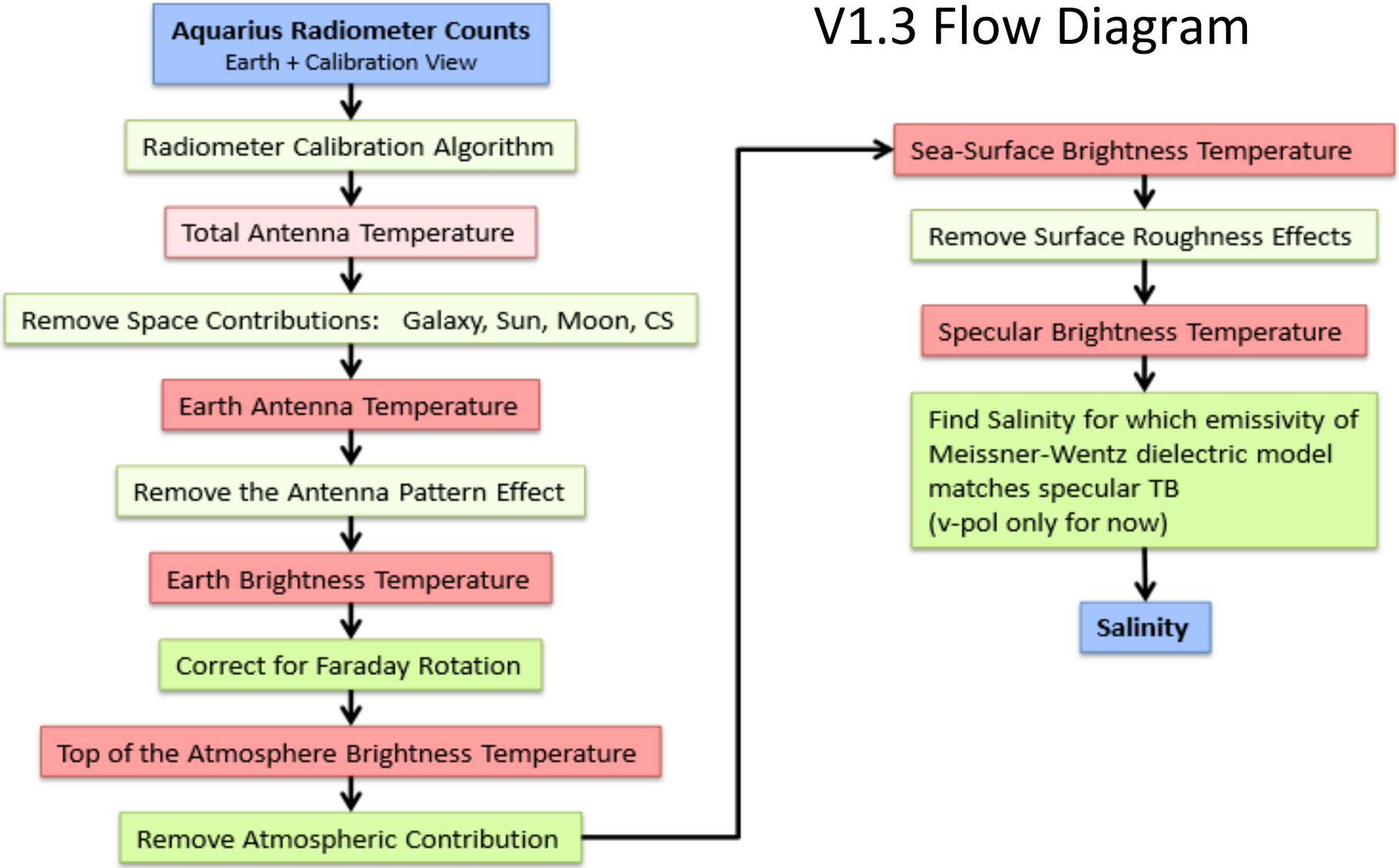
From V1 to V4

V1.3 - August 2012

- Initial adjustment to ND brightness to align TAs to mean global ocean model
- Correction to gain drift using noise diode ratio constraint (e.g. DR method)
- Update to APC cross-pol parameters to mitigate observed spurious coupling between polarizations
  - Initial APC based on scale model patterns
  - V1.3 update basically zeroed out cross-pol terms (diagonal terms untouched)
- Roughness correction coefficients updated
  - Parameterization for excess emission and backscatter as a function of WS and WD
  - Only NCEP wind speed used
- Only V-pol TBs used for salinity retreival

