

1. Global mean surface temperature

Recent: 13.9 C for 1901-2000

LST 8.5 C

SST 16.1 C

MST 13.9 C (mean weighted by area)

Observed change since industrial revolution 0.8 C

Δ of 5.7% for 13.9 C relative to 0 C (compare body temp of 104, homeostatic system)

Long term reconstructions

Instrumental (1800 on)

Tree ring

Bore hole

Ice core

Forecasts Δ = 3.4 C (2 C -- 5 C by 2100 'IS92a scenario', business as usual)

Forcings

Hindcast validation

Congruence of models

Quantifying uncertainty

2. Atmospheric CO₂

Recent – absolute value, change, rate of change

Reconstructions – natural range of variation in glacial and pluvial periods

3. Carbon cycles

Stocks – atmospheric, oceanic, terrestrial, rocks

Fluxes – fast, slow, very slow (relevance to mitigating anthropogenic flux)

Anthropogenic flux 9 GT/yr

Relative to atmospheric pool of 700 GT

1.3% annual rate of increase

Compensation of 5 GT, so measured Δ = 4 GT

0.6% annual rate of increase

Doubling time = 116 yr

Keeling Curve

Absolute value and rate of change relative to natural range of variation

4. EM radiation and greenhouse property of some gasses

Radiative Forcing

5. Radiation spectrum

Blackbody – Intensity proportional to K^4

Atmosphere

Adjust temperature to equalize radiation budget

Radiation in relatively fixed (time scale)

Radiation out affected by atmospheric CO₂, CH₄, H₂O

6. Abiotic effects

Temperature, precipitation, variability in each of these

Glaciers as indicators

7. Ecological responses

Abundance

Distribution

Phenology

Globally coherent fingerprint