$$T^{p}_{\mathrm{RMA,sky}} = T_{\mathrm{sky}} + \Delta T^{p}_{\mathrm{TL}} \quad (1)$$

$$\Delta T^{p}_{\mathrm{TL}} = (1 - t^{p}_{\mathrm{TL}})(T_{\mathrm{air}} - T_{\mathrm{sky}}) \quad (2)$$

$$t^{p}_{\mathrm{TL}} = 10^{-L^{p}_{\mathrm{TL}}/10} \quad (3)$$

$$T^{p,ch}_{source}(T_{\mathrm{CA}}) = \frac{T_{\mathrm{RS}} - T^{p}_{\mathrm{RMA,sky}}}{U^{ch}_{\mathrm{RS}} - U^{p,ch}_{\mathrm{sky}}}\left(U^{ch}_{source} - U^{p,ch}_{\mathrm{sky}}\right) + T^{p}_{\mathrm{RMA,sky}} \quad \text{for} \quad source = \{\mathrm{ACS}, \mathrm{HS}\} \quad (4)$$

$$T_{\mathrm{ACS}}(T_{\mathrm{CA}}) = 26.7715 + 0.2474 \cdot T_{\mathrm{CA}} \quad (5)$$

$$T_{\mathrm{HS}}(T_{\mathrm{CA}}) = 633.5730 + 0.8175 \cdot T_{\mathrm{CA}} \quad (6)$$

$$T^{p,ch}_{\mathrm{A}} = \frac{T_{\mathrm{HS}}(T_{\mathrm{CA}}) - T_{\mathrm{ACS}}(T_{\mathrm{CA}})}{U^{ch}_{\mathrm{HS}} - U^{ch}_{\mathrm{ACS}}} \cdot \left(U^{p,ch}_{\mathrm{RMA}} - U^{ch}_{\mathrm{ACS}}\right) + T_{\mathrm{ACS}}(T_{\mathrm{CA}}) \quad (7)$$

$$\Delta T^{p,ch}_{\mathrm{A}}(\theta_{\mathrm{A}}) = \sqrt{\Delta T^{p,ch}_{\mathrm{RFI}}(\theta_{\mathrm{A}})^2 + {\Delta T^{ch}_{\mathrm{RS}}}^2 + {\Delta T_{\mathrm{ELBARA-III}}}^2} \quad (8)$$

$$CF(W_{\mathrm{S},}, \rho_{\mathrm{S}}) = \sum_{\theta_{\mathrm{A}},p} \frac{\left(T^{p}_{\mathrm{A}}(\theta_{\mathrm{A}}) - T^{p}_{\mathrm{A,sim}}(\theta_{\mathrm{A}}, W_{\mathrm{S},}, \rho_{\mathrm{S}})\right)^2}{\Delta T^{p}_{\mathrm{A}}(\theta_{\mathrm{A}})^2} \quad (9)$$

$$\left| \begin{matrix} T^{\mathrm{H}}_{\mathrm{A}}(\theta_{\mathrm{A}}) = T^{\mathrm{H}}_{\mathrm{A,sim.}}\left(\theta_{\mathrm{A}}, W^{\theta_{\mathrm{A}}}_{\mathrm{S}}, \rho^{\theta_{\mathrm{A}}}_{\mathrm{S}}\right) \\ T^{\mathrm{V}}_{\mathrm{A}}(\theta_{\mathrm{A}}) = T^{\mathrm{V}}_{\mathrm{A,sim.}}\left(\theta_{\mathrm{A}}, W^{\theta_{\mathrm{A}}}_{\mathrm{S}}, \rho^{\theta_{\mathrm{A}}}_{\mathrm{S}}\right) \end{matrix} \right| \quad (10)$$

$$\widehat{\mathbf{K}}_{\mathbf{F}}(\theta_{\mathrm{F}}, \varphi_{\mathrm{F}}) = \begin{pmatrix} \sin\theta_{\mathrm{F}} \cdot \sin\varphi_{\mathrm{F}} \\ \sin\theta_{\mathrm{F}} \cdot \cos\varphi_{\mathrm{F}} \\ -\cos\theta_{\mathrm{F}} \end{pmatrix} \quad (11)$$

$$\hat{\mathbf{H}}_{\mathbf{F}}(\theta_{\mathrm{F}},\varphi_{\mathrm{F}}) = \frac{\hat{\mathbf{K}}_{\mathbf{F}}\otimes\hat{\mathbf{Z}}}{|\hat{\mathbf{K}}_{\mathbf{F}}\otimes\hat{\mathbf{Z}}|} = \frac{1}{N_{\mathrm{H,F}}}\begin{pmatrix} \sin\theta_{\mathrm{F}}\cdot\cos\varphi_{\mathrm{F}} \\ -\sin\theta_{\mathrm{F}}\cdot\sin\varphi_{\mathrm{F}} \\ 0 \end{pmatrix} \text{ with normalization} \tag{12}$$

