Looking Back, Looking Ahead: My Life in Climate Change Research

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CHANGE INSTITUTE
furthering the scientific
understanding of
earth systems
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My Philosophy of Science

"Don't get involved in partial problems, but always take flight to where there is a free view over the whole single great problem, even if the view is still not a clear one."

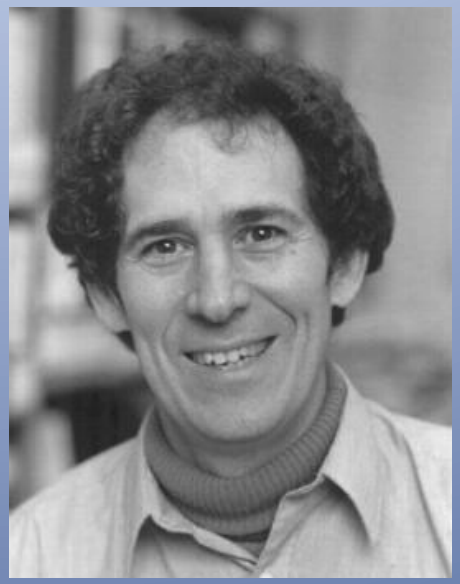
Ludwig Wittgenstein

"In the beginner's mind there are many possibilities, but in the expert's mind there are few."

Shunryu Suzuki

My Mentors








Simplifying the Story

$$\Delta T_s = \lambda \Delta F$$

My Life with the AGCI

Forcing & Feedback:

Radiation Feedbacks and the Credibility of Atmospheric Models
10 July – 23 July, 1994 * Attendee

Aerosols and the Hydrologic Cycle
11 July – 17 July, 2004 * Attendee

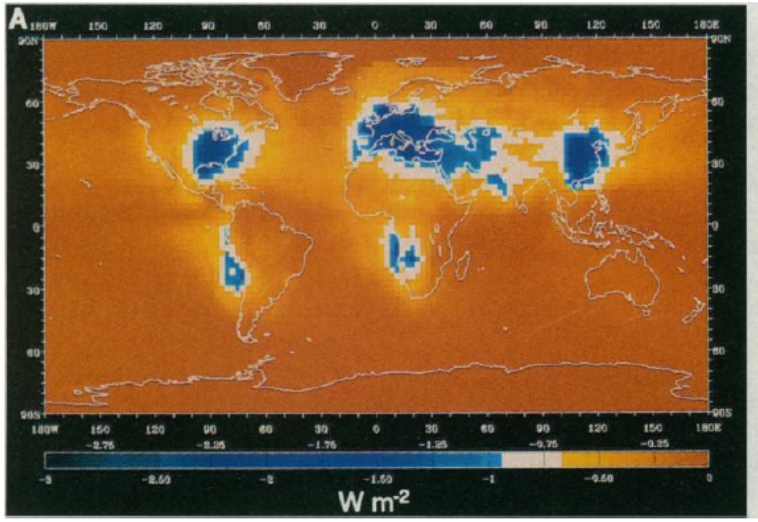
Response:

Exploring the Boundaries of Nature: A Reflective Dialogue on the Environment
13 August – 19 August 2006 * Chair

Climate Sensitivity on Decadal to Century Timescales: Implications for Civilization
20 May – 25 May 2012 * Chair

The Land of ΔF (How is Earth's Climate forced?):

- CH_4 in the Archean (climate and life at the beginning)
- Nuclear Winter (when simple equations break down)
- Cloud Radiative Forcing (a curious cancellation)
- GHG + Aerosol, Sulfate forcing (Direct & Indirect)



