

# Towards Coupled Data Assimilation with GEOS: Skin SST, IR & MW obs

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Air-Sea Interface: Exchange of heat, momentum and *mass*.

Focus on: SST  $\rightarrow$  heat exchange

- ✓ Accurate modeling of **air-sea interface** temperature:
  - Model for diurnal warming & cool skin
- ✓ Estimation of **skin SST** ( $T_s$ ):
  - CRTM:  $T_s \rightarrow$  BT simulation and Jacobian ( $\frac{\partial T_b}{\partial T_s}$ )
  - Atmospheric Analysis (GSI): **IR**, **MW** & in-situ obs
- ✓ **Forecast model initial conditions**
  - Use  $T_s$  analysis increment
- ★ **Upper ocean temperature** from **Ocean Analysis**:  
*bulk* SST

# Current Model (Uncoupled)



Skin SST = Ocean Bulk SST

# Skin SST



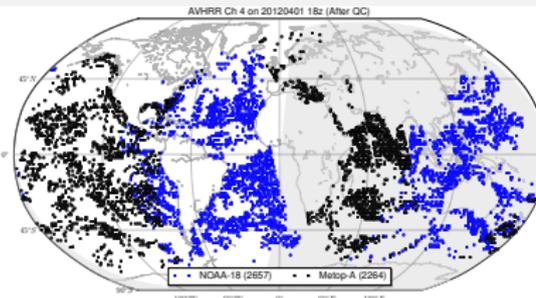
- \* **Skin SST = Ocean Bulk SST + Diurnal Warming - Cool Skin**
- \* Near-surface temperatures (ocean and atmosphere) coupled
- \* Impacts Atmospheric variables ( $T_{air}, \dots$ )

# Near Surface IR Obs: +AVHRR

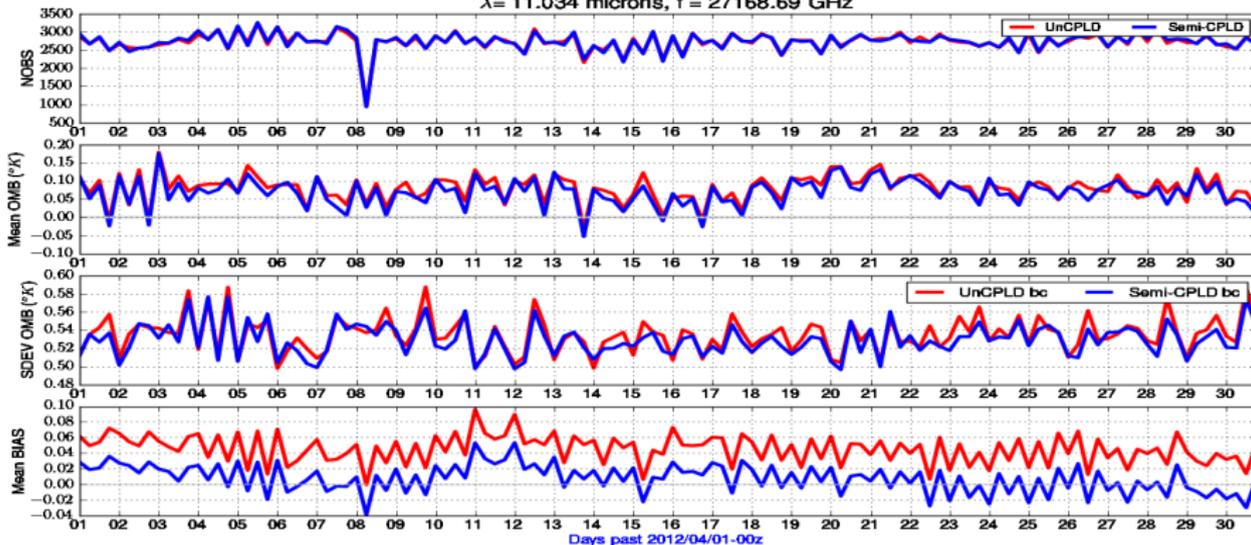


- \* GSI & CTRM: use *new* Skin SST
- \* Add 3 channels of AVHRR
- \* GEOS AGCM use  $T_s$  ana increment

