The modeling of global surface air temperature

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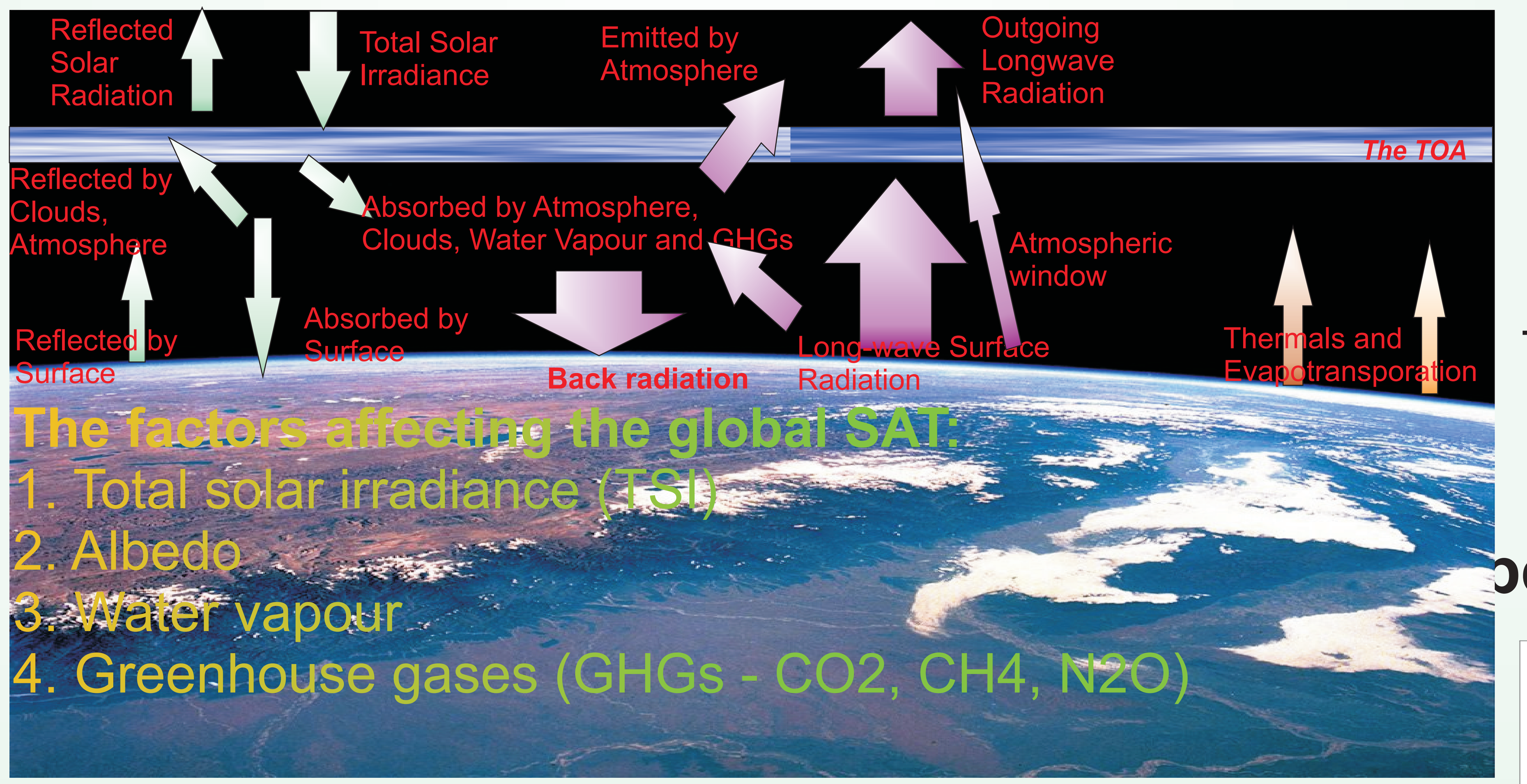
Earth's radiation balance