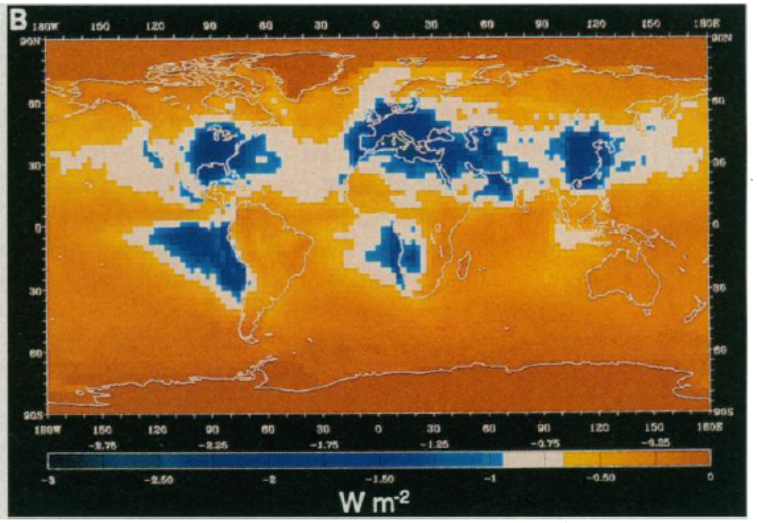
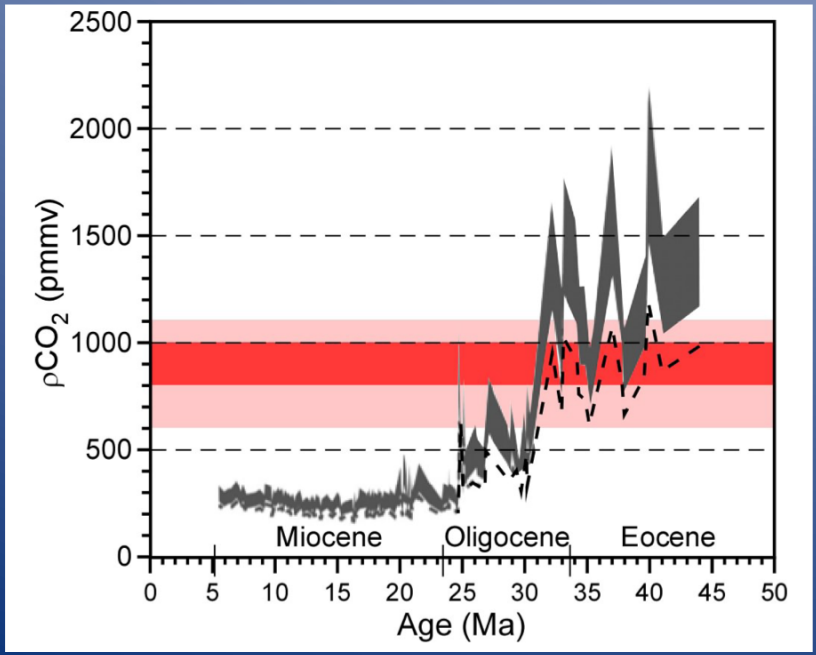


Fig. 2. Annual mean direct forcing (in watts per square meter) resulting from (**A**) anthropogenic sulfate aerosols (global = −0.28 W m^{-2}) and (**B**) anthropogenic plus natural sulfate aerosols (global = −0.54 W m^{-2}).

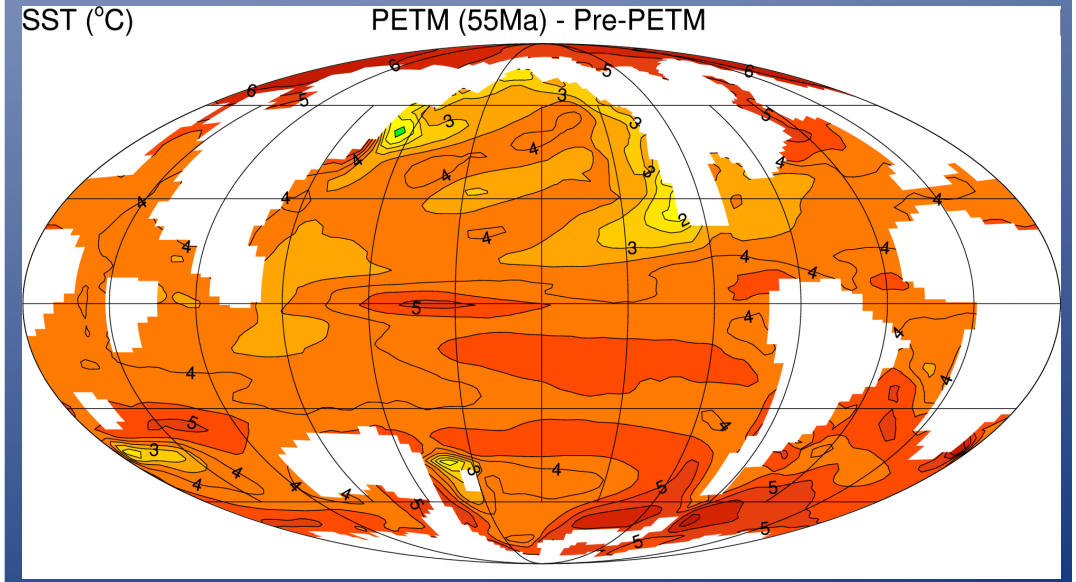
Kiehl, J.T. & B.P. Briegleb, Science,1993

The Land of λ (How do climate feedbacks work?):

