ATMS Radiance Based Calibration Algorithm

The two-point calibration is derived in radiance form as

$$R_b = R_w + G_b^{-1}(C_s - C_w) + Q_b = R_{b,I} + Q_b$$

where the linear and nonlinear terms are expressed as

$$R_{b,I} = R_w + G_b^{-1}(C_s - C_w)$$

$$G_b = \frac{C_w - C_c}{T_w - T_c} \qquad x = \frac{R_{b,I} - R_c}{R_w - R_c}$$

The maximum nonlinearity value can be derived by performing the derivative with respect to x. Using Taylor's expansion for f(x) = x(x-1) at x_0=0.5

$$Q_b = \mu G_b^{-2}(C_s - C_w)(C_s - C_c) = \mu(R_w - R_c)^2 x(x-1)$$

$$Q_b = Q^{\max}[4 \cdot (x - 0.5)^2 - 1]$$

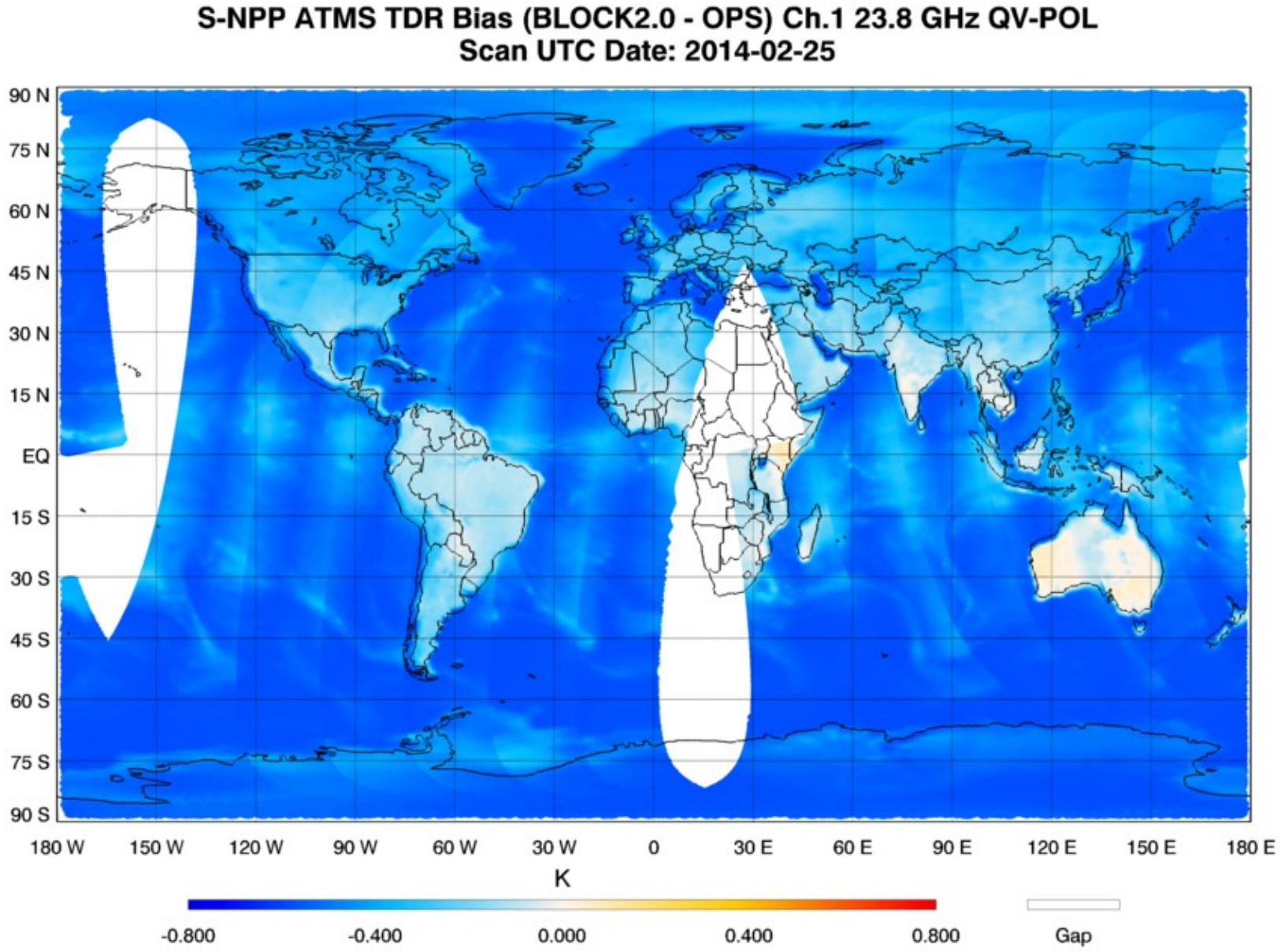
$$Q^{\max} = \frac{1}{4} \cdot \mu \cdot (Rw - Rc)^2$$

