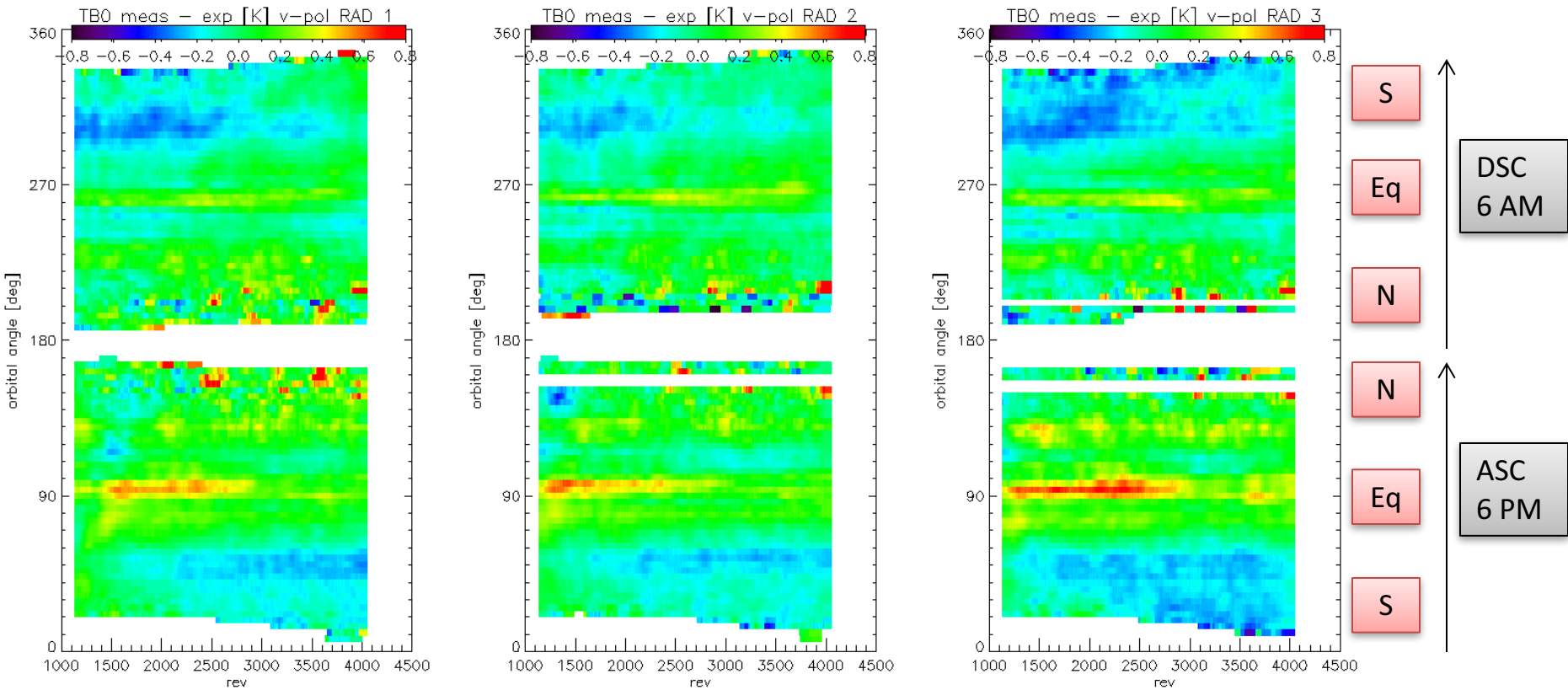
Aquarius Cal/Val: Zonal + Orbit Position Biases