- Cloud feedbacks (getting to know the sign)
- Cloud microphysics (even small things matter)
- Chemistry-Climate interactions (reveries with chemists)
- Earth's deep warm past (never forget where we have been)



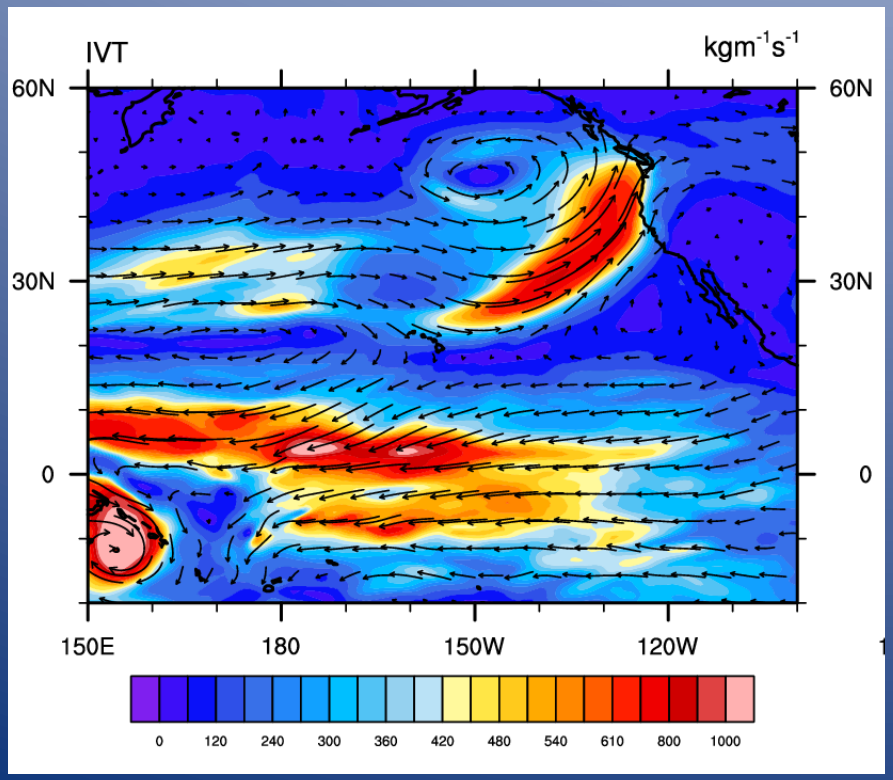
Kiehl, J.T., Science, 2011 & NRC Deep Past

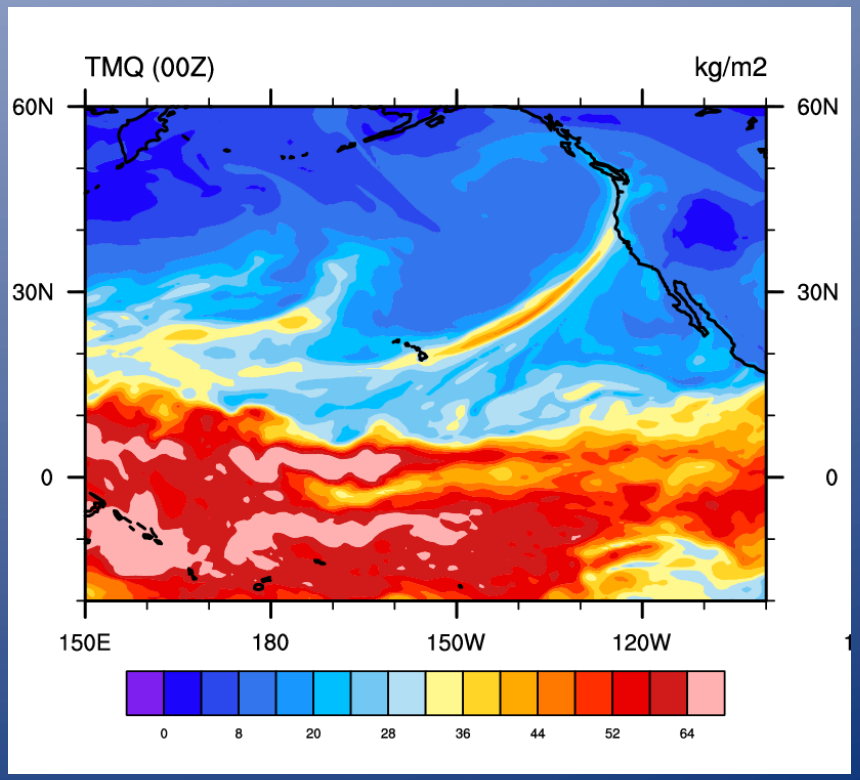


Kiehl, J.T. & C.A. Shields, Proc. Roy.Soc.,2013

The Land of ΔT_s (How does Earth's climate respond?):

