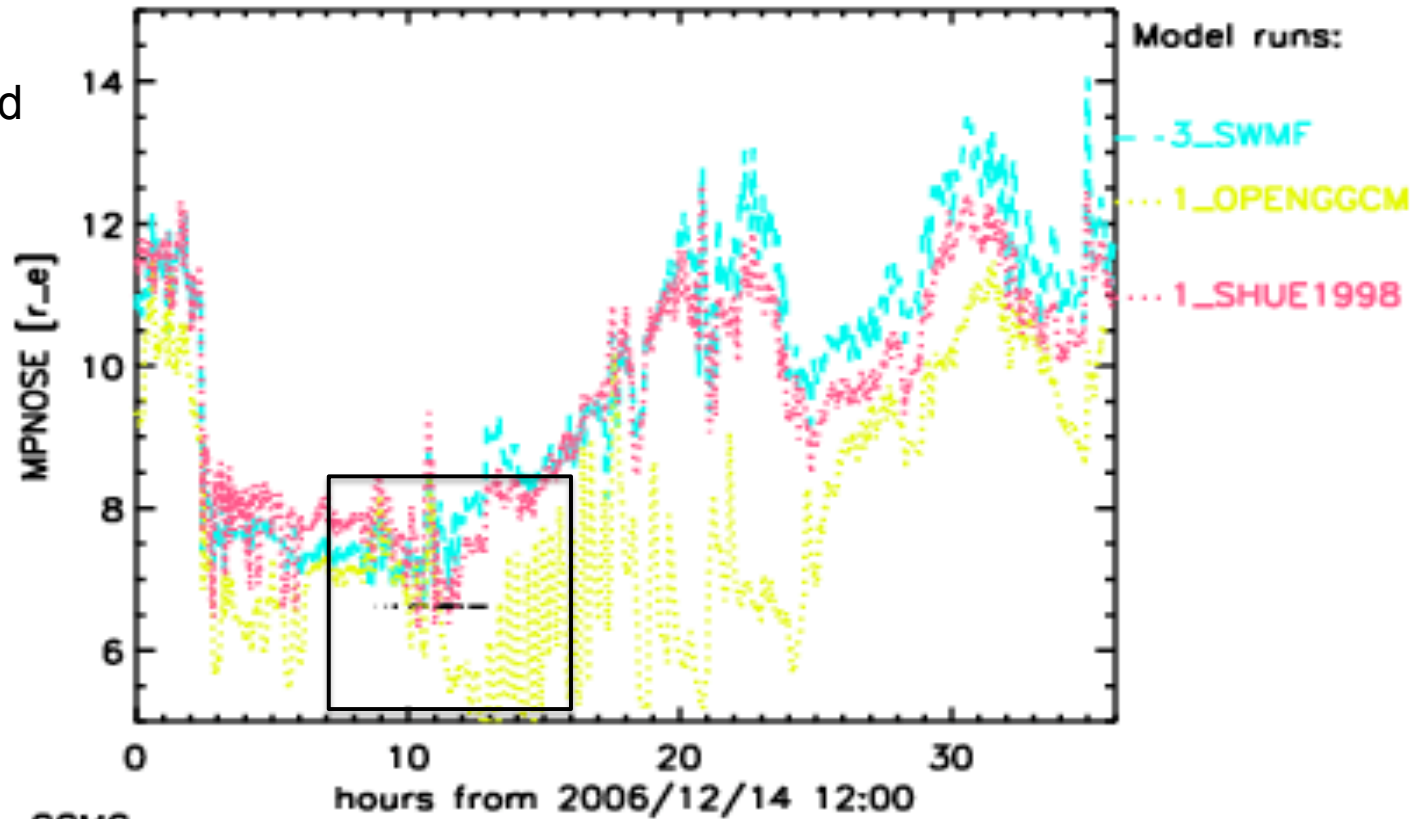


# What is “Ground Truth”?

## GEM2008 Challenge Event 2 (AGU storm)