V1.3 Flow Diagram



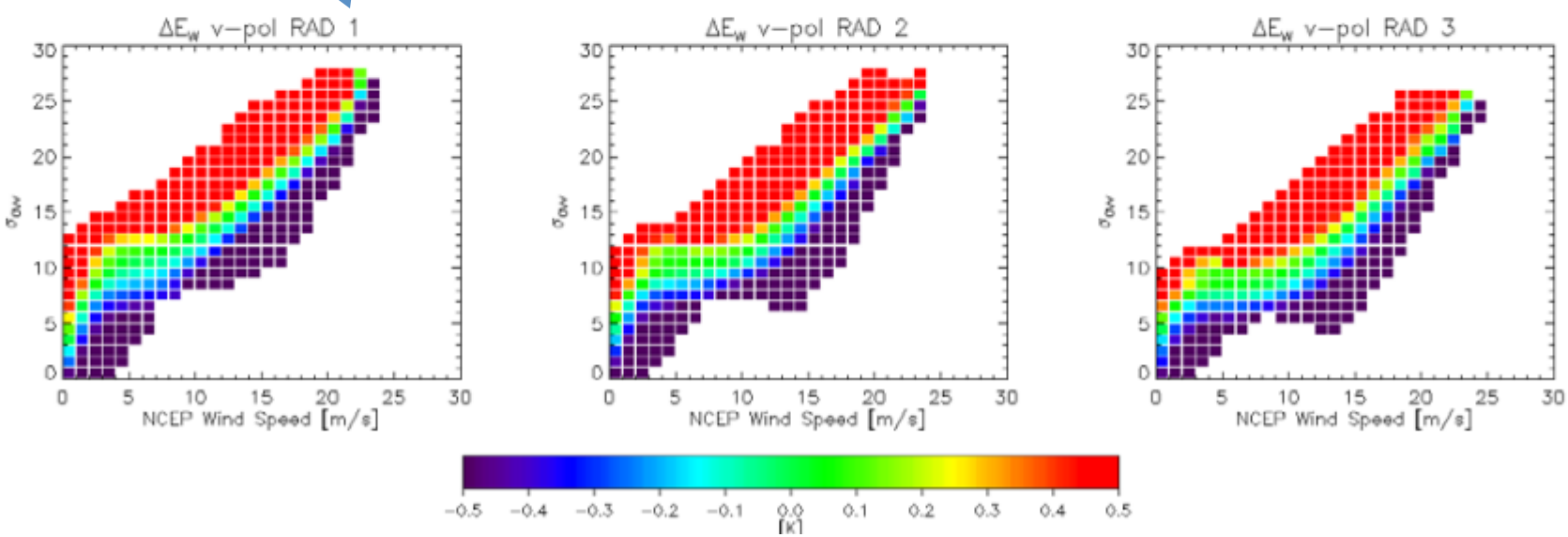
V2 - February 2013 (1 of 3)

- S/C pointing calibration based on RSS and JPL analysis
  - Roll: -0.51 deg, Pitch: 0.16 deg, Yaw: 0 deg
  - Updated correction tables that were impacted by new pointing (e.g. land/sea ice fraction, reflected galaxy etc)
- APC coefficients updated to use new 2012 GRASP patterns
  - Cross-pol coupling parameters still empirically tuned based on pitch maneuver polarization rotation data
  - Spill-over about 1% higher than previous, thought to be too high
- Updated drift correction
  - Exponential gain correction fit to HYCOM ocean residuals
  - Wiggles implemented as a moving offset correction based on method to extract instrument component from residuals (e.g. common component between N/S hemisphere, A/D passes

V2 - February 2013 (2 of 3)