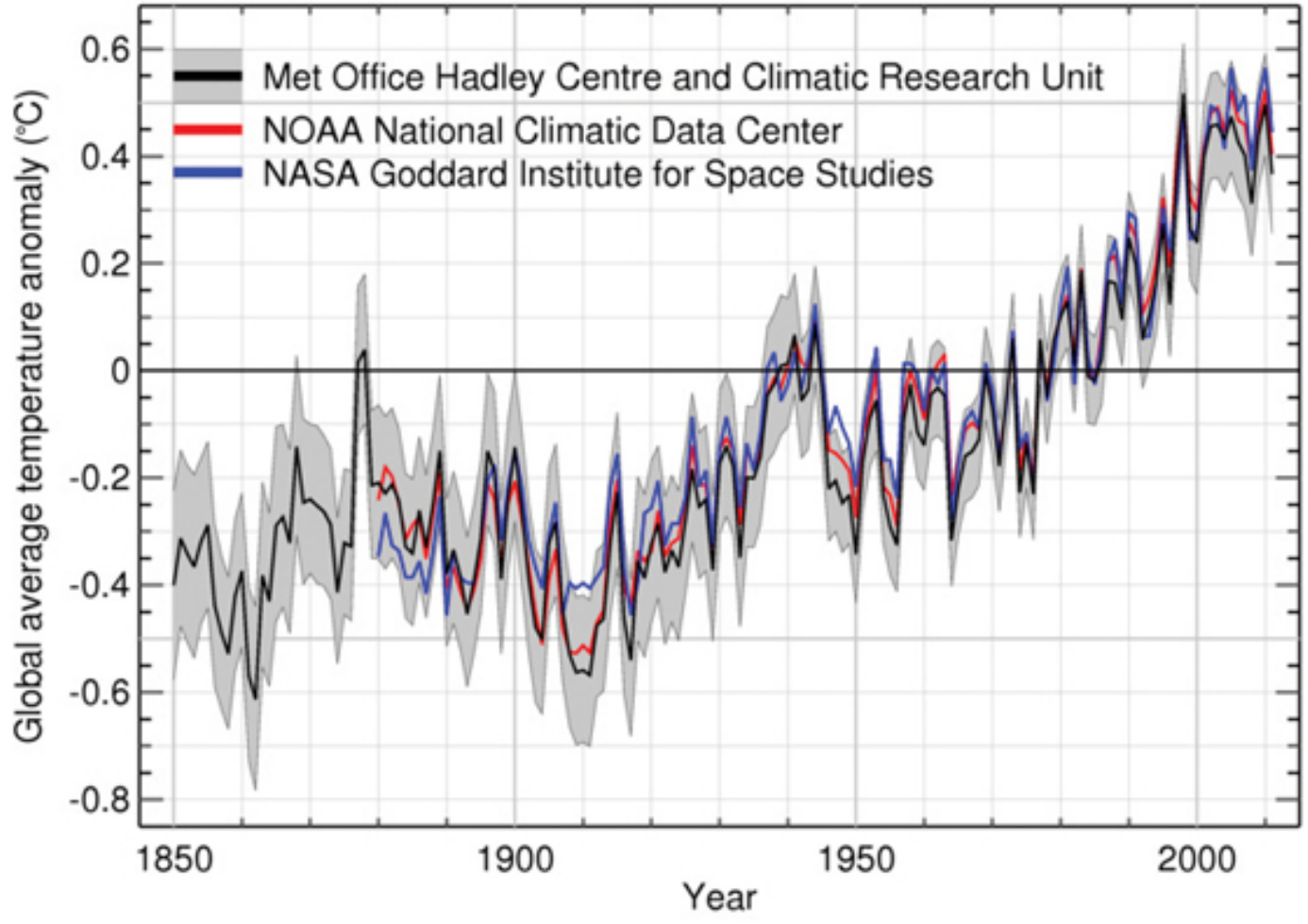
- Stratospheric ozone (an early relevant problem)
- 20th century and 21st century (verify, verify, verify)
- Hydrologic cycle & atmospheric rivers (new frontiers)