Improved assimilation of surface sensitive channels



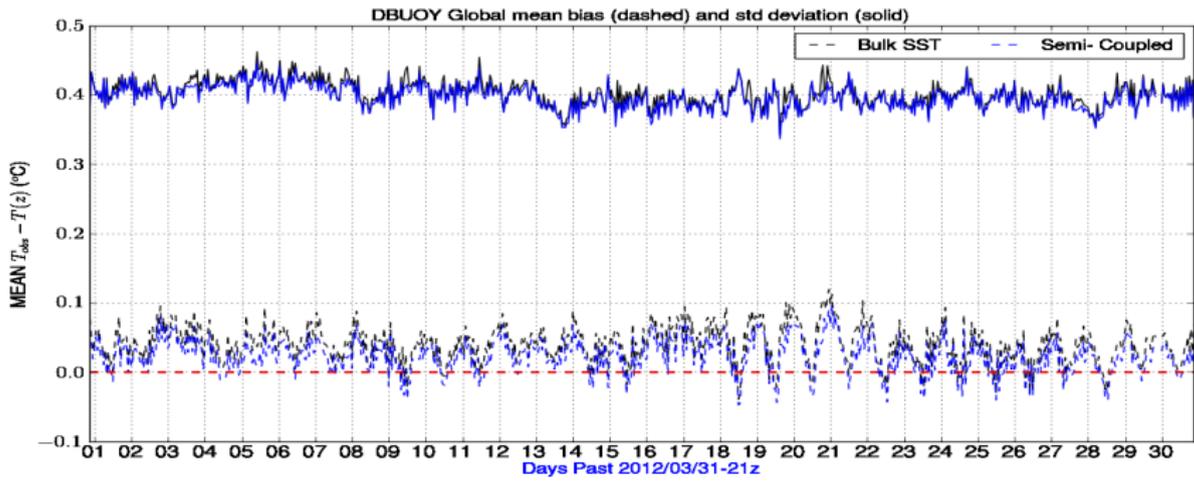
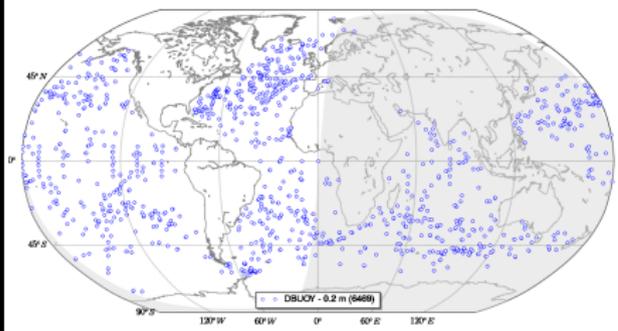
iasi metop-a[202]; ch1046  
 $\lambda = 11.034$  microns,  $f = 27168.69$  GHz



# Fit to Drifting Buoy Temperatures

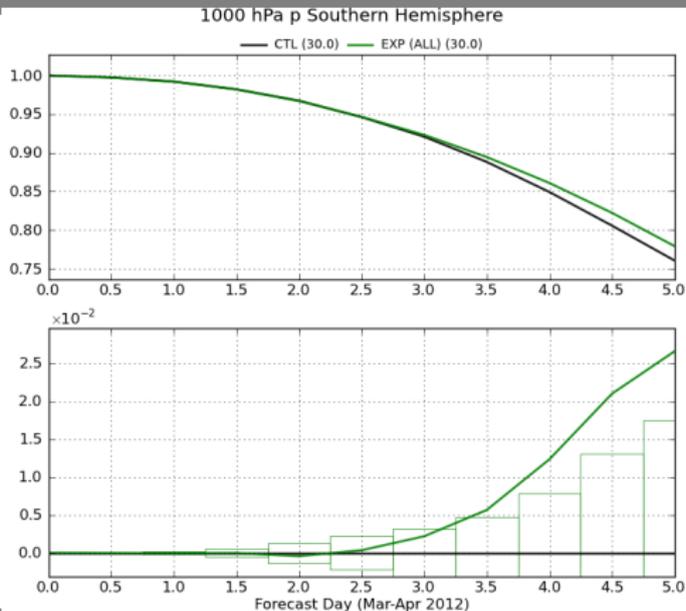
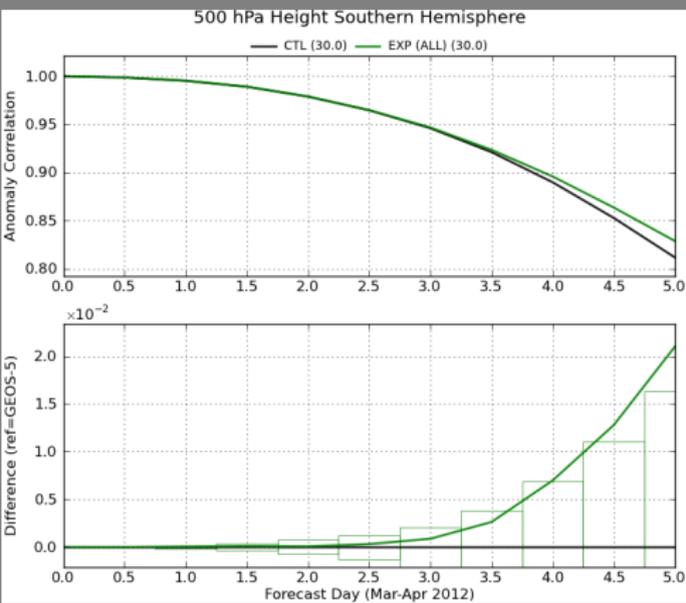
Coupled DA  $\Rightarrow$   
Obs in **air** influence Obs in **water**.

