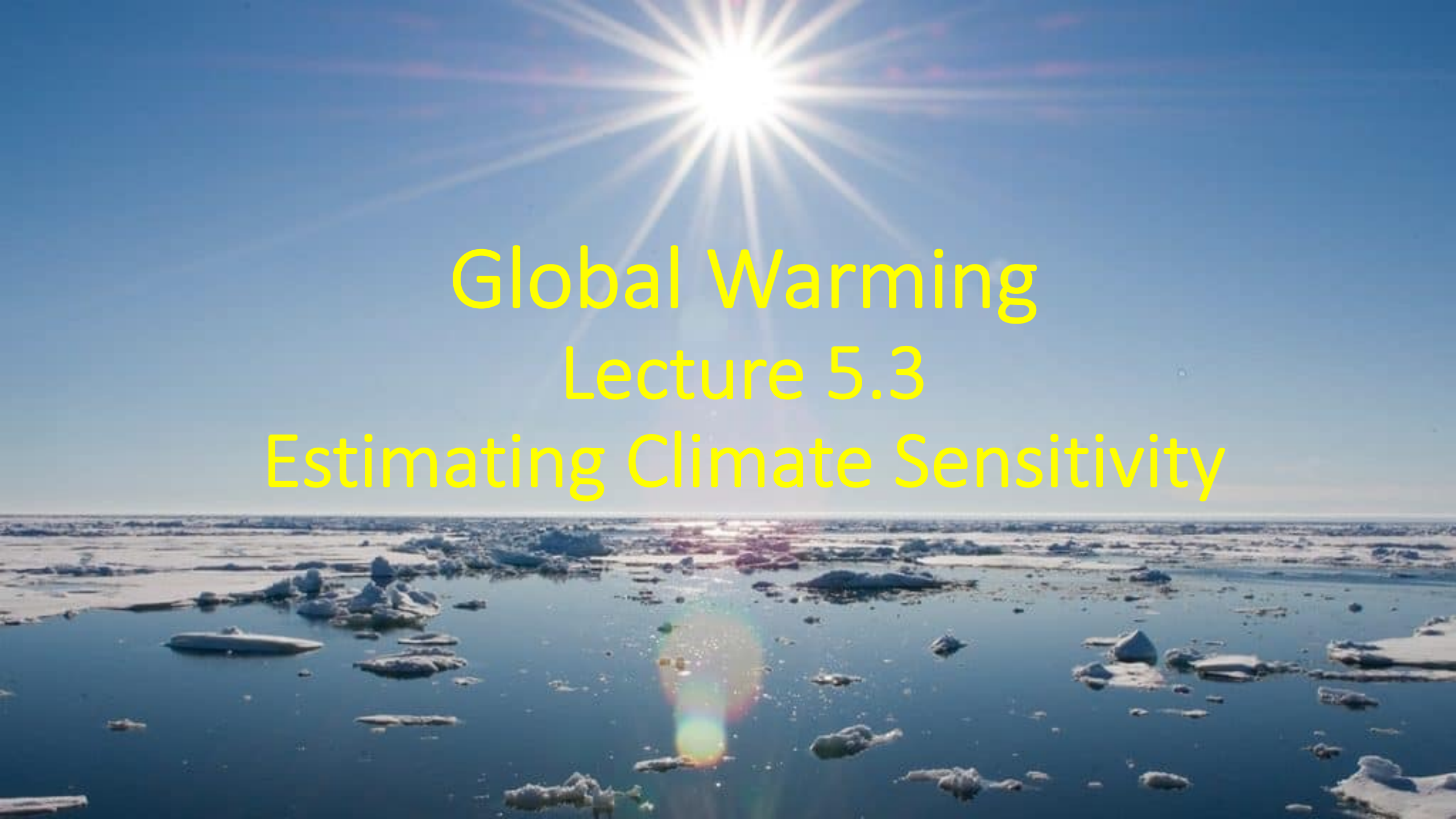


Global Warming
Lecture 5.3
Estimating Climate Sensitivity

Climate sensitivity (review)