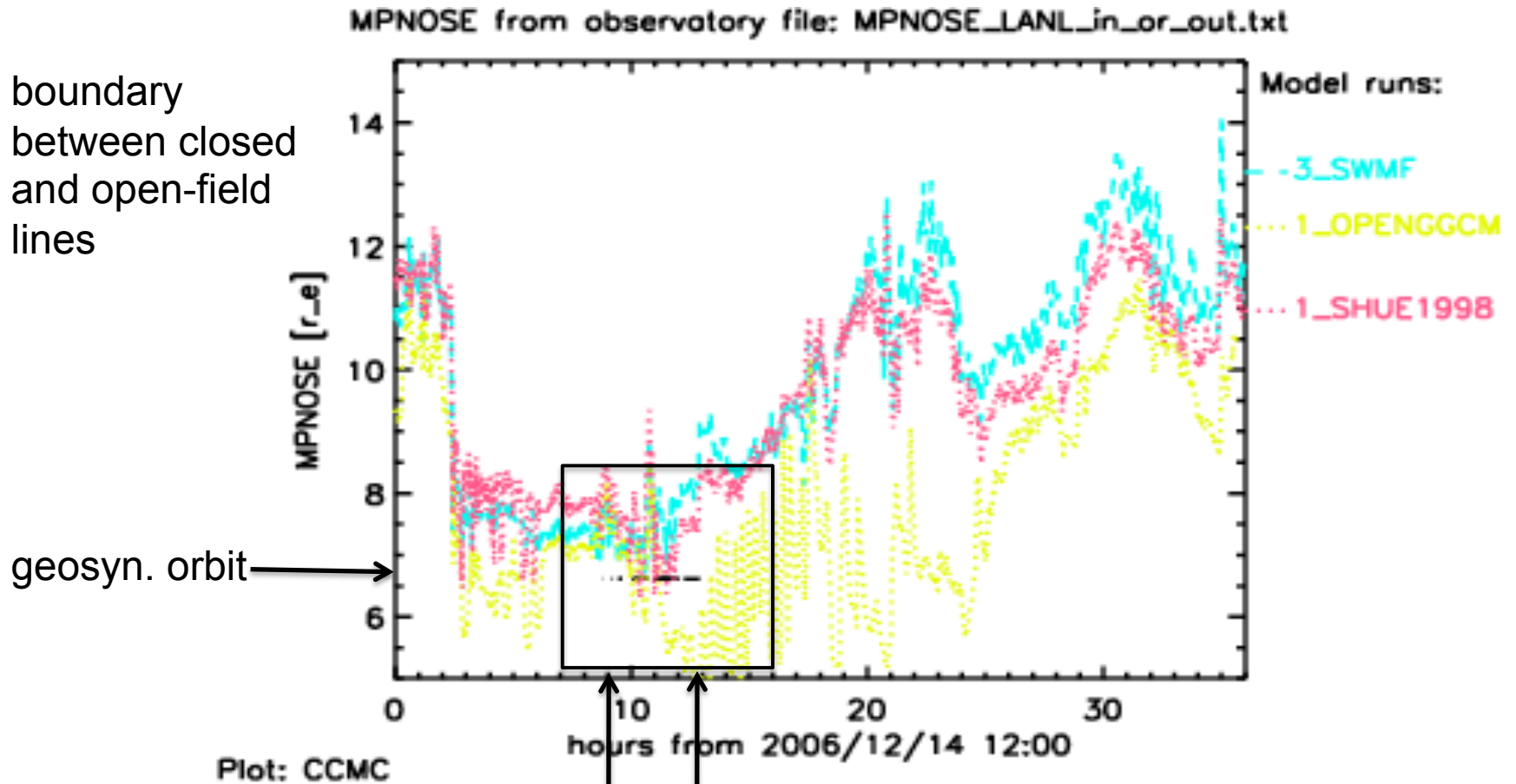
boundary  
between closed  
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lines