Thomas Meissner

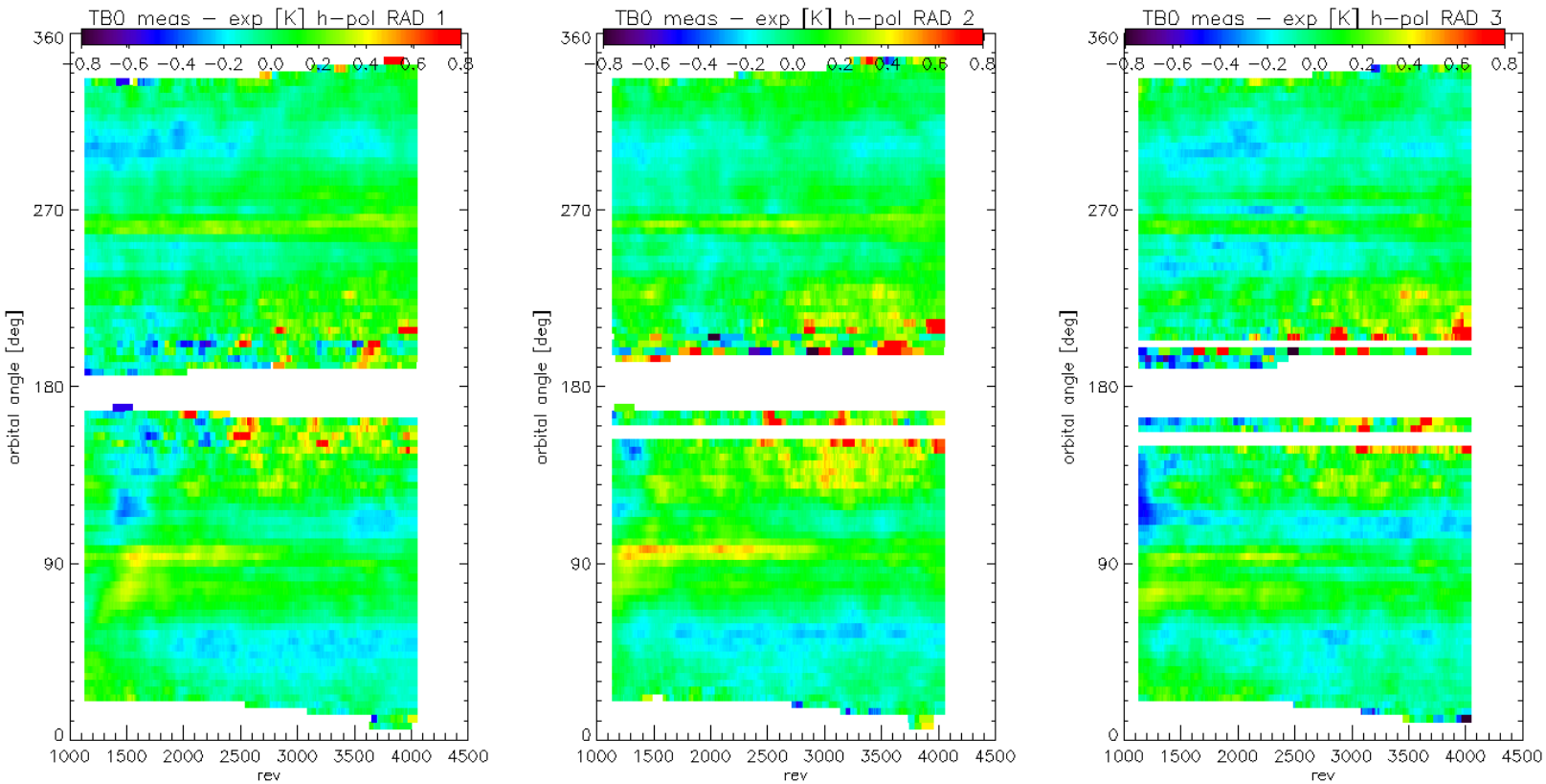
Frank Wentz

Gary Lagerloef

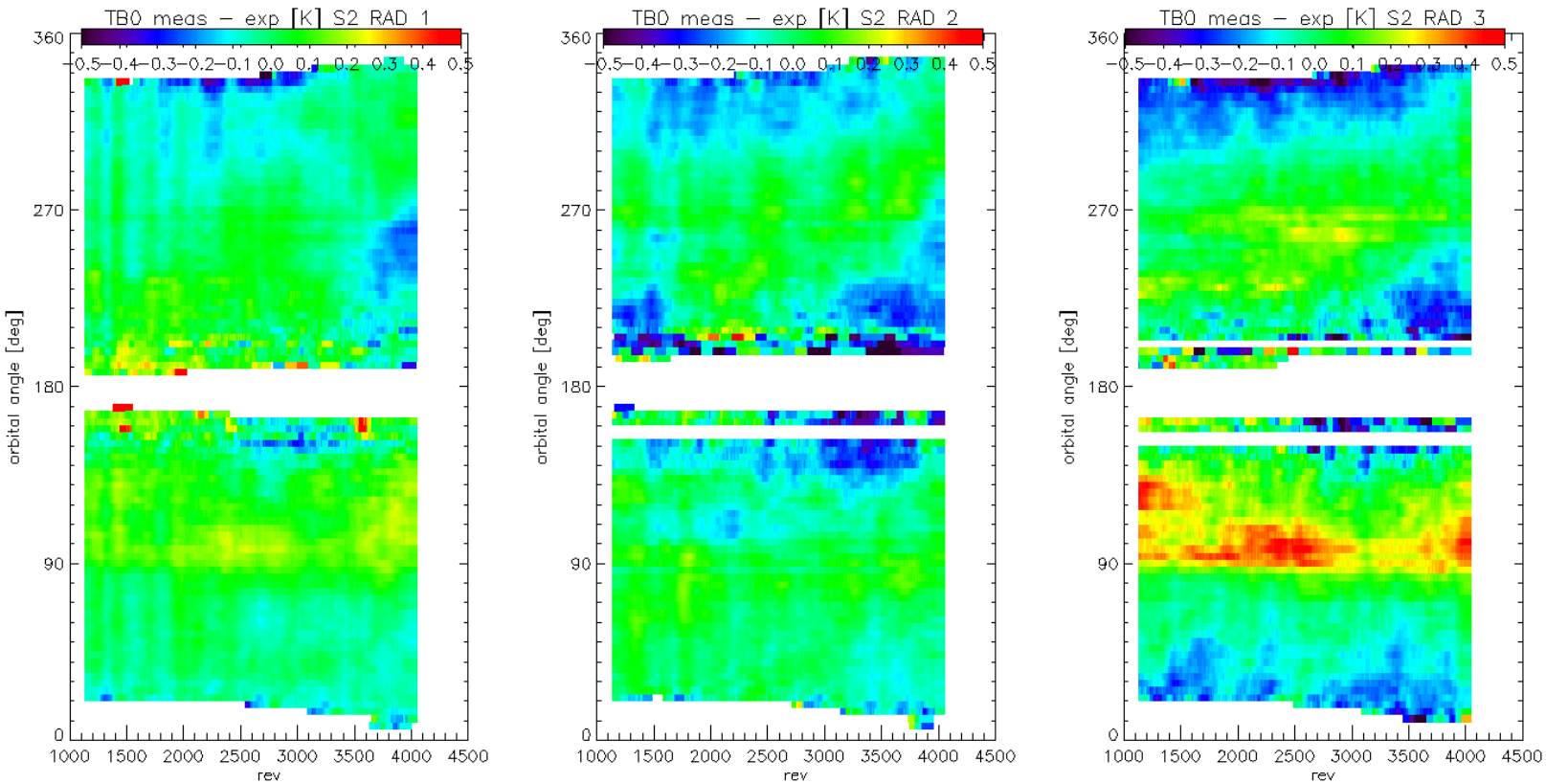
Zonal Biases: V-pol



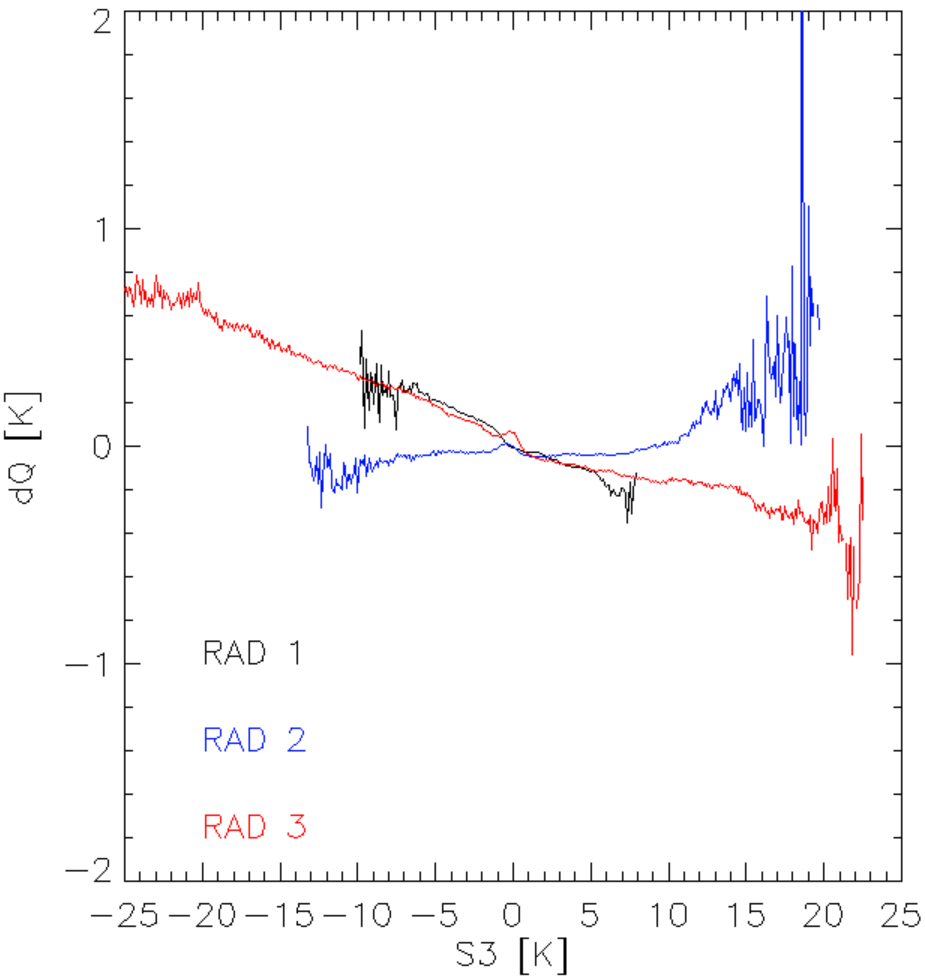
Zonal Biases: H-pol



Zonal Biases: Q = V - H



Zonal Biases: ΔQ vs S3



1. Faraday Rotation

   $$Q_{TOA}^{\ 2} = Q_{TOI}^{\ 2} + S_3^{\ 2}$$

   cannot explain ΔQ (sign) !

2. APC X-pol mixing: S3 into Q.