$$\frac{F_S(1-A)}{4}=\sigma T^4$$

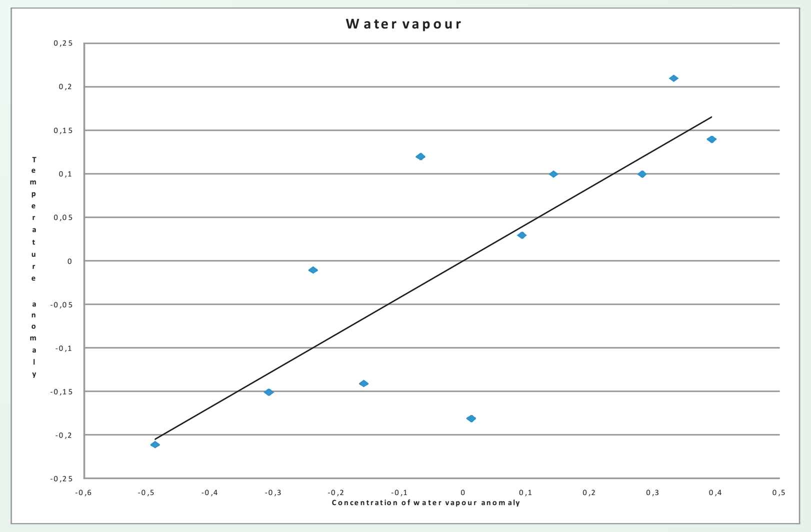
Fs - TSI, (W/m^2)
A - Albedo
T - Global SAT, (K)
σ – Stefan–Boltzmann constant, (W/(m^2*K^4))

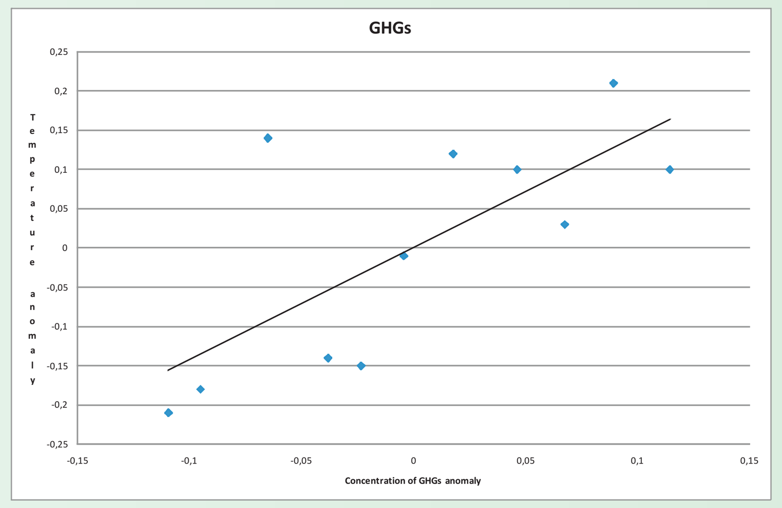
The model of global surface air temperature (SAT) is based on the Earth's radiation balance principle

$$\frac{dT}{dt}=\frac{1}{\rho C_p \Delta H}\left|\frac{F_s(1-A)}{4}-\sigma T_t^4\left(1-\delta_1-\delta_2\right)\right|$$

ρ – atmospheric density, (kg*m-3)
Cp - specific heat, (j/(K*kg))
δ1 - part of energy absorbed by GHGs
δ2 - part of energy absorbed by water vapour
t - time, (sec)
H - height, (m)

The relationship between the concentration of GHGs, water vapour and global SAT has been established on the basis of the regression analysis. The concentration of GHGs and water vapour is a function of the global SAT.





$$\Delta G=\alpha*\Delta Tt+\beta \qquad \Delta W=\mu*\Delta Tt+\gamma$$

$$\delta = f\left(\frac{T_t}{T_0}\right)$$

ΔG - concentration of GHGs anomaly
ΔW - concentration of water vapour anomaly
ΔT - temperature anomaly
α, β, μ, γ – coefficients

