User's guide

Zero-dimensional Energy Balance Model

The model can be run using defaults values by pressing the button "submit". A curve, representing the temperature change with time will then appear on the graph below. In order to appreciate the model sensitivity to the evolution of the globally average temperature, the user is prompted to modify the default values of the following parameters by moving the appropriate cursors:

Parameters	Values		Outcome
	min	max	
T_o	150 K	350 K	cold start (150 K) or hot start (350K)
α_p	0	1	system absorbs (0) or reflects (1) all incident solar radiation
τ_a	0	1	system is opaque (0) or transparent (1) with respect to the infrared radiation
F_s	0.5	1.5	F_s x I_o : weaker (0.5) or stronger (1.5) sun
D_m	20 m	200 m	shallow (20 m) or deep ocean (200 m) mixed-layer depth

A total of 3 experiments can be performed before resetting the graphs. The red, green and blue curves represent respectively the 3rd, 2nd, and 1st experiments.

This is the most simple parametric climate model that can be used to simulate evolution of the globally average temperature, T. It considers the following equation

$$C\frac{\partial T}{\partial t} = \frac{I_o}{4}\left(1-\alpha_p\right) - \varepsilon \tau_a \sigma T^4$$

The model is based on the difference between the absorbed solar radiation and the emitted infrared terrestrial radiation. The solution is a time series of the globally average temperature, $T(t)$, as a function of $C = C(D_m)$, the effective heat capacity of the surface of the Earth comprising the ocean mixed-layer (D_m) in the units of J m^{-2} K^{-1}, I_o is the solar constant equal to 1370 W m^{-2}, α_p the planetary albedo, ε the emissivity of the earth surface equal to 1, τ_a the atmospheric infrared transmissivity, and σ the Stefan-Boltzmann constant equals to 5.67×10^{-8} W m^{-2} K^{-4}.