3. Calibration of S3 (gain, losses).

4. S3 at ocean surface not 0.
   Relevant at high wind speeds.

APC Coefficients

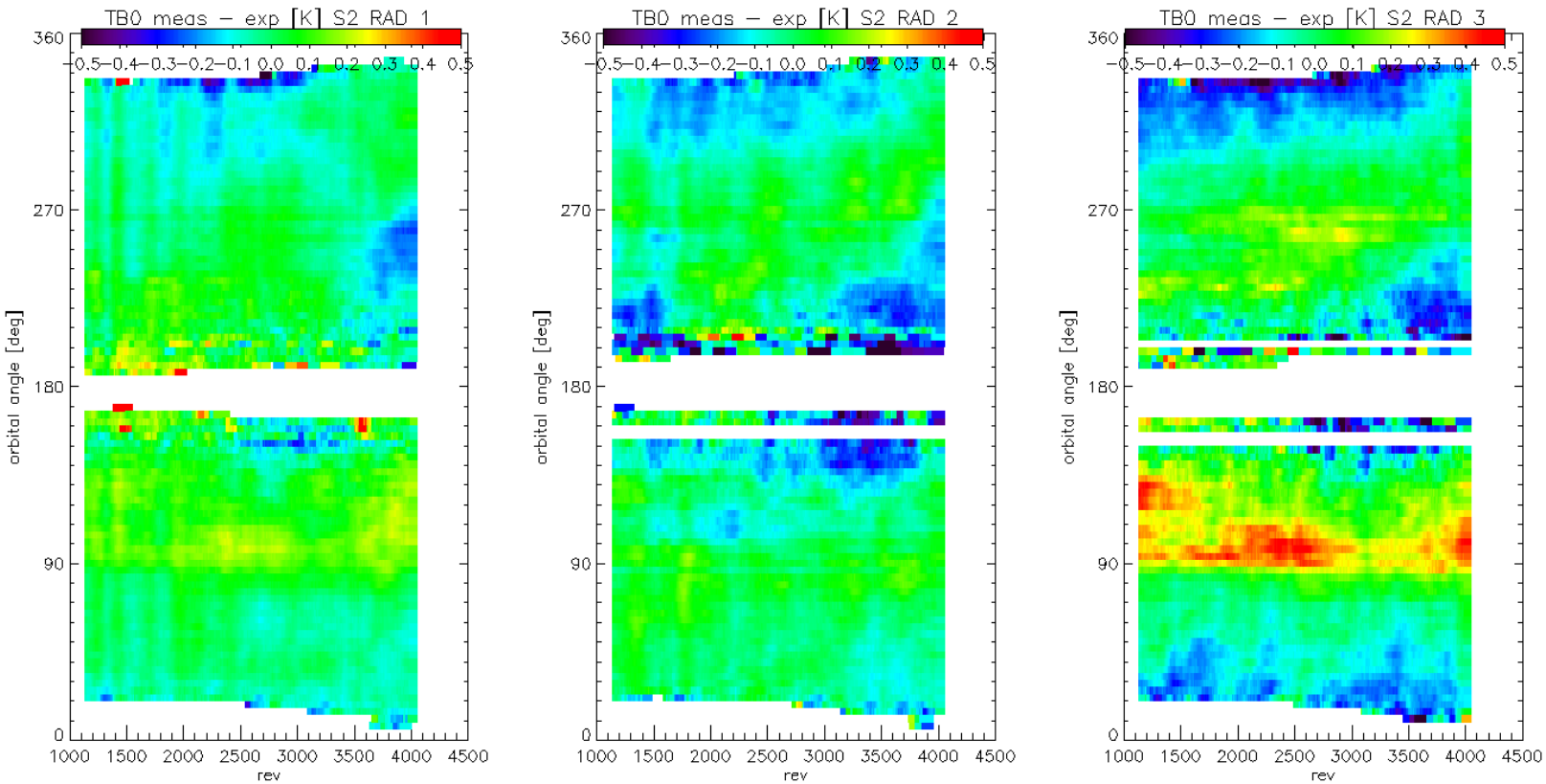
$$\mathbf{T_A} = \begin{bmatrix} T_{A1} \\ T_{A2} \\ T_{A3} \end{bmatrix} \qquad \mathbf{T_B} = \begin{bmatrix} T_{B1} \\ T_{B2} \\ T_{B3} \end{bmatrix} \qquad \mathbf{T_A} = \mathbf{A}^{-1}\mathbf{T_B} \quad \mathbf{T_B} = \mathbf{A}\mathbf{T_A}$$