The change in temperature resulting from a **doubling** in CO2 is more or less constant

$$\Delta T_{2x} = \Delta T \left(\frac{\log 2}{\log \left(\frac{(CO_2)_f}{(CO_2)_0} \right)} \right)$$

How to estimate climate sensitivity

$$\Delta T_{2x} = \Delta T \left(\frac{\log 2}{\log \left(\frac{(CO_2)_f}{(CO_2)_0} \right)} \right)$$

Get the data for $\Delta T, (CO_2)_f, (CO_2)_0$:

1. Observational Record (since preindustrial)
2. GCMs
3. Paleoclimate (L 5.2)

(Details: see notes)

Probability Density Functions (PDFs)

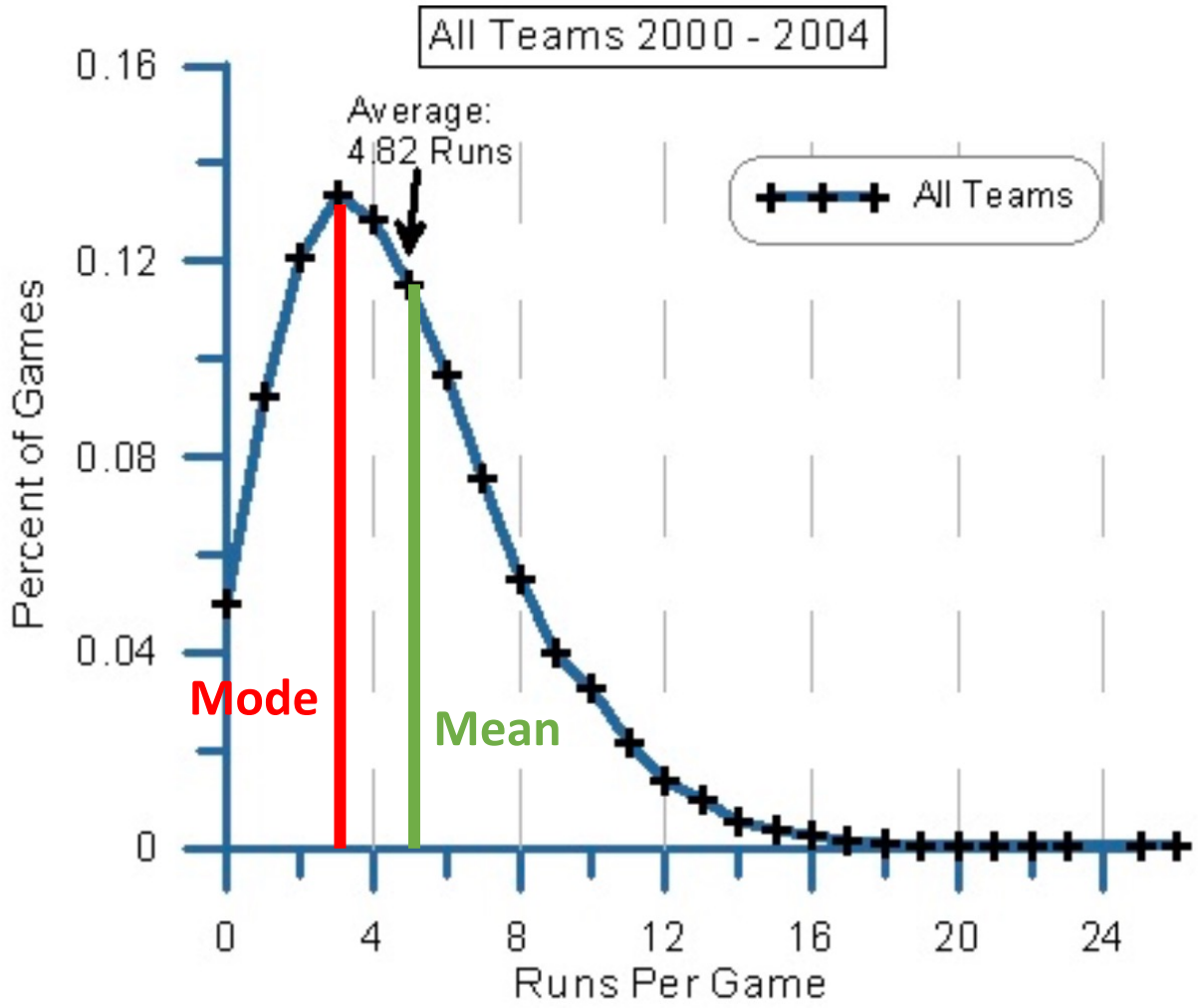
A PDF is a function whose value at any point gives you the **probability** (likelihood) that the value of the variable on the x-axis is equal to that point