$N_{\mathrm{H,F}} = |\sin\theta_{\mathrm{F}}|$

$$\hat{\mathbf{V}}_{\mathbf{F}}(\theta_{\mathrm{F}},\varphi_{\mathrm{F}}) = \frac{\hat{\mathbf{K}}_{\mathbf{F}}\otimes\hat{\mathbf{H}}_{\mathbf{F}}}{|\hat{\mathbf{K}}_{\mathbf{F}}\otimes\hat{\mathbf{H}}_{\mathbf{F}}|} = \frac{1}{N_{\mathrm{V,F}}}\begin{pmatrix} -\cos\theta_{\mathrm{F}}\cdot\sin\theta_{\mathrm{F}}\cdot\sin\varphi_{\mathrm{F}} \\ -\cos\theta_{\mathrm{F}}\cdot\sin\theta_{\mathrm{F}}\cdot\cos\varphi_{\mathrm{F}} \\ -\sin^2\theta_{\mathrm{F}} \end{pmatrix} \text{ with normalization} \tag{13}$$

$N_{\mathrm{V,F}} = \sqrt{(\cos\theta_{\mathrm{F}}\cdot\sin\theta_{\mathrm{F}}\cdot\sin\varphi_{\mathrm{F}})^2 + (\cos\theta_{\mathrm{F}}\cdot\sin\theta_{\mathrm{F}}\cdot\cos\varphi_{\mathrm{F}})^2 + \sin^4\theta_{\mathrm{F}}}$

$$\hat{\mathbf{K}}_{\mathbf{A}}(\theta_{\mathrm{A}}) = \begin{pmatrix} 0 \\ \sin\theta_{\mathrm{A}} \\ -\cos\theta_{\mathrm{A}} \end{pmatrix} \tag{14}$$

$$\hat{\mathbf{H}}_{\mathbf{A}}(\theta_{\mathrm{A}}) = \frac{1}{N_{\mathrm{A,H}}}\begin{pmatrix} \sin\theta_{\mathrm{A}} \\ 0 \\ 0 \end{pmatrix} \text{ with normalization} \tag{15}$$

$N_{\mathrm{A,H}} = \sin\theta_{\mathrm{A}}$

$$\hat{\mathbf{V}}_{\mathbf{A}}(\theta_{\mathrm{A}}) = \frac{1}{N_{\mathrm{A,V}}}\begin{pmatrix} 0 \\ -\cos\theta_{\mathrm{A}}\cdot\sin\theta_{\mathrm{A}} \\ -\sin^2\theta_{\mathrm{A}} \end{pmatrix} \text{ with normalization} \tag{16}$$

$N_{\mathrm{A,V}} = \sqrt{(\cos\theta_{\mathrm{A}}\cdot\sin\theta_{\mathrm{A}})^2 + \sin^4\theta_{\mathrm{A}}}$

$$H_{\mathrm{A}}^{\mathrm{H_F}} = \hat{\mathbf{H}}_{\mathbf{F}} \odot \hat{\mathbf{H}}_{\mathbf{A}} = \cos\varphi_{\mathrm{F}} \tag{17}$$

$$H_{\mathrm{A}}^{\mathrm{V_F}} = \hat{\mathbf{V}}_{\mathbf{F}} \odot \hat{\mathbf{H}}_{\mathbf{A}} = \cos\theta_{\mathrm{F}}\cdot\sin\varphi_{\mathrm{F}} \tag{18}$$

$$V_{\mathrm{A}}^{\mathrm{V_F}} = \hat{\mathbf{V}}_{\mathbf{F}} \odot \hat{\mathbf{V}}_{\mathbf{A}} = \cos\varphi_{\mathrm{F}}\cdot\cos\theta_{\mathrm{A}}\cdot\cos\theta_{\mathrm{F}} + \sin\theta_{\mathrm{A}}\cdot\sin\theta_{\mathrm{F}} \tag{19}$$

$$V_{\mathrm{A}}^{\mathrm{H_F}} = \hat{\mathbf{H}}_{\mathbf{F}} \odot \hat{\mathbf{V}}_{\mathbf{A}} = \cos\theta_{\mathrm{A}}\cdot\sin\varphi_{\mathrm{F}} \tag{20}$$