Matrix A^{-1}

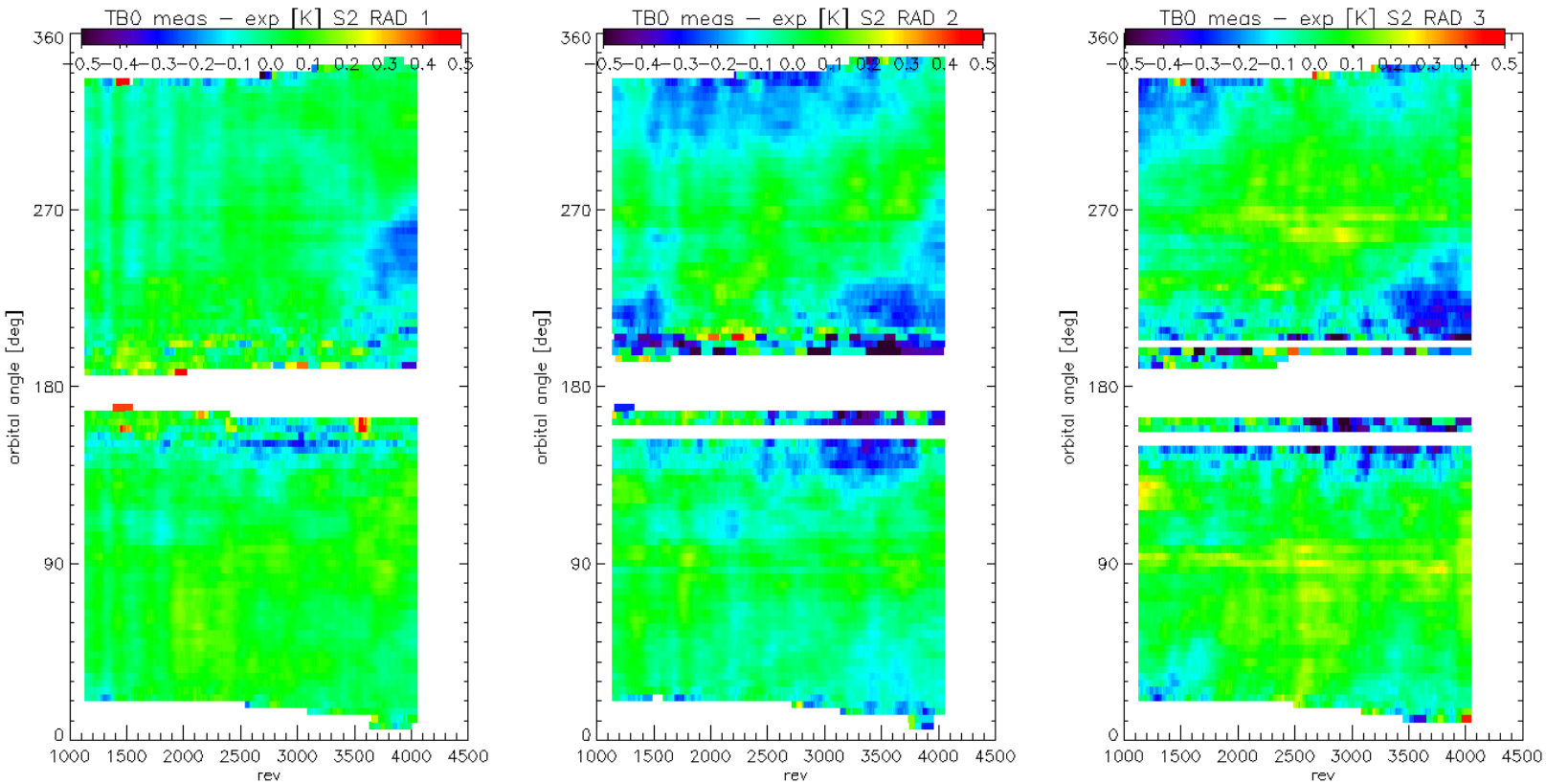
Pre-Launch			Post-Launch V1.2.2			Adjusted		
Horn 1			Horn 1			Horn 1		
0.97087	0.01684	-0.02718	0.97087	0.00000	0.00000	0.97087	0.00000	0.00000
-0.00010	0.92868	-0.05440	0.00000	0.92635	0.00000	0.00007	0.92635	0.03500
-0.01381	0.05498	0.92870	0.00300	0.00000	0.95848	0.00300	0.00000	0.95848
Horn 2			Horn 2			Horn 2		
0.96734	0.01414	-0.02700	0.96734	0.00000	0.00000	0.96734	0.00000	0.00000
-0.00062	0.94139	0.01538	0.00000	0.91095	0.00000	0.00000	0.91095	-0.00400
-0.01845	-0.01169	0.94168	0.00000	0.00000	0.93824	0.00000	0.00000	0.93824
Horn 3			Horn 3			Horn 3		
0.95966	0.01785	-0.01658	0.95966	0.00000	0.00000	0.95966	0.00000	0.00000
-0.00186	0.95200	-0.03767	0.00000	0.89485	0.00000	0.00000	0.89485	0.02500
-0.01387	0.04364	0.95421	0.00500	0.00000	0.90913	0.00500	0.00000	0.90913