MPNOSE from observatory file: MPNOSE\_LANL\_in\_or\_out.txt



# What is “Ground Truth”?

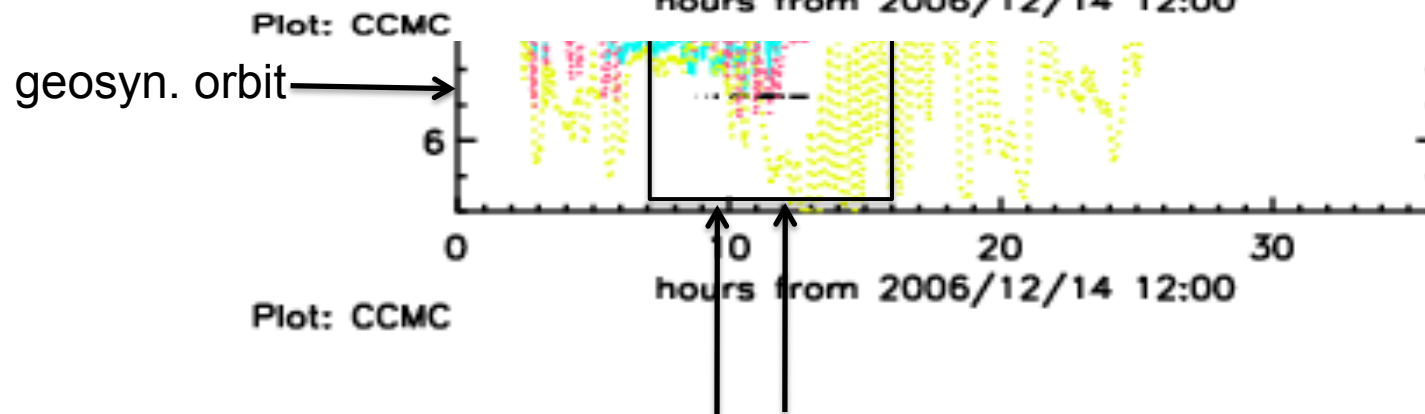
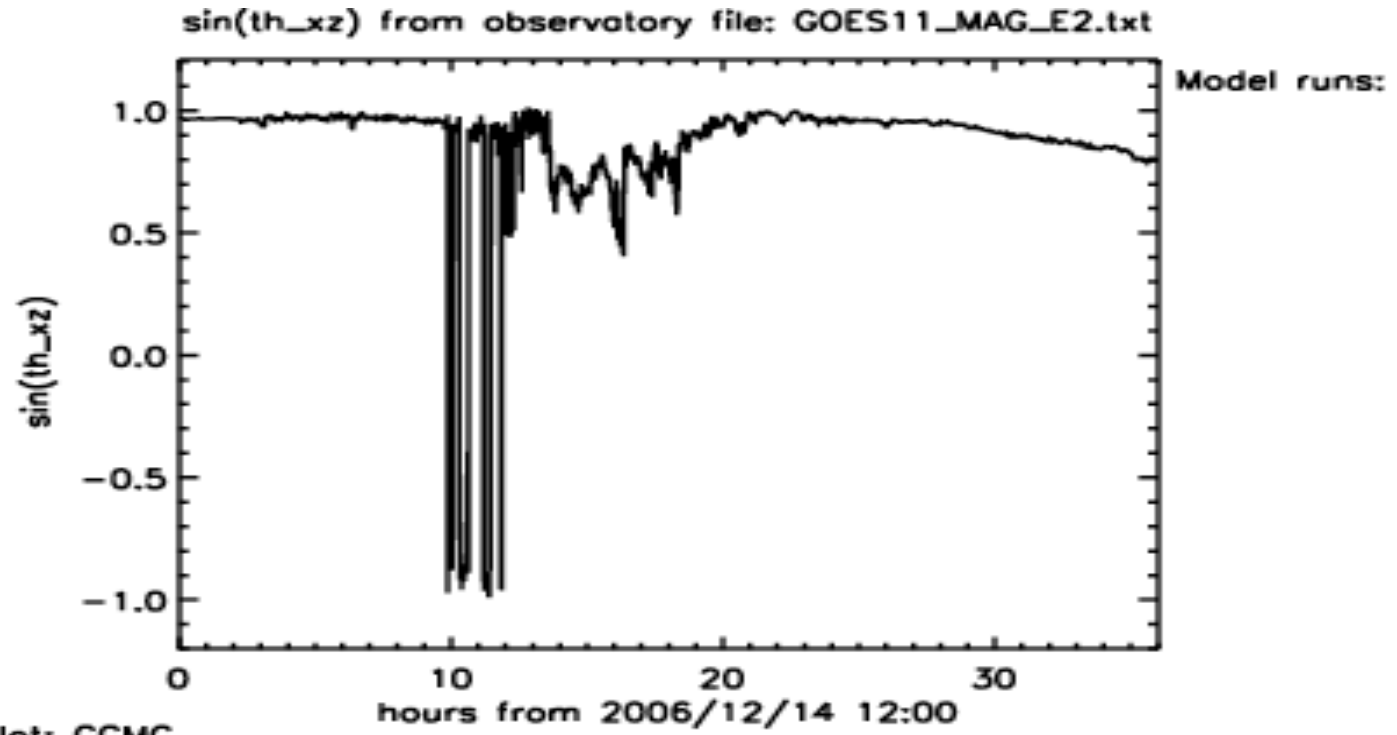
## GEM2008 Challenge Event 2 (AGU storm)