Mode = Value that appears most often (peak of PDF)

Mean = Average value

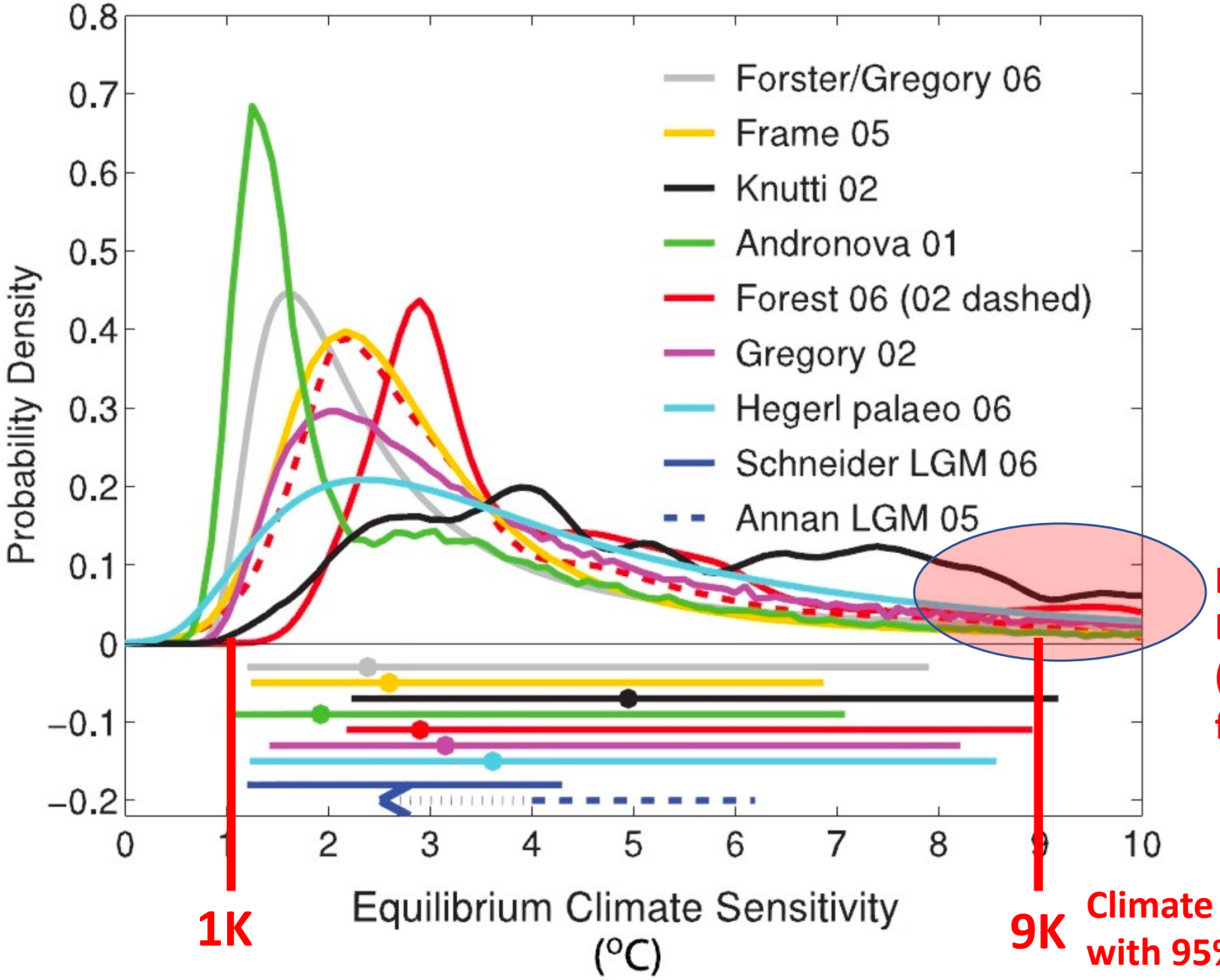
Median = 50% of values are smaller than it, 50% are greater than it