"μ" is a function of instrument temperature and can be characterized from TVAC data collected at different base plate temperature

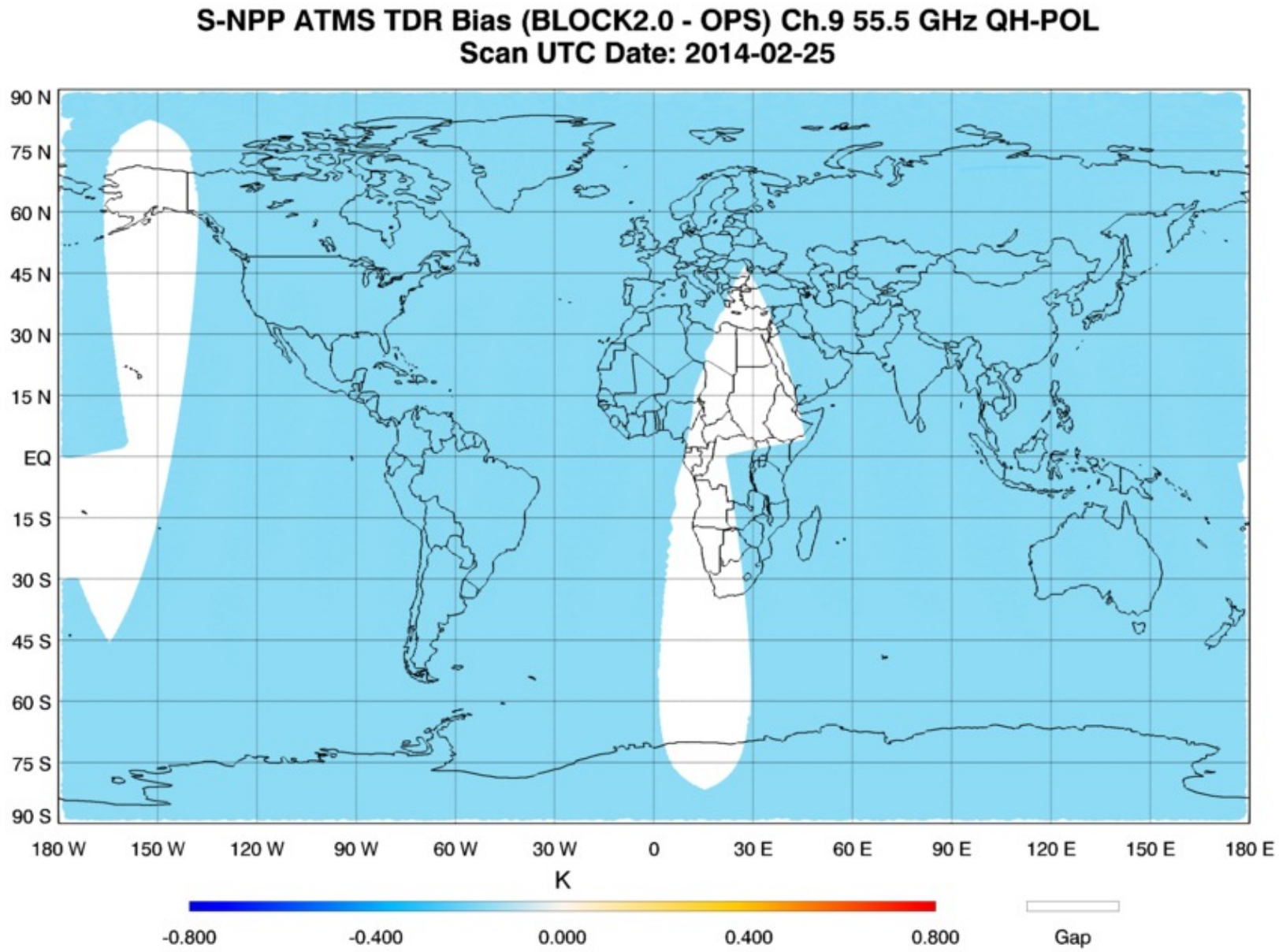
Weng, F., Zou, X., Sun, N., Yang, H., Tian, M., Blackwell, W. J., ... & Anderson, K. (2013). Calibration of Suomi national polar-orbiting partnership advanced technology microwave sounder. *Journal of Geophysical Research: Atmospheres*, *118*(19).