- Roughness correction algorithm updated to use both NCEP wind vector and scatterometer sigma0-VV
  - Sigma-0 used as a residual roughness correction look-up table

$$\Delta E_w = R'(W_{NCEP}, \sigma o'_{vv}) + A_0(W_{NCEP}) + [A_1(W_{NCEP}) \cos(\varphi_{rel}) + A_2(W_{NCEP}) \cos(2\,\varphi_{rel})] \qquad \text{(III.1)}$$



V2 - February 2013 (3 of 3)

- Update to RFI algorithm parameters
  - Removed short accumulation 1 due to anomalous bias and noise
  - Detection thresholds tuned using measured ocean data to equalize false alarm rate between channels
- Land mask updated to use 1km mask
  - Biggest impact near islands

V3 - June 2014

- Updated APC parameters
  - Adjusted spill-over downward for V/H-pol only based on cold sky transects over land/sea transition
  - Spill-over from scale model, cross-pol from 2012 GRASP pattern
  - 3rd stokes coupling adjusted to remove biases over ocean and amazon

horn 1

1	1.0448	-0.0383	+0.0500
2	- 0.0030	1.0786	+0.0300
3	-0.0009	-0.0258	1.0755

horn 2

1	1.0497	-0.0343	0.0000
2	-0.0006	1.0593	0.0000
3	-0.0067	+0.0111	1.0555

horn 3

1	1.0580	-0.0344	+0.0250
2	-0.0004	1.0485	+0.0300
3	-0.0045	-0.0148	1.0489

horn 1

1	**1.0300**	**-0.0350**	+0.0500
2	**0.0001**	**1.0641**	+0.0300
3	**0.0000**	-0.0258	1.0755

horn 2

1	**1.0337**	**-0.0304**	0.0000
2	**0.0027**	**1.0435**	**-0.0144**
3	**-0.0006**	**+0.0211**	1.0555

horn 3

1	**1.0420**	**-0.0326**	+0.0250
2	**0.0011**	**1.0328**	**+0.0215**
3	**0.0000**	-0.0148	1.0489

V3 - June 2014 (1 of 5)

- Roughness correction updated to use both scatterometer data and H-pol TA
  - HH uses only scatterometer sigma0-HH
  - HHH uses scatterometer sigma0-HH plus TA Hpol with ancillary SST and climatological SSS inputs
  - NCEP also used in both and WD comes form NCEP
  - HH used for computation of drift correction

$$\chi^2_{HH}(W) = \frac{\left[\sigma^{measured}_{0,HH} - \sigma^{GMF}_{0,HH}(W,\varphi_r)\right]^2}{\mathrm{var}\left(\sigma_{0,HH}\right)} + \frac{\left[W - W_{NCEP}\right]^2}{\mathrm{var}\left(W_{NCEP}\right)} \qquad (2).$$

The SOS in the MLE for the HHH wind speed algorithm is:

$$\chi^2_{HHH}(W) = \frac{\left[\sigma^{measured}_{0,HH} - \sigma^{GMF}_{0,HH}(W,\varphi_r)\right]^2}{\mathrm{var}\left(\sigma_{0,HH}\right)} + \frac{\left[T^{measured}_{B,surf,H} - T^{GMF}_{B,surf,H}(W,\varphi_r)\right]^2}{\mathrm{var}\left(T_{B,surf,H}\right)} + \frac{\left[W - W_{NCEP}\right]^2}{\mathrm{var}\left(W_{NCEP}\right)} \qquad (3).$$

$$\Delta E_{rough} = \Delta E_{W0}\left(W_{HHH},\varphi_r,T_S\right) + \Delta E_{W1}\left(W_{HHH},\sigma'_{0,VV}\right) + \cancel{\Delta E_{W2}\left(W_{HHH},SWH\right)}$$

