Bistatic data processing steps for calculating the Stokes parameters

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The raw bistatic data are processed to yield four data files per collect. The files represent the Real and Imaginary components of the Horizontal and Vertical polarizations, referred to as VR, VI, HR and HI herein.

It is important that the initial steps of processing are done on the full resolution data. The first step is to calculate the power in the H and V channels

$$|V|^2 = VR^2 + VI^2 \qquad (1)$$

$$|H|^2 = HR^2 + HI^2 \qquad (2)$$

Calibrating the powers in the H and V channels involves correcting for measured differences in the amplitudes of the two channels:

$$|V_C|^2 = a^2|V|^2 \qquad (3)$$

$$|H_C|^2 = \frac{1}{a^2}|H|^2 \qquad (4)$$

where $a^2 = 1.2232$

The Stokes parameters S_1 and S_2 are produced from the calibrated power in each channel:

$$S_1 = H_C^2 + V_C^2 \qquad (5)$$

$$S_2 = H_C^2 - V_C^2 \qquad (6)$$

The Stokes parameters S_3 and S_4 are produced from the real and imaginary components of the cross product of the H and V channels

$$HV^* = (HR + iHI)(VR + iVI)^* \qquad (7)$$

$$HV^* = (HRVR + HIVI) + i(-HRVI + HIVR) \qquad (8)$$

and require a correction for the phase difference between the H and V channels. That difference is dependent on the antenna temperature T, such that

$$S_3 = 2 * Re\langle HV^*\rangle cos(177° - 0.36°\times T) - Im\langle HV^*\rangle sin(177° - 0.36°\times T) \qquad (9)$$

$$S_4 = -2 * Re\langle HV^*\rangle sin(177° - 0.36°\times T) + Im\langle HV^*\rangle cos(177° - 0.36°\times T) \qquad (10)$$