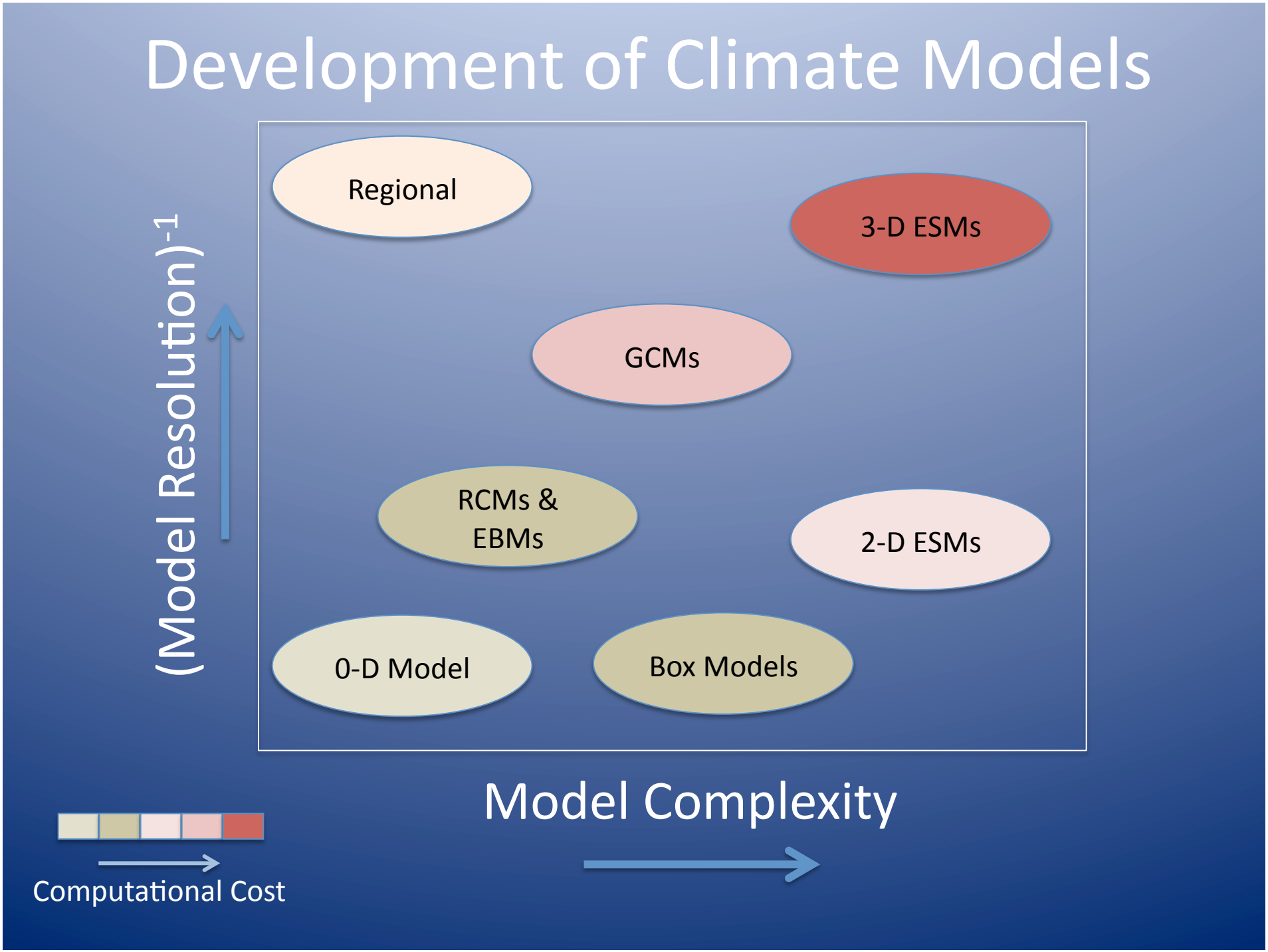


Life gets complicated…

$$\Delta T_s = \lambda(\Delta T_s, \tau)\, \Delta F_\varepsilon - H_{ocn} + \sigma_{NV}(\Delta T_s)$$



Development of Climate Models



Life gets even more complicated… my life in psychology…

Barriers to Changing Climate Change

- Transformation in Ways We Communicate
- Basic Understanding of Science
- Social, Economic & Cultural Dimensions
- Psychological Dimensions

Looking Ahead

- Models will continue to increase in complexity, at what point will they be too complex?
- Are there unexplored 'big' feedbacks (biological)?
- How to connect people to the issue of global warming?
- How do we account for other dimensions of 'knowing' (humanities & arts)
- Erasmus Darwin held that every so often you should perform a "damn fool experiment"

Exploring the Boundaries of Nature:
A Reflective Dialogue on the Environment