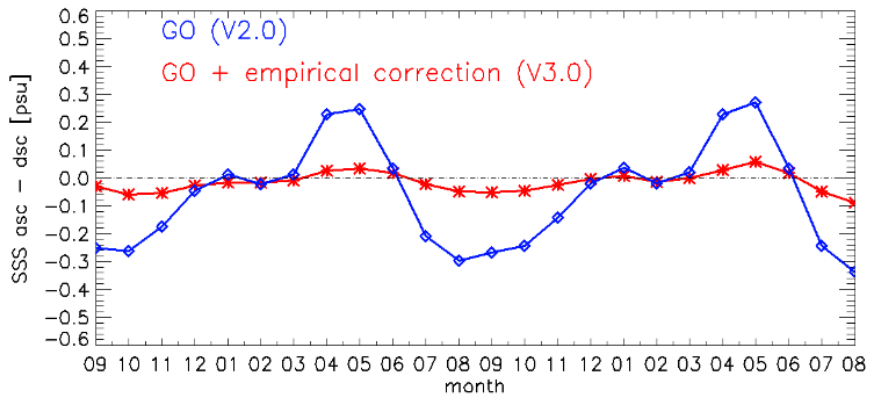
V3 - June 2014 (2 of 5)

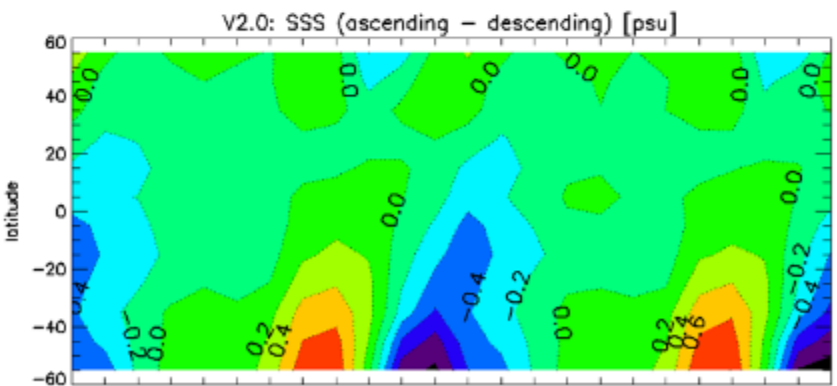
- Salinity retrieval algorithm updated to use both V-pol and H-pol TBs
  - Retrievals use computed specular TBs

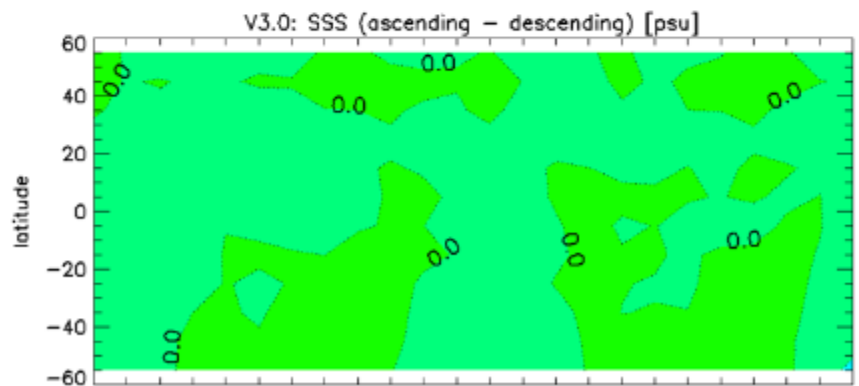
$$\chi^2 = \frac{\left[T_{B,spec,V}^{measured} - T_{B,spec,V}^{RTM}\left(T_S, SSS\right)\right]^2}{\mathrm{var}\left(T_{B,spec,V}\right)} + \frac{\left[T_{B,spec,H}^{measured} - T_{B,spec,H}^{RTM}\left(T_S, SSS\right)\right]^2}{\mathrm{var}\left(T_{B,spec,H}\right)}$$

V3 - June 2014 (3 of 5)

- Empirical ascending/descending symmeterization to remove biases suspected from reflected galaxy correction
  - Correction removes observed zonal asc/dsc biases
  - Partitions error based on strength of reflected galaxy

