T_{atm}

T_{emi}

1,2

1

$J(\nu, T)$

ν

T

$$T^{\mathrm{RJ}}$$

$$k_{\mathrm{bolt}}\, T^{\mathrm{RJ}} = J(\nu, T).$$

$$T^{\mathrm{RJ}} = T$$

$$h\nu << k_{\mathrm{bolt}}\, T$$

$$h\nu >> k_{\mathrm{bolt}}\, T$$

C

$$C = c_{\mathrm{dark}} + g\,(T_{\mathrm{ant}}^{\mathrm{tot}} + T_{\mathrm{rec}}),$$

c_{dark}

g

$$T_{\mathrm{rec}}$$

$$T_{\mathrm{ant}}^{\mathrm{tot}}$$

$$T_{\rm ant}^{\rm tot} = \frac{T_{\rm ant}^{\rm sig} + G_{\rm im}\, T_{\rm ant}^{\rm ima}}{1 + G_{\rm im}},$$

$$T_{\mathrm{ant}}^{\mathrm{sig}}$$

$$T_{\mathrm{ant}}^{\mathrm{ima}}$$

G_{im}

$$g_{\mathrm{sig}}$$

g_{ima}

$$T_{\text{ant}}$$

$$T_{\mathrm{loss}}$$

T_{astro}

$$T_{\mathrm{ant}} = F_{\mathrm{eff}}\ [T_{\mathrm{atm}} \exp(-a\tau) + T_{\mathrm{astro}}] + (1 - F_{\mathrm{eff}})\, T_{\mathrm{loss}}$$

F_{eff}

τ

a

$$a = 1/\sin(\text{elevation});$$

T_{cab}

T_{amb}

$$T_{\mathrm{loss}} = \alpha T_{\mathrm{cab}} + (1 - \alpha) T_{\mathrm{amb}},$$

α

T_{sky}

$$T_{\mathrm{emi}}^{\mathrm{tot}}$$

$$T_{\rm sky} = F_{\rm eff} T_{\rm emi}^{\rm tot} + (1 - F_{\rm eff}) T_{\rm loss}.$$

$$T_{\mathrm{emi}}^{\mathrm{tot}} = \frac{T_{\mathrm{emi}}^{\mathrm{sig}} + G_{\mathrm{im}}\, T_{\mathrm{emi}}^{\mathrm{ima}}}{1 + G_{\mathrm{im}}},$$

$$T_{\mathrm{emi}}^{\mathrm{sig}} = T_{\mathrm{atm}}^{\mathrm{sig}} \left\{1 - \exp\left(-a\tau_{\mathrm{sig}}\right)\right\} \quad \text{and} \quad T_{\mathrm{emi}}^{\mathrm{ima}} = T_{\mathrm{atm}}^{\mathrm{ima}} \left\{1 - \exp\left(-a\tau_{\mathrm{ima}}\right)\right\}.$$

$$\tau = \tau_{\text{dry}} + \tau_{\text{wet}},$$

τ_{dry}

τ_{wet}

w_{H_2O}

$$\tau_{\mathrm{wet}} = \alpha_{\mathrm{H_2O}}\, w_{\mathrm{H_2O}}$$

α_{H_2O}

$$\frac{T_{\rm hot} - T_{\rm sky}^{\rm tot}}{C_{\rm hot} - C_{\rm sky}^{tot}} = \frac{T_{\rm hot} - T_{\rm cold}}{C_{\rm hot} - C_{\rm cold}},$$

T_{hot}

T_{cold}

C_{hot}

C_{cold}

$$T_{\mathrm{sky}}^{\mathrm{tot}}$$

$$T_{\mathrm{a}}^{\star} = T_{\mathrm{cal}} \frac{C_{\mathrm{on}} - C_{\mathrm{off}}}{C_{\mathrm{hot}} - C_{\mathrm{off}}},$$

T_{cal}

T_{cal}

$=$

$$(1 + G_{\mathrm{im}}) \left[T_{\mathrm{emi}}^{\mathrm{sig}} - T_{\mathrm{bg}} \right]$$

$$(1 + G_{\mathrm{im}}) \left[T_{\mathrm{loss}} - T_{\mathrm{emi}}^{\mathrm{sig}} \right] \exp(a\tau_{\mathrm{sig}})$$

$$G_{\mathrm{im}}\left[T_{\mathrm{emi}}^{\mathrm{sig}}-T_{\mathrm{bg}}\right]\left[\exp\left\{a(\tau_{\mathrm{sig}}-\tau_{\mathrm{ima}})\right\}-1\right]$$

$$\frac{1 + G_{\text{im}}}{F_{\text{eff}}} \; [T_{\text{hot}} - T_{\text{loss}}] \; \exp(a\tau_{\text{sig}}).$$

T_{bg}

$$T_{\mathrm{emi}}^{\mathrm{sig}}$$

$$T_{\rm cal} = (T_{\rm hot} - T_{\rm sky}) \frac{1 + G_{\rm im}}{F_{\rm eff}\ \exp\left(-a\tau_{\rm sig}\right)}.$$

$T^{\star}_{\mathrm{a}}$

H_2O

O_2

O_3

2

$$1 - \exp(-a\tau)$$

$$T_{\mathrm{emi}} \propto T_{\mathrm{atm}} \left[1 - \exp(-a\tau)\right]$$

$$T_{\mathrm{cal}} \propto \exp(a\tau)$$

$$\exp(-a\tau)$$

$$(T_{\rm hot} - T_{\rm sky})$$

$$[1 + G_{\mathrm{im}}] \, / \, [F_{\mathrm{eff}} \, \exp{(-a\tau)}]$$

τ_{true}

$$G_{\mathrm{im}}^{\mathrm{true}}$$

$$F_{\text{eff}}^{\text{true}}$$

$$T_{\mathrm{cal}}^{\mathrm{true}}$$

τ_{mod}

$$G_{\mathrm{im}}^{\mathrm{meas}}$$

$F_{\mathrm{eff}}^{\mathrm{meas}}$

$$T_{\mathrm{cal}}^{\mathrm{meas}}$$

$$\frac{T_{\rm cal}^{\rm meas} - T_{\rm cal}^{\rm true}}{T_{\rm cal}^{\rm true}} = \frac{F_{\rm eff}^{\rm true}(1 + G_{\rm im}^{\rm meas})}{F_{\rm eff}^{\rm meas}(1 + G_{\rm im}^{\rm true})} \exp\left[a(\tau_{\rm mod} - \tau_{\rm true})\right] - 1$$