Number of runs scored by a Major League Baseball team per game



Range of climate sensitivities from IPCC

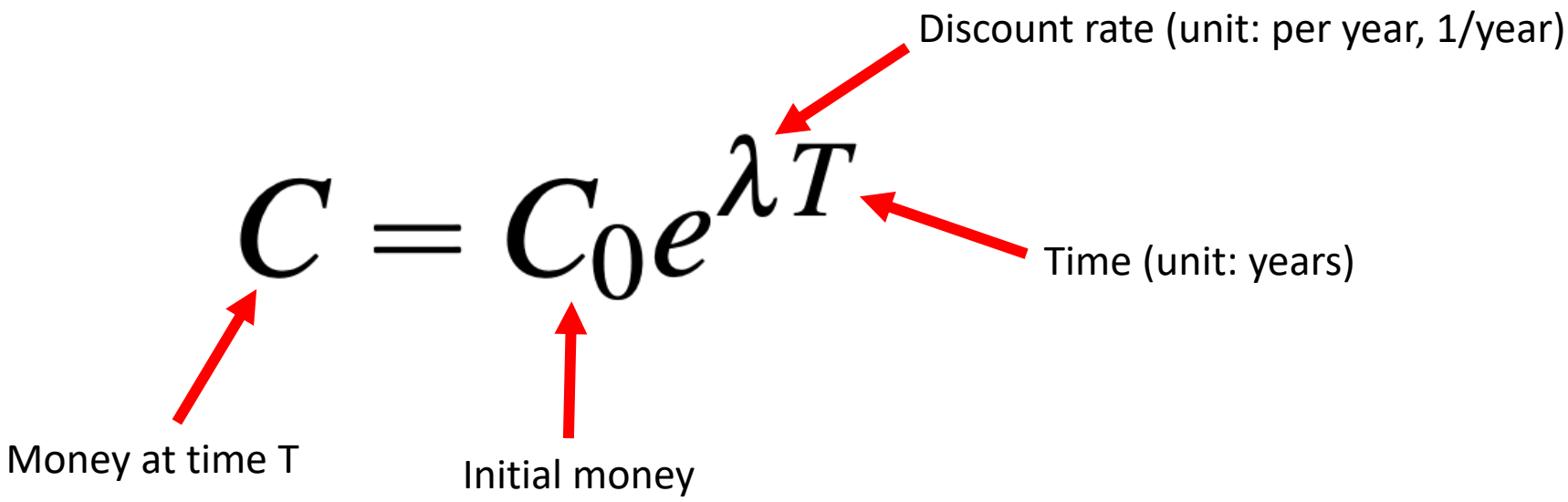
The relative probability (likelihood) of that climate sensitivity



Does not go to zero. Extends to very high values! (Because of positive climate feedbacks)

Climate sensitivity ranges with 95% confidence

Economics: Discount Rate



Economics: Discount Rate

Compound interest: if you have 1 dollar and it increases by 10% per year, how much will you have after 100 years?

