What features characterize climate of the past century?
- What forcings and processes might explain them?
Discussion of Stott et al (2000)
- What drives the observed changes in surface temperature?
GEOL 437 Global Climate Change
3/27/18: The past century

Key concepts

- Detection and attribution
- Radiative forcing
Climate change detection and attribution

1. Observations of one or more climate variables physically linked to the process in question
2. External radiative forcing estimates
3. Quantitative, physically (model) based hypothesis linking radiative forcing to climatic response
4. Estimates of the unforced climatic variance

Radiative forcing of the climate system

- Instantaneous change in the radiative balance at the top of the troposphere, and originating from outside the climate system, relative to that estimated for the global and annual average for 1750. An instantaneous RF does not account for temperature change in the stratosphere.

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\[ \text{Instantaneous RF} \]

\[ \text{Equilibrium climate response} \]

\[ \text{RF} = \text{net flux imbalance at tropopause} \]

\[ \text{temperature fixed everywhere} \]

\[ \text{No flux imbalance} \]

\[ \text{temperatures adjust everywhere} \]

\[ \Delta T_s \]

If simulations and observations of climate are in agreement in many different ways, what may we infer?

Hypothesized radiative forcing → Climate model → Simulations

Actual radiative forcing → Actual Climate → Observations

Agreement
Radiative forcing: the 20th century

Which forcings are important?

Radiative forcing: the 20th century

Which forcings are important?

Summary

- The net radiative forcing of climate is composed of multiple components with different amplitudes and time histories.
- Detection and attribution of climate change mechanisms depends on observations, radiative forcing estimates, hypothesized mechanisms, and estimates of the unforced variations.
- Next:
  - Discussion of Stott et al. (2000)
  - Thurs: the past millennium (discussion of McGregor et al 2015; HW7)
Observed and simulated patterns of surface temperature change

Bindoff, Stott et al (2013), FAQ 10.1, Fig 1