Improved Fit to near-surface  
*passive* Buoy Temperatures:  
**less Bias & RMSE**





# Overall impact: Forecast Skill



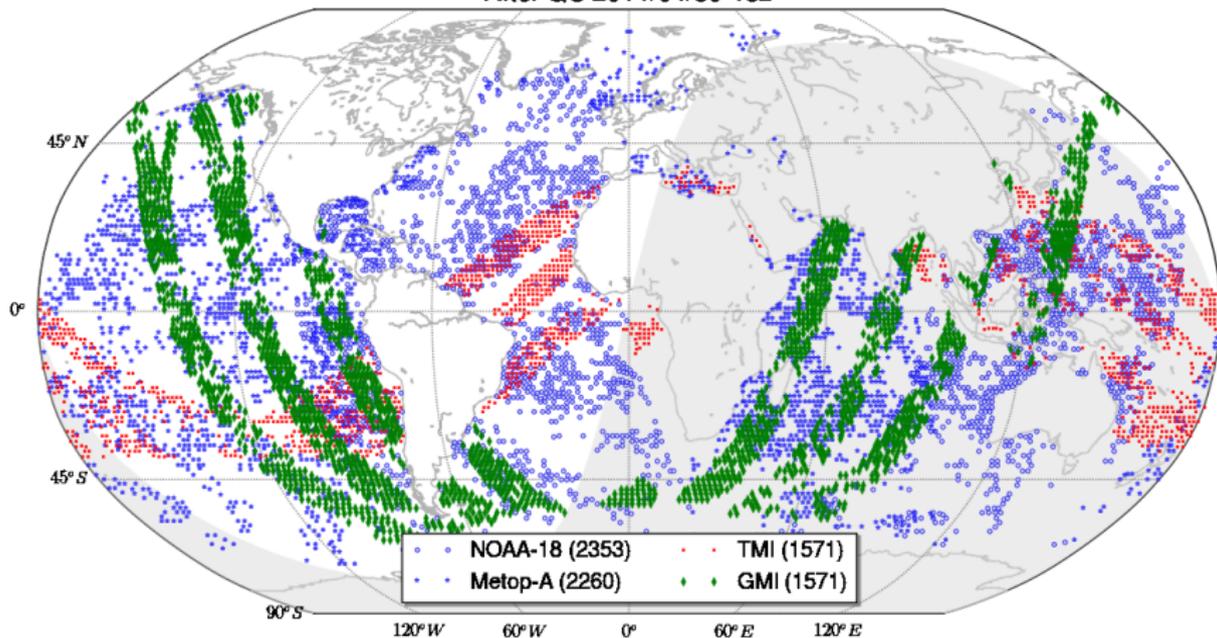
- ▲ Better forecast skill in SH:  
for height, temperature, (u,v) winds, surface pressure
- No significant change in NH skills