Adjusted coupling from 3rd into 2nd Stokes

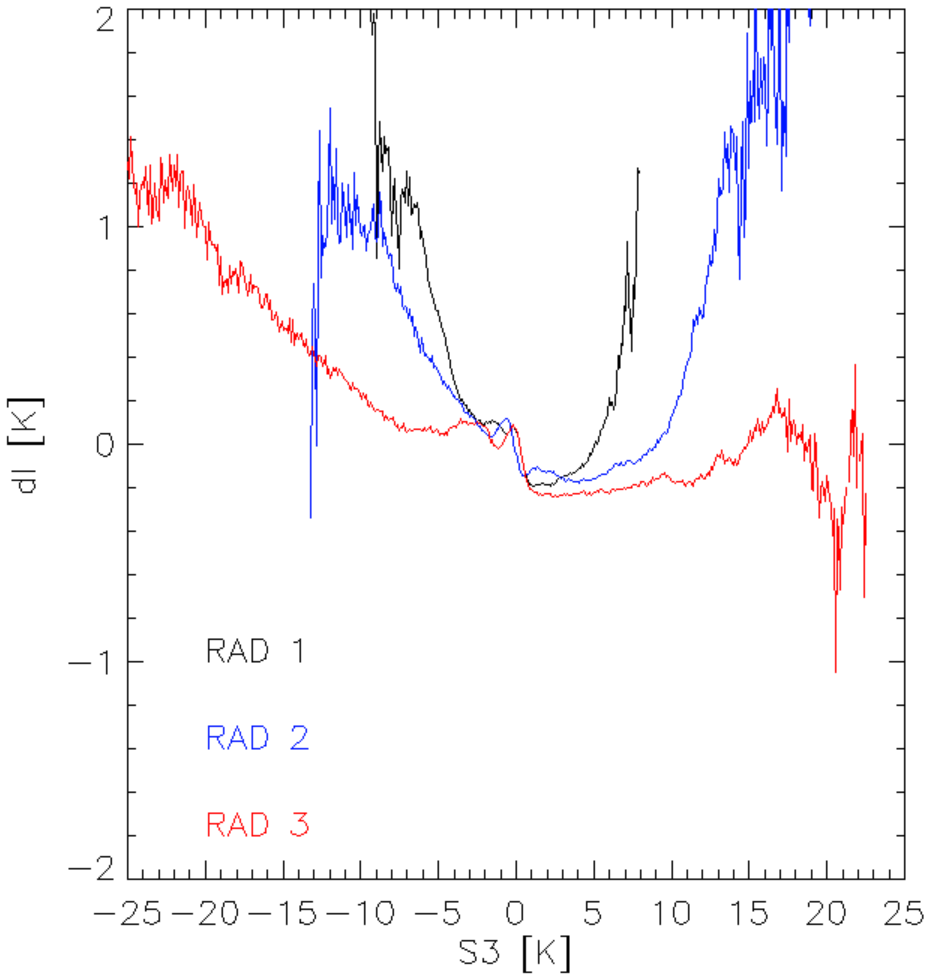
Zonal Biases: Q = V – H: current APC



Zonal Biases: Q = V – H: adjusted APC



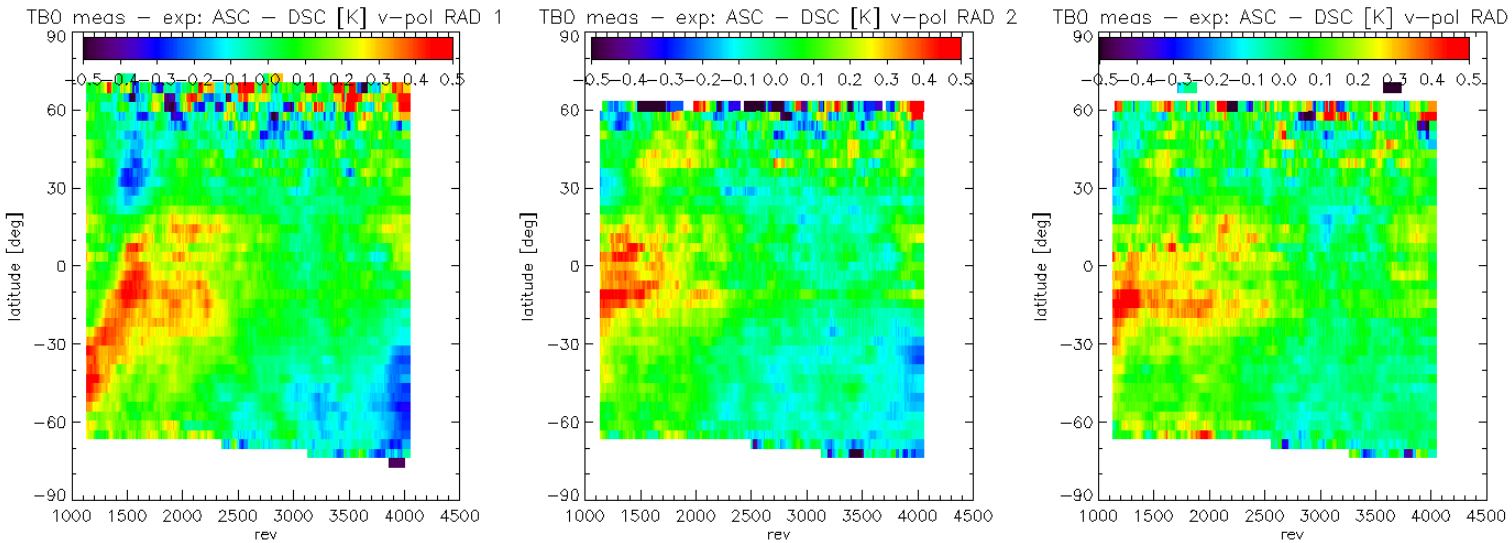
Zonal Biases: ΔI vs S3



Ascending – Descending: V-pol

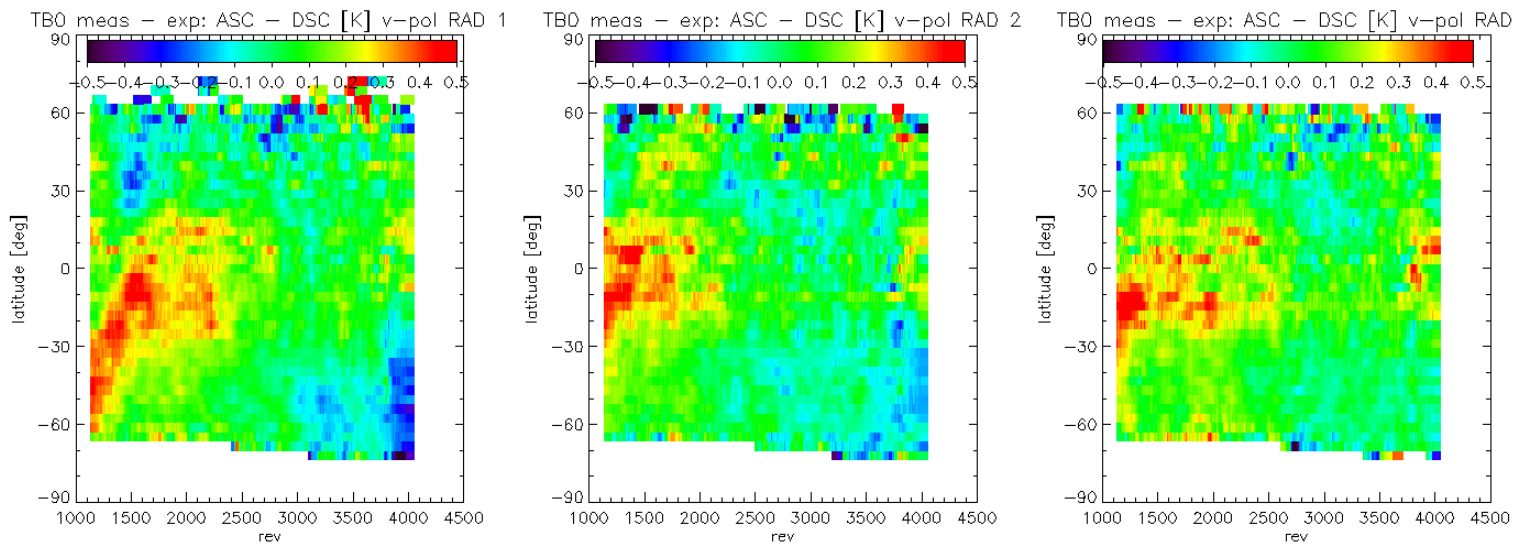