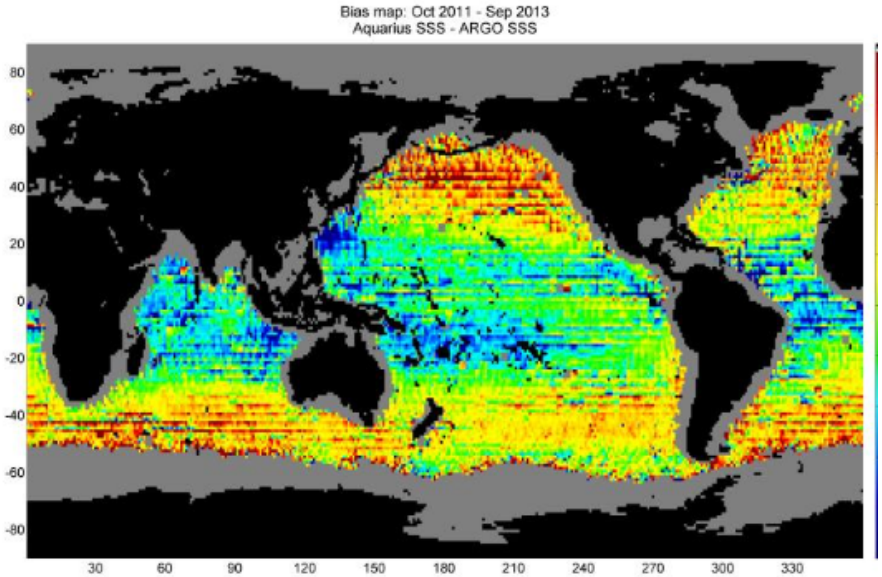


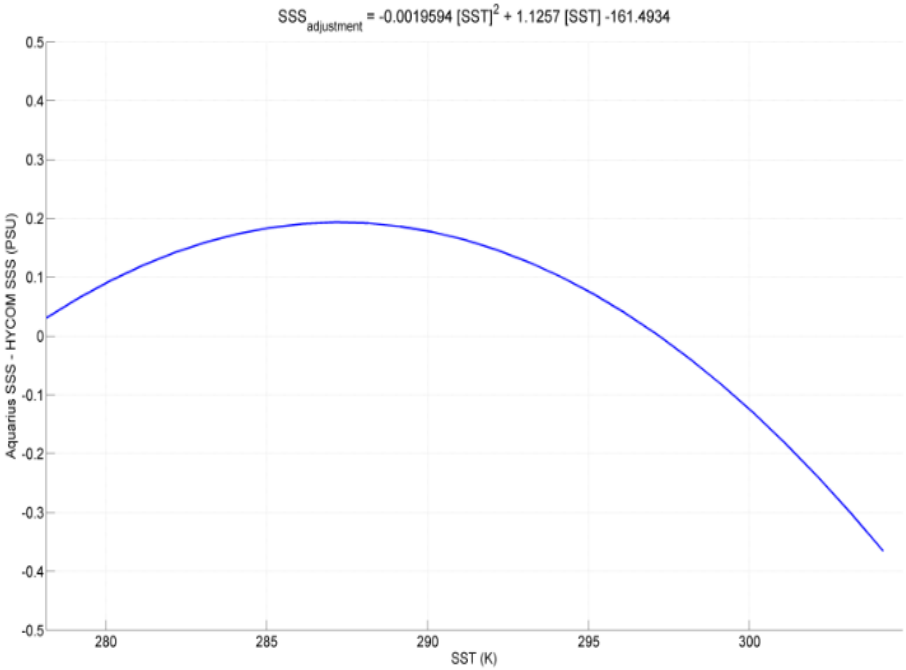




V3 - June 2014 (4 of 5)

- Empirical SST salinity bias adjustment
  - Polynomial correction directly to SSS derived from residual HYCOM biases