Obs: + AVHRR + GMI + TMI



Pass thru clouds and in Tropics  
where most SST diurnal variation occurs

After QC 2014/04/30 18z

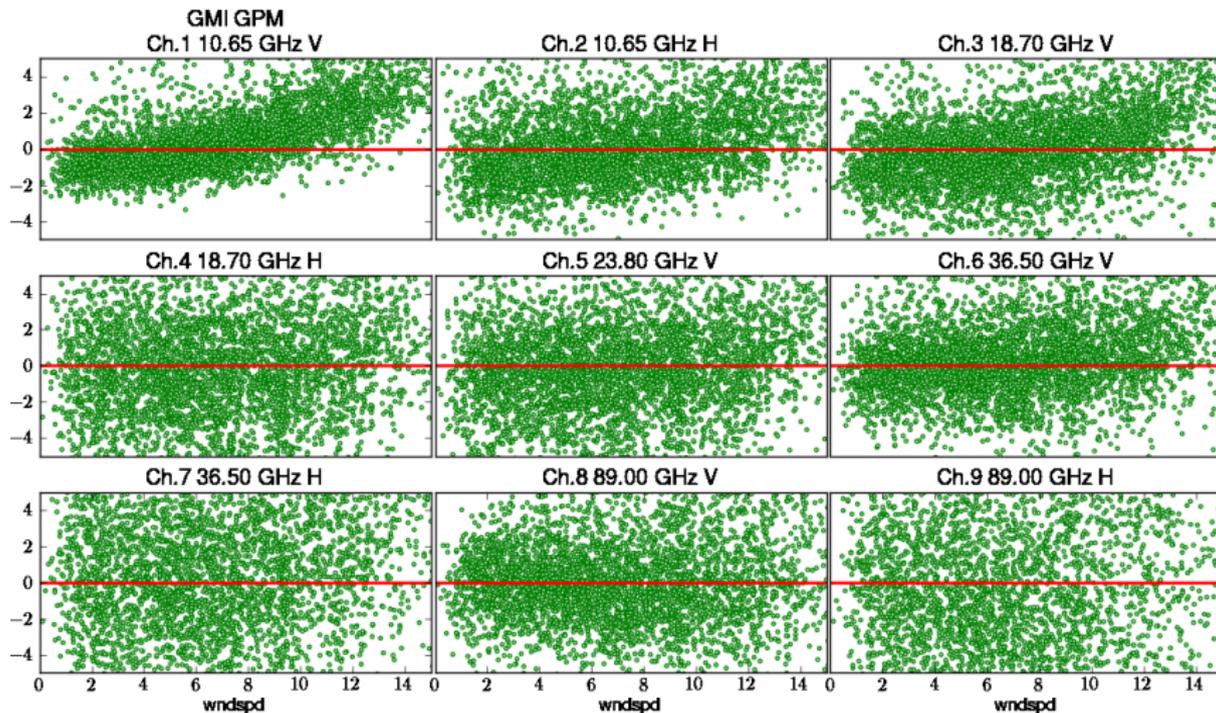


Please see: J.Jin et al., [Poster 645](#). Wed, 2:30- 4 PM.