$\Delta T_{B0,surf}$

daily Reynolds SST



$\Delta T_{B0,surf}$

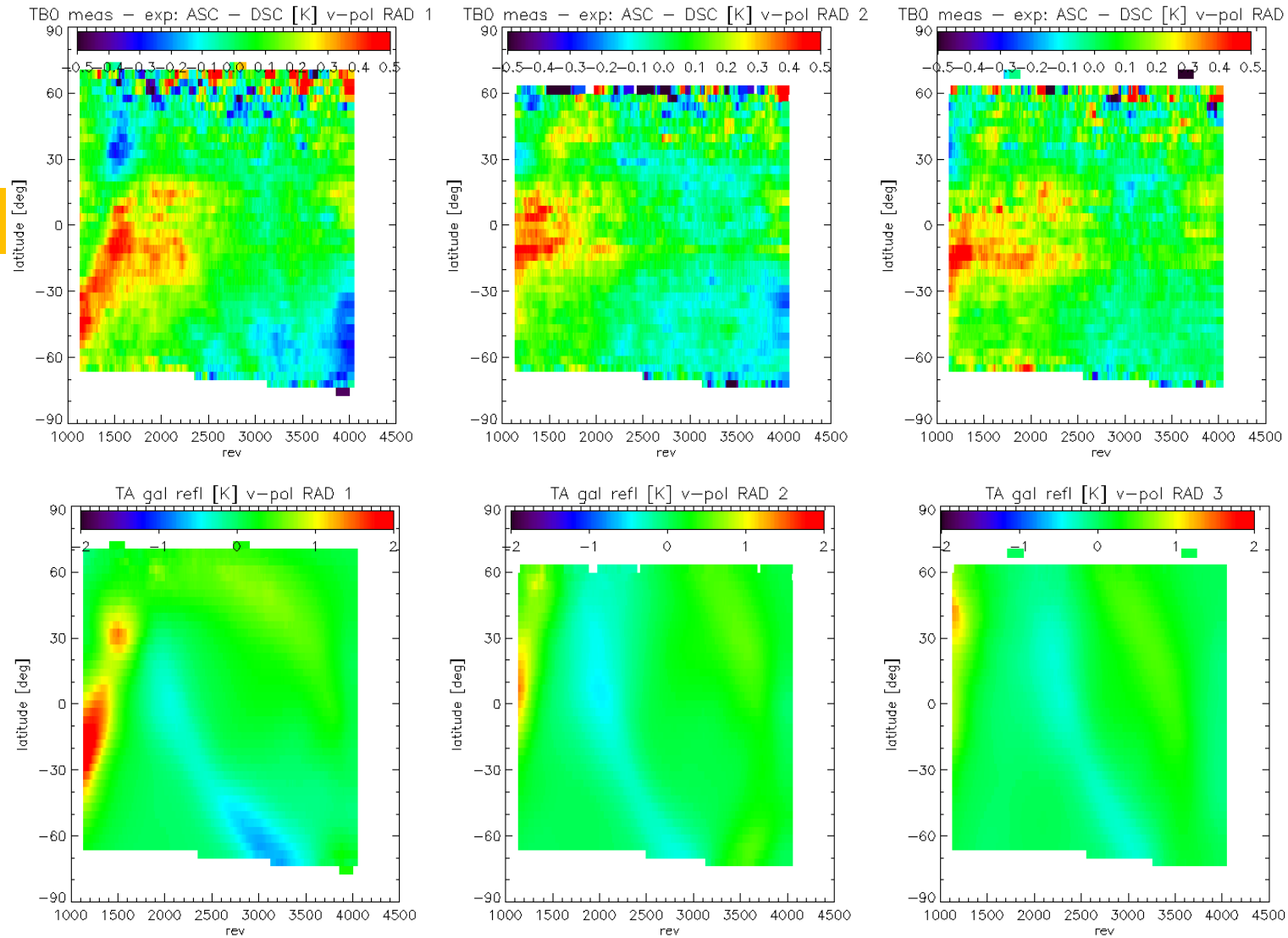
WindSat SST



Ascending – Descending: V-pol

$\Delta T_{B0,surf}$

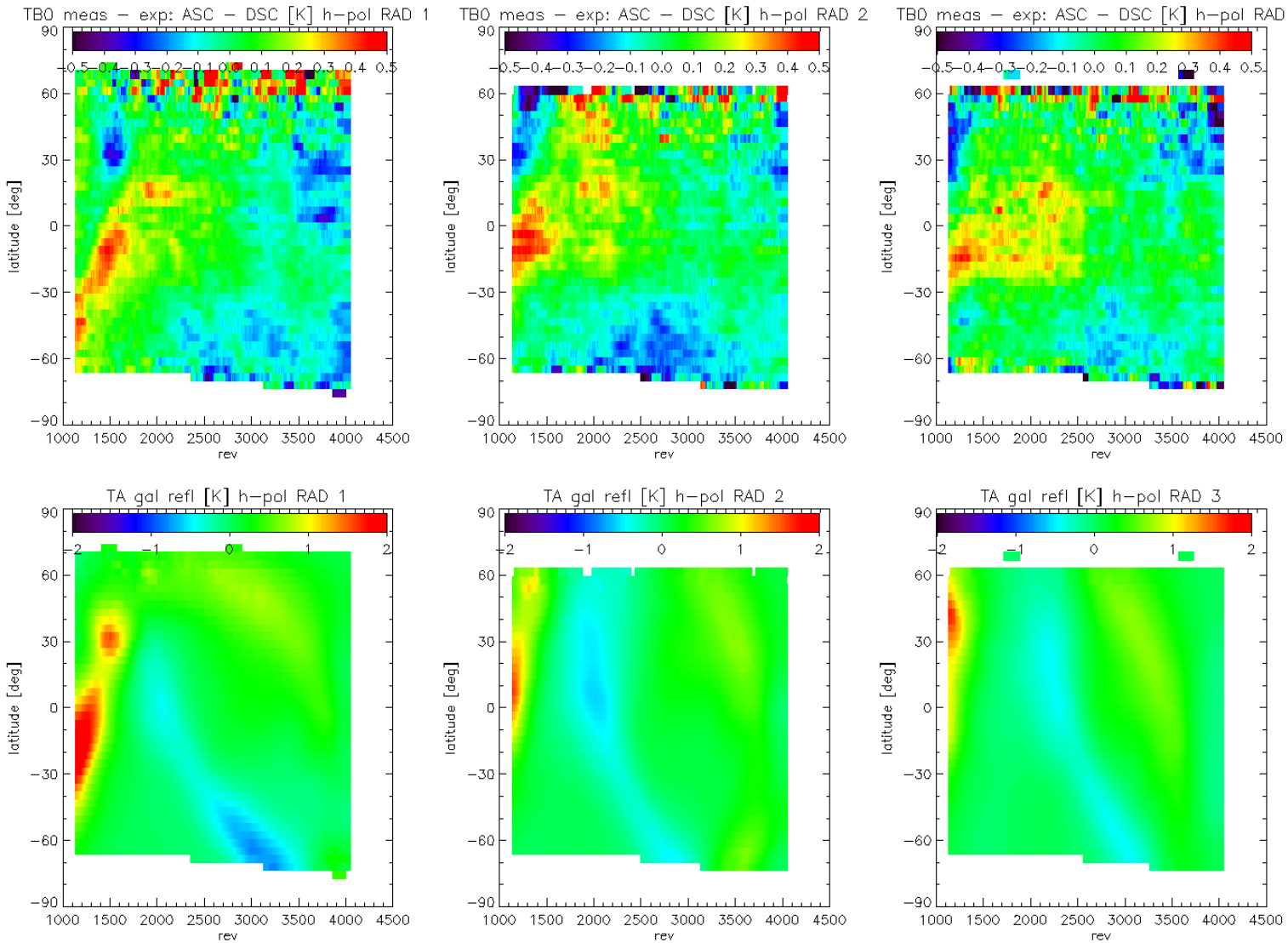
$T_{A,\ galaxy}$



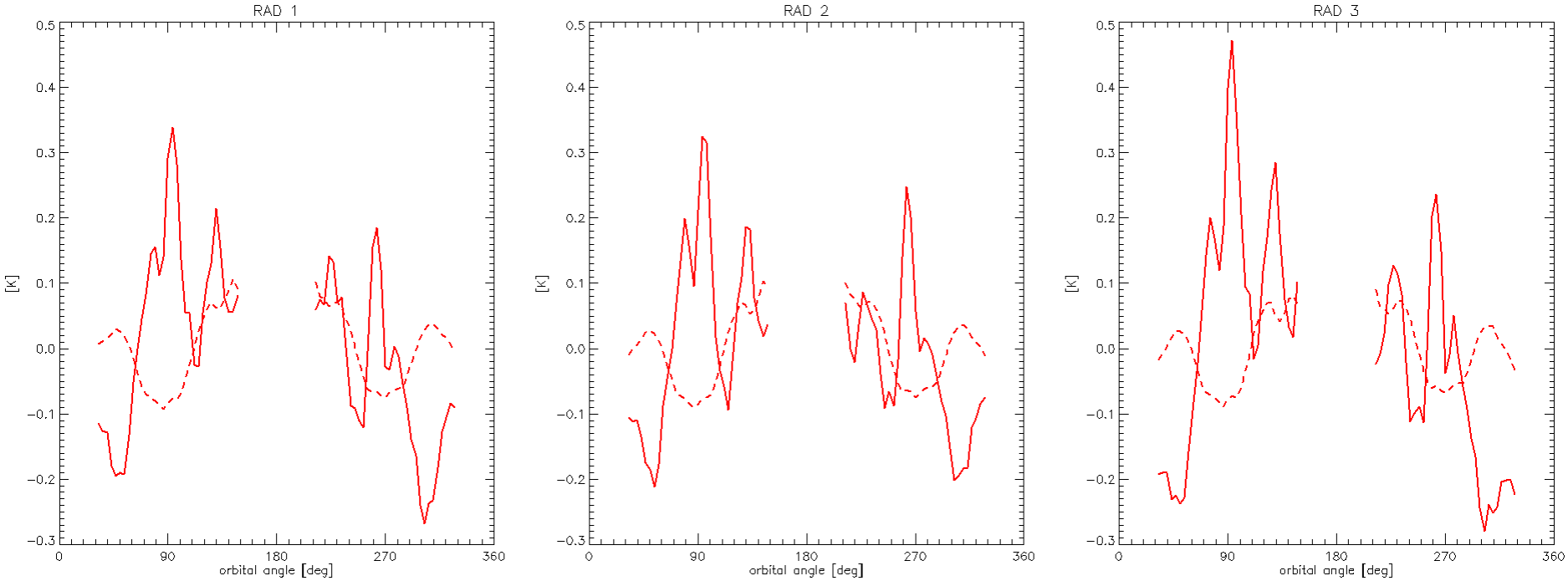
Ascending – Descending: H-pol