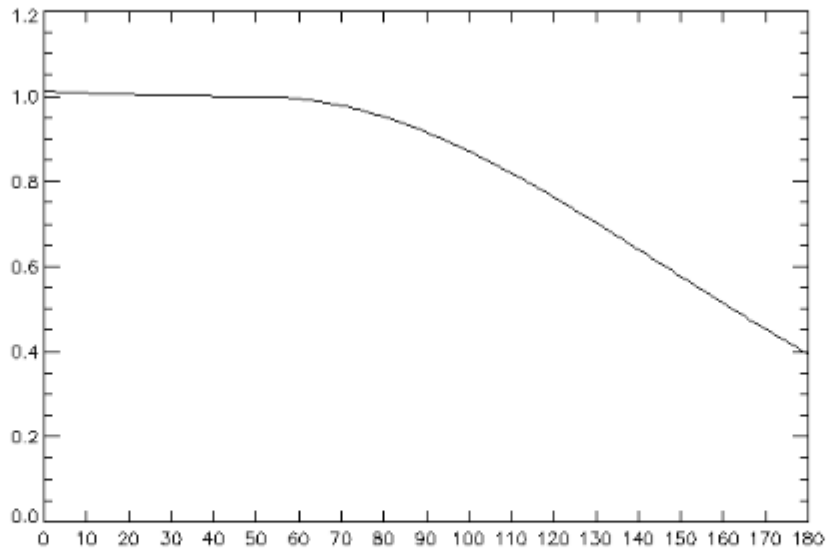


V3 - June 2014 (5 of 5)

- Drift correction simplified
  - Same exponential ND correction used
  - 7-day global mean ocean differences from HYCOM removed from data as an offset

V4 - July 2015 (1 of 3)

- Developed hybrid antenna pattern to adjust excess spill-over in 2012 GRASP patterns
  - Tapered sidelobe envelop in backlobes
  - Used to derived new correction tables (solar, land, ice)
  - Galaxy correction tables and APC parameters unchanged



V4 - July 2015 (2 of 3)

- Empirical SST bias correction applied at TB level instead of SSS level
  - Basically an additional dTB that is removed during the excess roughness correction process
  - Independent for each channel

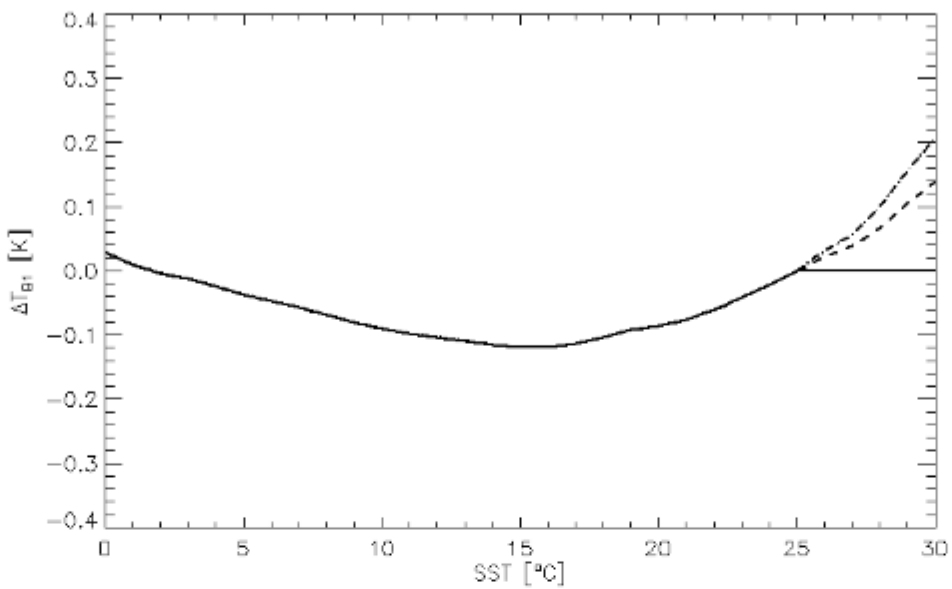


Figure 8: Value of $\Delta T_{B1}(T_S)$ for horn2 H-pol. Full line: W = 0 m/s, dashed line: W = 7.0 m/s, dashed-dot line: W = 12 m/s.

V4 - July 2015 (3 of 3)

- Empirical correction for observed non-linear I/Q coupling
  - Cause not understood