# Wind Speed/ Emissivity



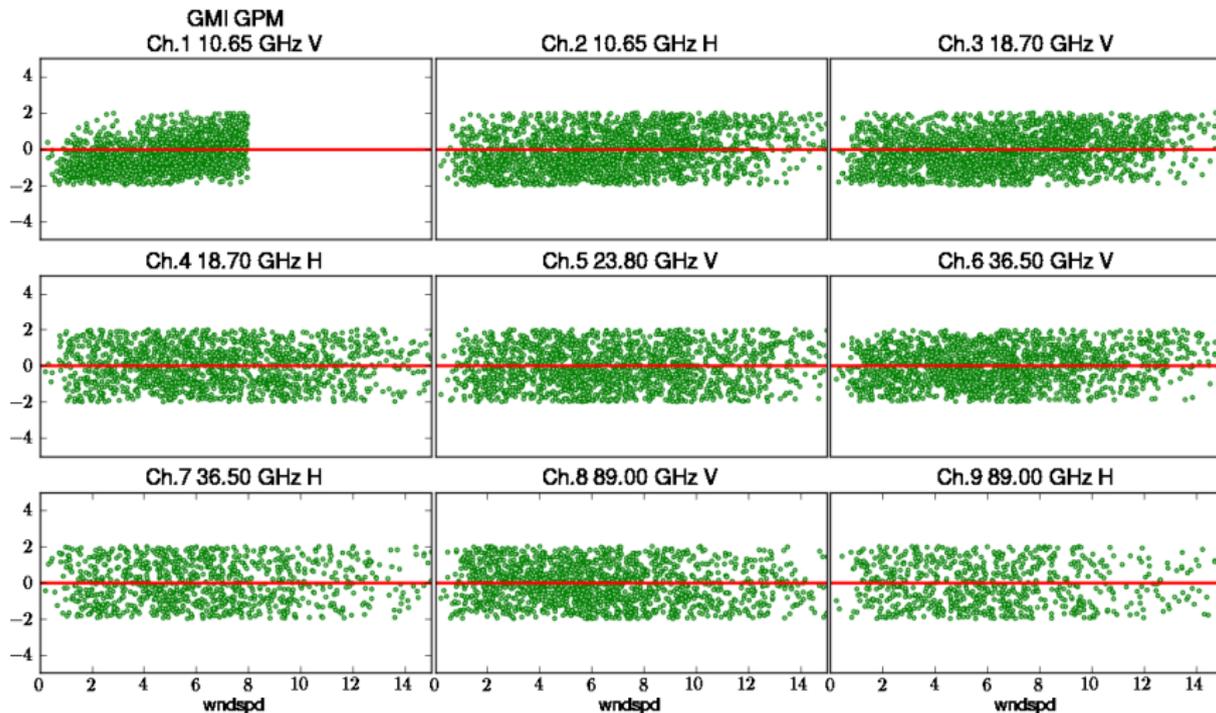
## Before QC



# Wind Speed/ Emissivity (*cont.*)



After QC



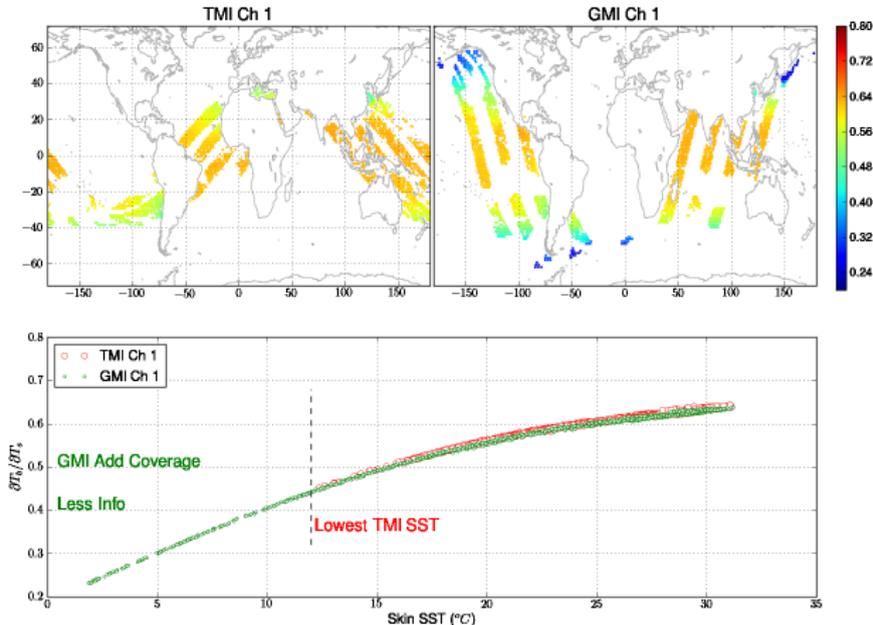
# GMI High Latitudes

BT sensitivity to  $T_s$ :  $\frac{\partial T_b}{\partial T_s}$

Lower

⇒ Larger signal/noise ratio.

⇒ GSI obs error (varinv) needs to be tuned





- Assimilate GMI, AMSR-2 (7–10GHz)
- Improve Sea-ice temperature → polar climate
- Introduce Wave model → exchange of momentum
- Couple with ocean analysis → **bulk** SST

Thanks for your attention & Appreciate your feedback!

Questions...

More...