Observed MP crossings of LANL satellites

# What is "Ground Truth"?

magnetic  
elevation  
 $\sin(\theta_{xz})$

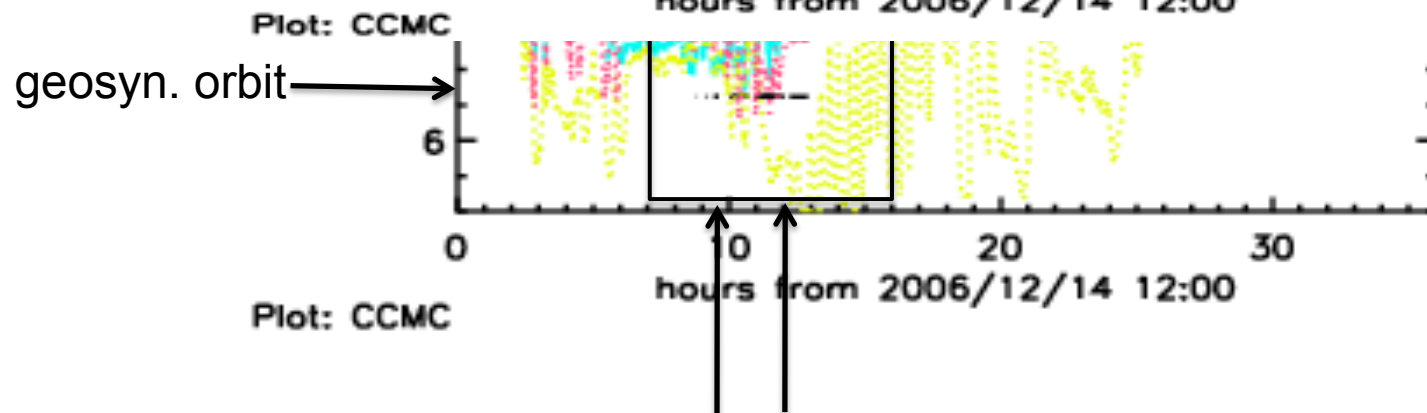
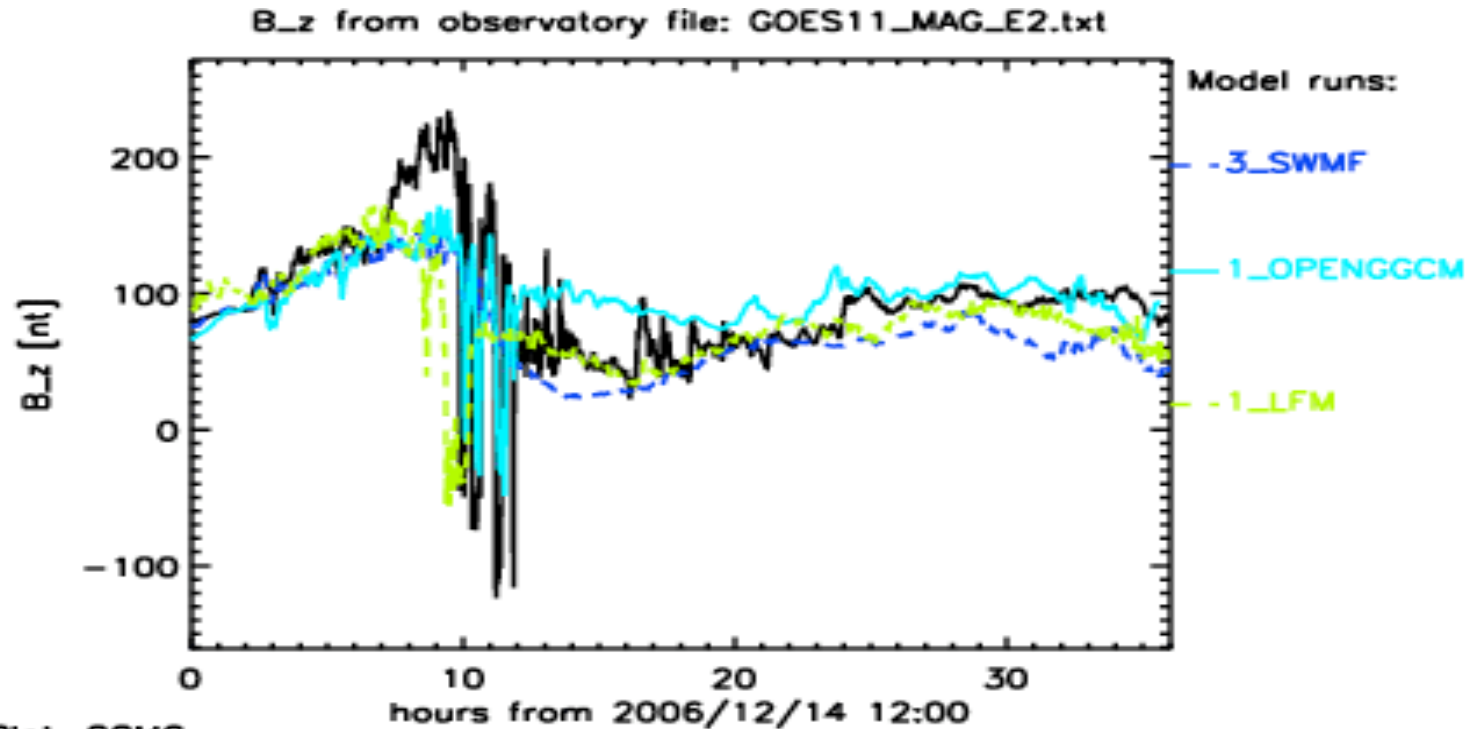


Observed MP crossings of GOES11 satellite



# What is "Ground Truth"?

magnetic field  $B_z$



Observed MP crossings of GOES11 satellite