$\Delta T_{B0,surf}$

$T_{A,\ galaxy}$



Zonal Biases: Atmospheric Correction



$$T_B \approx (1 - R\tau^2) \cdot T_{eff}$$

$$T_{eff} = \frac{1}{2}\left(T_S + 273.15K\right)$$

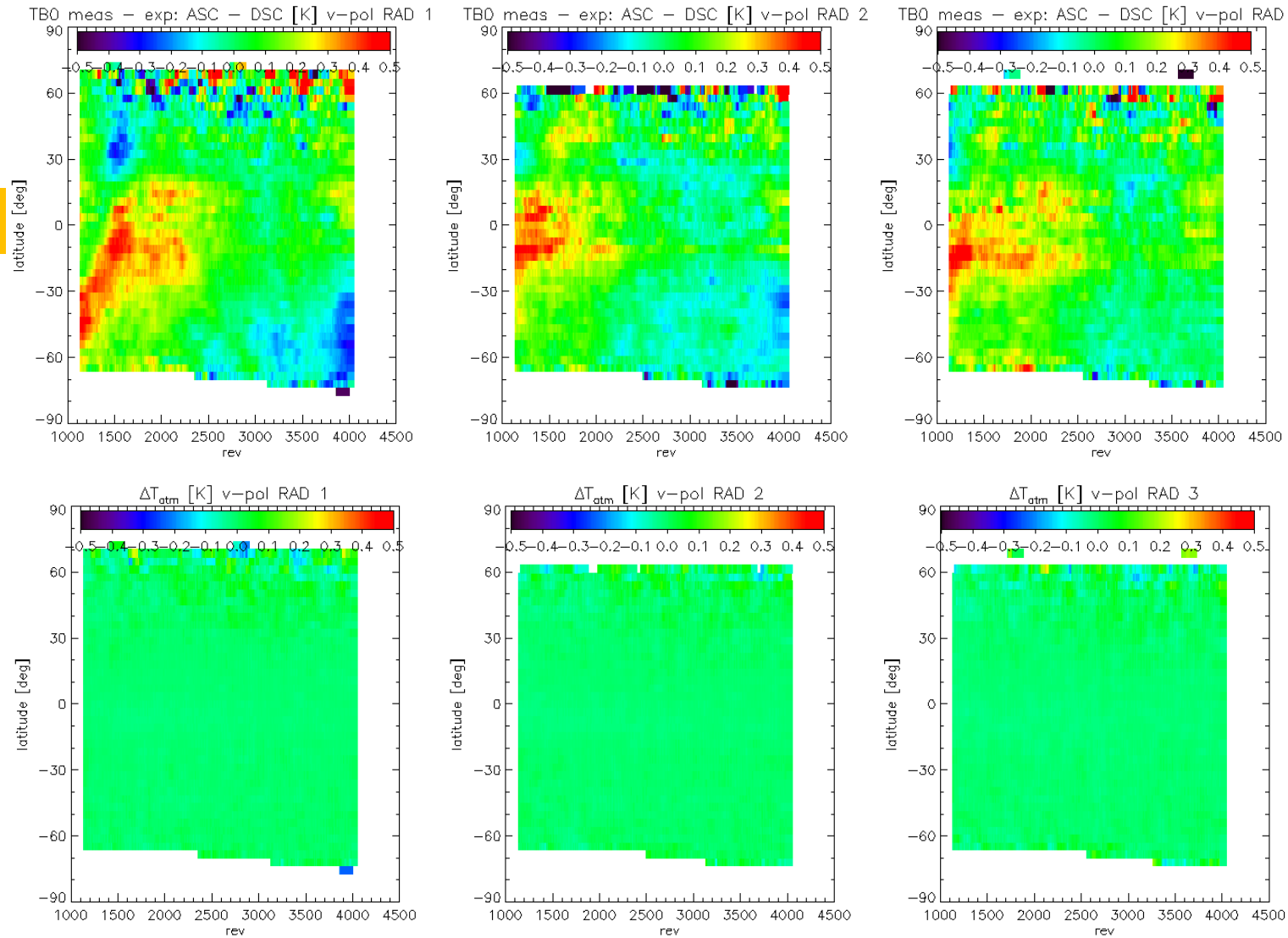
$$\Delta T_{atm} = T_B(\tau) - T_B(\tau = 1) \approx R\left(1 - \tau^2\right) \cdot T_{eff}$$