Weng, F., & Zou, X. (2013). Errors from Rayleigh–Jeans approximation in satellite microwave radiometer calibration systems. *Applied optics*, *52*(3), 505-508.

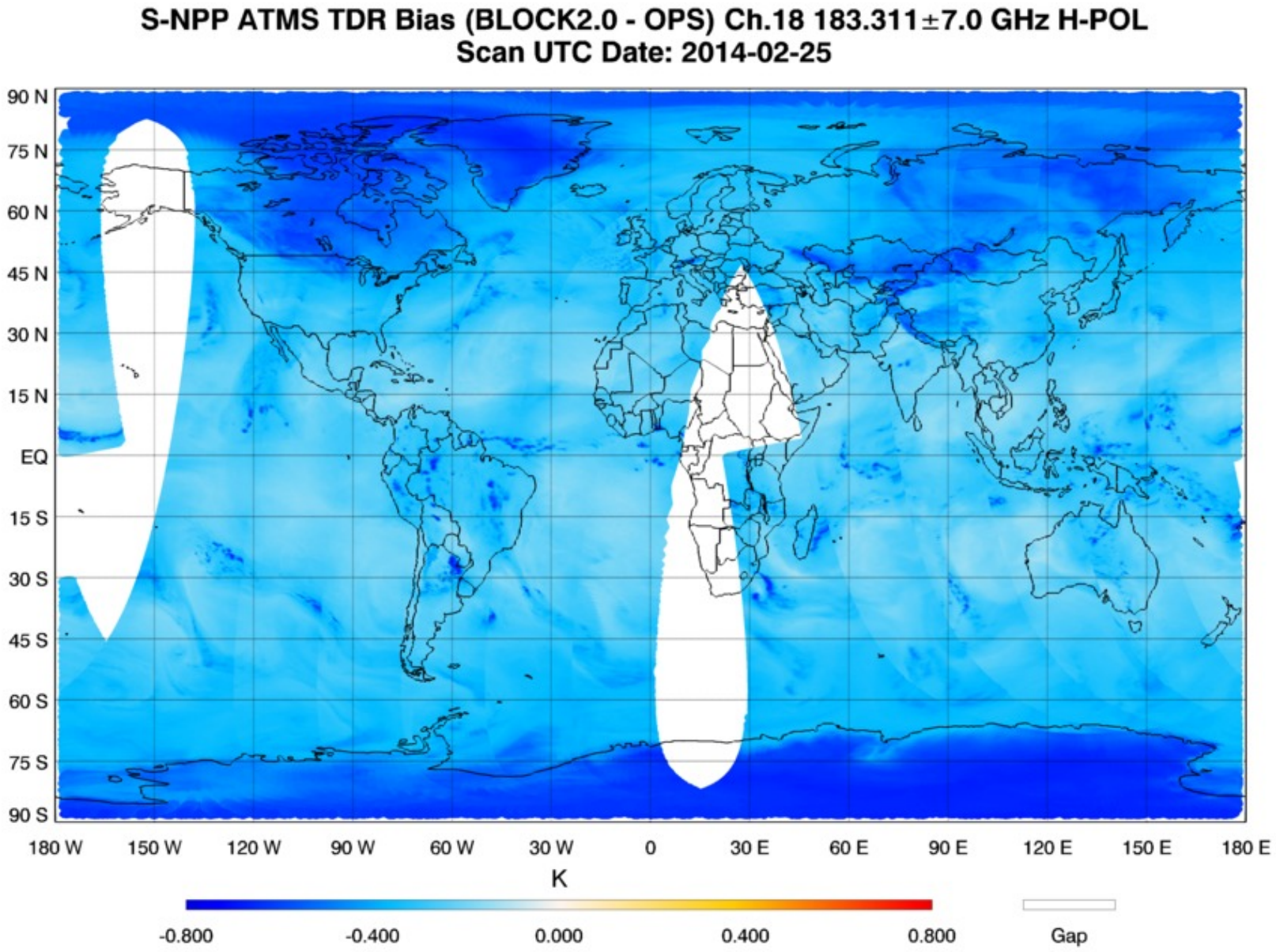
ATMS TDR Bias (Block2.0 – OPS[Block1.2])



ATMS TDR Bias (Block2.0 – OPS[Block1.2])



ATMS TDR Bias (Block2.0 – OPS[Block1.2])



ATMS TDR/SDR Bias (Block2.0 – OPS[Block1.2])