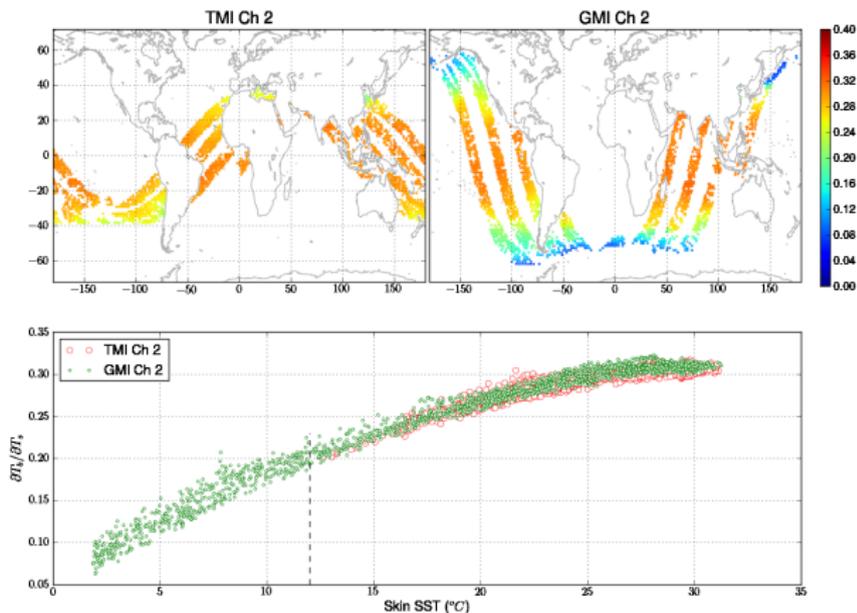


**EXTRA SLIDES**

# $\frac{\partial T_b}{\partial T_s}$ for Ch.2 10.6GHz H-pol



Sensitivity to  $T_s$ : lower than that for Ch.1 (10 GHz V-pol)

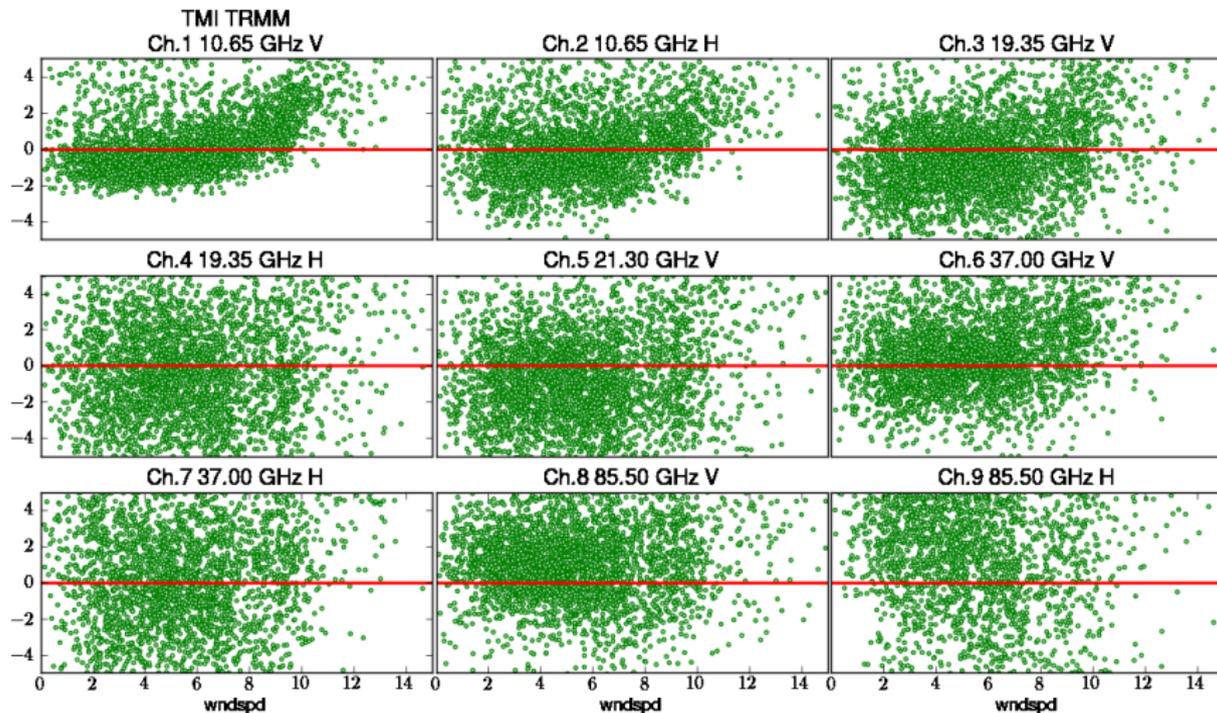


Sensitivity to wind  $\rightarrow$  increment in surface wind speed

# TMI Wind Speed/ Emissivity



## Before QC



# TMI Wind Speed/ Emissivity (*cont.*)



After QC