$$\mathbf{E}_{\mathbf{A}}^{\mathbf{H}} = \begin{pmatrix} H_{\mathrm{A}}^{\mathrm{H_F}} \cdot E_{\mathrm{F}}^{\mathrm{H}} \\ H_{\mathrm{A}}^{\mathrm{V_F}} \cdot E_{\mathrm{F}}^{\mathrm{V}} \end{pmatrix} \quad \text{and} \quad \mathbf{E}_{\mathbf{A}}^{\mathbf{V}} = \begin{pmatrix} V_{\mathrm{A}}^{\mathrm{H_F}} \cdot E_{\mathrm{F}}^{\mathrm{H}} \\ V_{\mathrm{A}}^{\mathrm{V_F}} \cdot E_{\mathrm{F}}^{\mathrm{V}} \end{pmatrix} \tag{21}$$

$$T_{\mathrm{A,F}}^{\mathrm{H}} \propto \left|\mathbf{E}_{\mathbf{A}}^{\mathbf{H}}\right|^{\mathbf{2}} = {H_{\mathrm{A}}^{\mathrm{H_F}}}^2 \cdot T_{\mathrm{F}}^{\mathrm{H}} + {H_{\mathrm{A}}^{\mathrm{V_F}}}^2 \cdot T_{\mathrm{F}}^{\mathrm{V}} \quad \text{and} \quad T_{\mathrm{A,F}}^{\mathrm{V}} \propto \left|\mathbf{E}_{\mathbf{A}}^{\mathbf{V}}\right|^{\mathbf{2}} = {V_{\mathrm{A}}^{\mathrm{H_F}}}^2 \cdot T_{\mathrm{F}}^{\mathrm{H}} + {V_{\mathrm{A}}^{\mathrm{V_F}}}^2 \cdot T_{\mathrm{F}}^{\mathrm{V}} \tag{22}$$

$$T_{\mathrm{A}}^{\mathrm{H}} = \frac{1}{N} \iint_{\Omega} T_{\mathrm{A,F}}^{\mathrm{H}} \cdot D \cdot d\Omega = \frac{1}{N} \int_{\theta_{\mathrm{F}}} \int_{\varphi_{\mathrm{F}}} \left({H_{\mathrm{A}}^{\mathrm{H_F}}}^2 \cdot T_{\mathrm{B,F}}^{\mathrm{H}} + {H_{\mathrm{A}}^{\mathrm{V_F}}}^2 \cdot T_{\mathrm{B,F}}^{\mathrm{V}} \right) \cdot D \cdot \sin\theta_{\mathrm{F}} \cdot d\theta_{\mathrm{F}} \cdot d\varphi_{\mathrm{F}} \tag{23}$$

$$T_{\mathrm{A}}^{\mathrm{V}} = \frac{1}{N} \iint_{\Omega} T_{\mathrm{A,F}}^{\mathrm{V}} \cdot D \cdot d\Omega = \frac{1}{N} \int_{\theta_{\mathrm{F}}} \int_{\varphi_{\mathrm{F}}} \left({V_{\mathrm{A}}^{\mathrm{H_F}}}^2 \cdot T_{\mathrm{B,F}}^{\mathrm{H}} + {V_{\mathrm{A}}^{\mathrm{V_F}}}^2 \cdot T_{\mathrm{B,F}}^{\mathrm{V}} \right) \cdot D \cdot \sin\theta_{\mathrm{F}} \cdot d\theta_{\mathrm{F}} \cdot d\varphi_{\mathrm{F}} \tag{24}$$

$$D(\alpha) = \exp[-\alpha^2/\alpha_0^2] \quad \text{with} \quad \alpha_0 = 13.8366° \tag{25}$$

$$\cos\alpha = \widehat{\mathbf{K}}_{\mathrm{F}} \odot \widehat{\mathbf{K}}_{\mathrm{A}} = \cos\theta_{\mathrm{A}} \cdot \cos\theta_{\mathrm{F}} + \cos\varphi_{\mathrm{F}} \cdot \sin\theta_{\mathrm{A}} \cdot \sin\theta_{\mathrm{F}} \tag{26}$$

$$N = \iint_{\Omega} D \cdot d\Omega = \int_{\theta_{\mathrm{F}}} \int_{\varphi_{\mathrm{F}}} D \cdot \sin\theta_{\mathrm{F}} \cdot d\theta_{\mathrm{F}} \cdot d\varphi_{\mathrm{F}} \tag{27}$$

$$T_{\mathrm{F}}^{p}(\theta_{\mathrm{F}}) = \begin{cases} T_{\mathrm{LS-MEMLS}}^{p}(\theta_{\mathrm{F}}) & \text{for: } 0° \le \theta_{\mathrm{F}} \le 90° \quad \text{(below horizon)} \\ T_{\mathrm{sky}}(180° - \theta_{\mathrm{F}}) & \text{for: } 90° < \theta_{\mathrm{F}} \le 180° \quad \text{(above horizon)} \end{cases} \tag{28}$$