Full: Tb $_{surf,0}$ measured – expected
Dashed: ΔT $_{atm}$ (centered at 0).

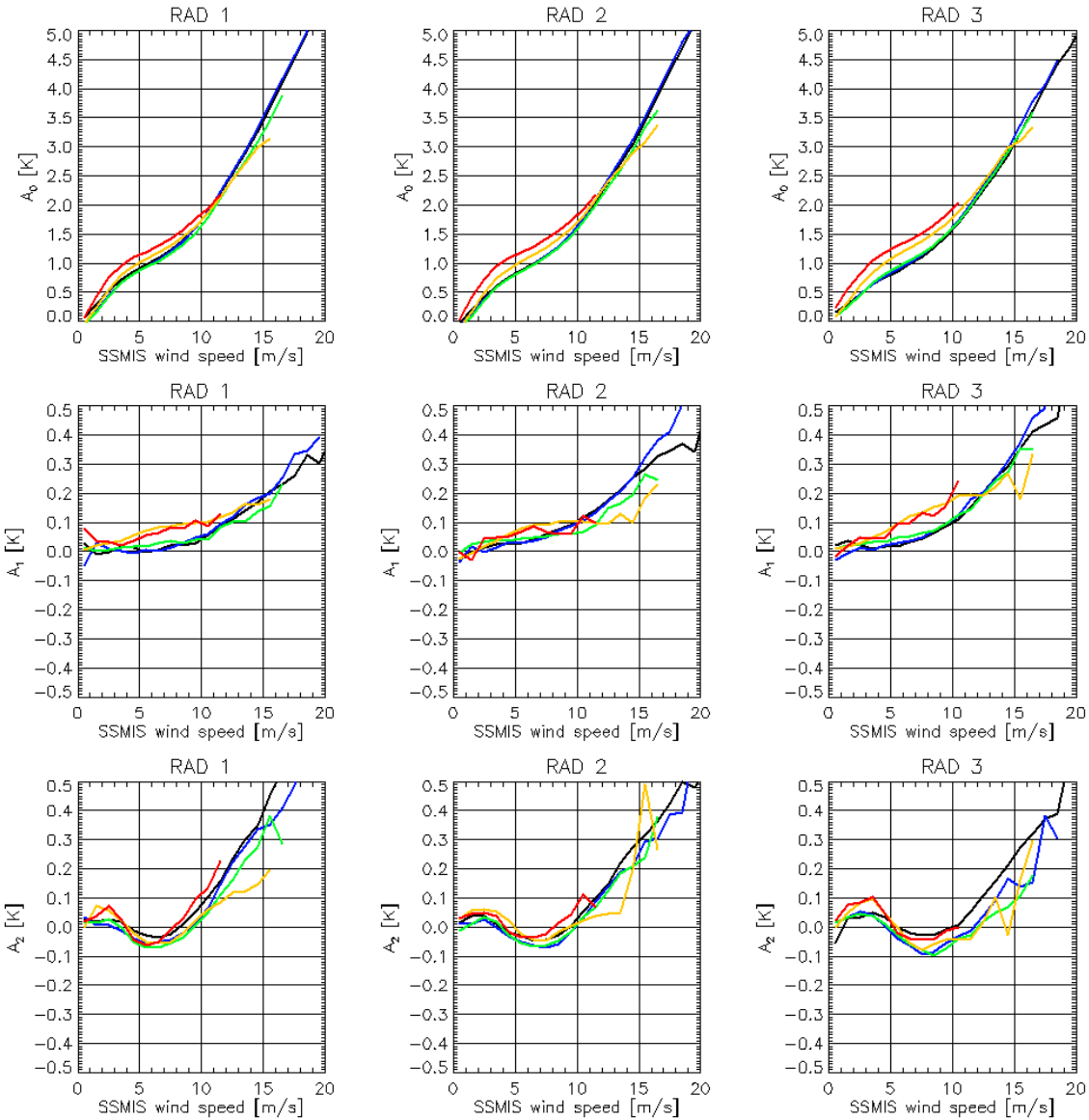
Ascending – Descending: V-pol

$\Delta T_{B0,surf}$

ΔT_{ATM}



Roughness Correction vs SST



- V-pol ΔE_{rough} [*290 K] harmonics versus SSMIS wind speed. Stratified into 5 SST. (-2 K to 33 K)
- Roughness induced emissivity ties into SST or something else that itself correlates with SST (e.g. SWH).
- **A_0 goes to zero at zero wind speed in each SST bin (≈ ±0.1 K).**
  - Wind induced roughness effect.
  - Dielectric model. Consistency
- Does not fix asc – dsc biases

Summary

- Asc – Dsc biases in Q (2nd Stokes) correlate with S3
  - Can be largely removed by adjust x-pol coupling from S3 into Q
  - RAD 1 + RAD 3
  - Cannot fix 1st Stokes
- Residual ASC –DSC biases are
  - Not persistent in time
  - Not strictly zonal
  - Not due to diurnal SST
  - Not due to diurnal ATM
  - Galaxy shows, but not major cause
- Use green zones for deriving model coefficients