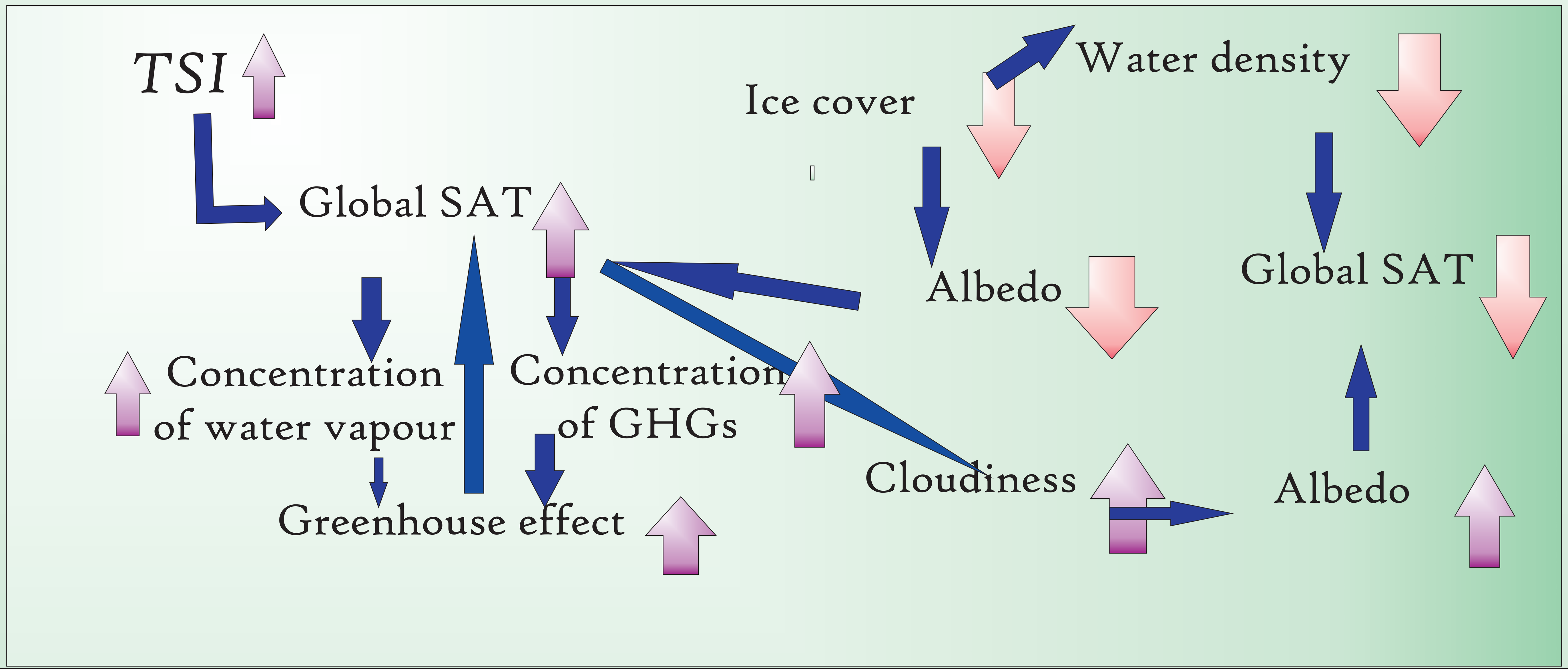
$$\delta_t=\delta_0+C\left|\frac{T_t}{T_0}-1\right|$$

This parametrization is used in the model developed

$$\frac{dT}{dt}=\frac{1}{\rho C_p \Delta H}\left|\frac{F_s(1-A)}{4}-\sigma T_t^4\left(1-\left(\delta_0+C\left|\frac{T_t}{T_0}-1\right|\right)\right)\right|$$

Positive and negative feedback in the Earth's atmosphere

The smallest fluctuations of TSI intensify the positive and negative feedback in the Earth's



The model was used to predict global SAT from 2010 to 2030