

Mere budgets. Do they satisfy as "dynamics"?

$$\frac{\partial T}{\partial t} = \text{Hor. transport} + \text{Vertical term} + LW_{\text{rad}} + SW_{\text{rad}} + L(c-e) + F_{\text{sf}} + \dots$$

Suppose we want an explanation for a hot time.

$+$ $=$ $-$ $+$ $-$ $+$ $-$ $+$ \dots

Biggest term!
most external term
better, maybe

need higher-level reasoning...

Example 1: climate change

CO₂ Forcing

$$\frac{\partial T}{\partial t} = \cancel{H_{\text{or}}} + \cancel{V_{\text{ER}}} + \text{RAD-SW} + \text{RAD-LW} + \text{COND-EVAP} + \dots$$

part of this term

Integrate over world, transport vanishes etc. etc.

also part of low

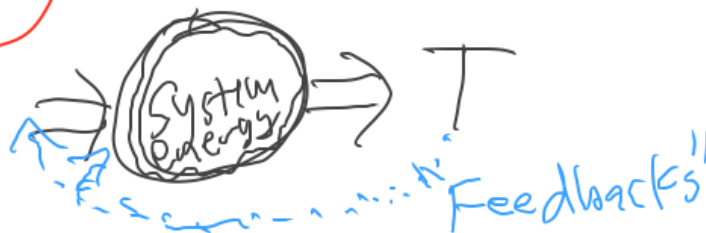
an ODE that rules the world

$$\frac{dT'}{dt} = F - \lambda T'$$

$T' = T - T_{\text{PI}}$ \swarrow pre-industrial
(T is global annual avg)
 $T_{\text{2m air}}$

"forcing"

Up stream, F
Endogenous,
external



biggest is water vapor
most uncertain clouds

Example 2: T in afternoon in Florida \Rightarrow a/c energy demand

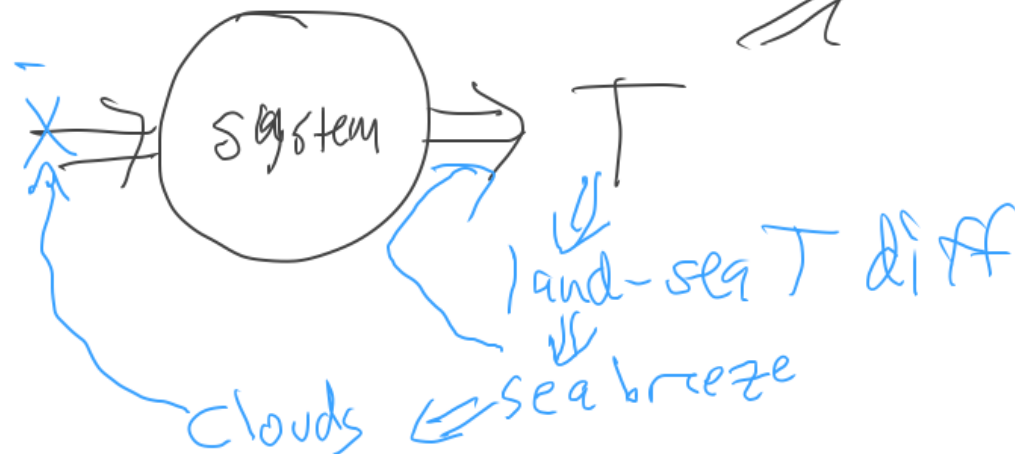
$$\frac{\partial T}{\partial t} = \text{hor} + \text{ver} + \text{SW} + \text{LW} + F_{\text{afc}} + L(c-e)$$

"System" is now

- scale of Florida
- timescale of a day

upstream forcing

Sun comes up



\Rightarrow a/c energy demand
"impact" downstream