1^{st}: $1*1.1=1.1$; 2^{nd}: $1*1.1^2=1.21$; …… 100^{th}: $1*1.1^{100}=13781$

Economics: Discount Rate

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Exponentially growth: $C = C_0 e^{\lambda T}$

Discount rate (unit: per year, 1/year)

Time (unit: years)

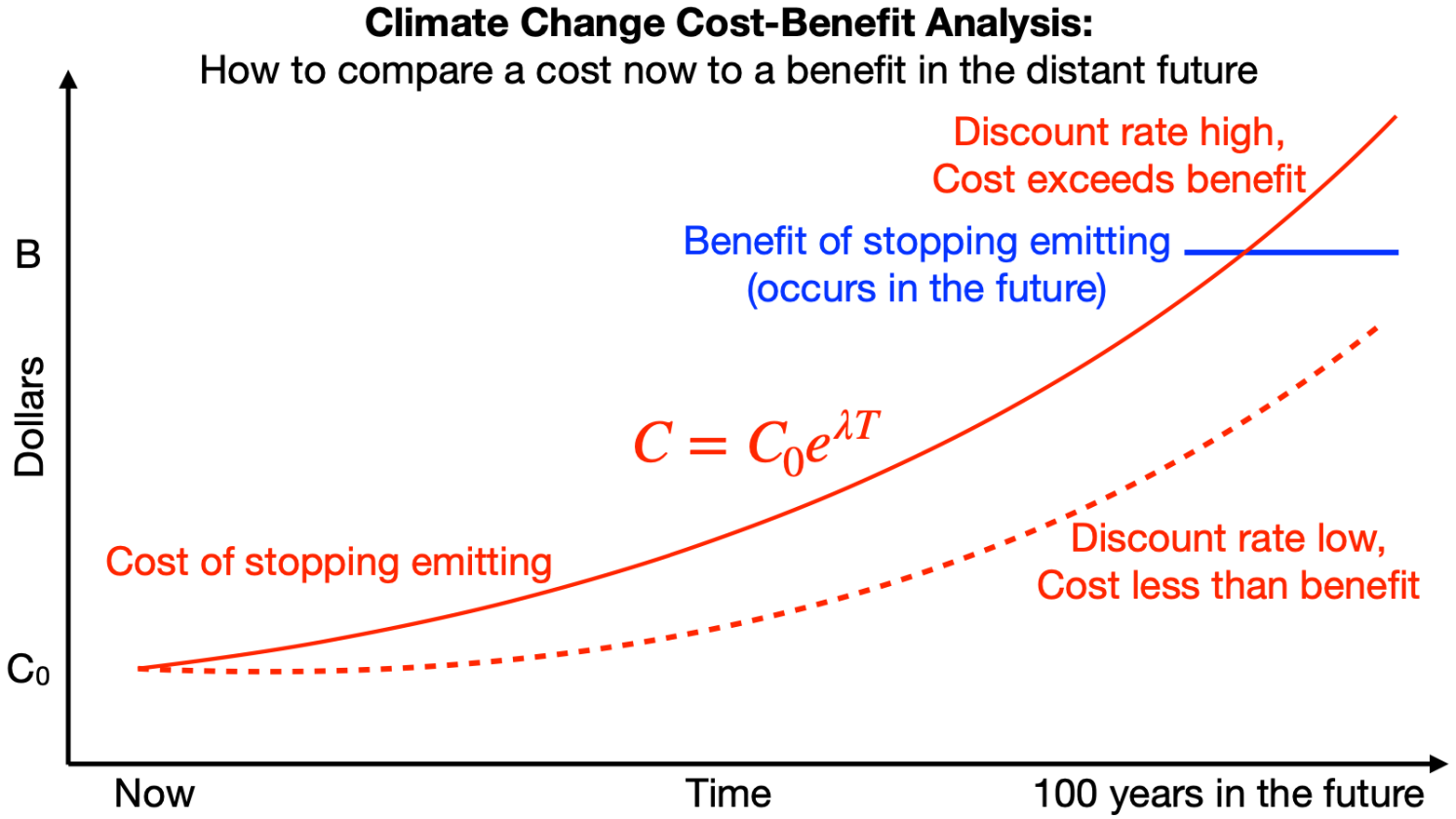
Money at time T

Initial money

*Units for discount rate and time and be changed **simultaneously** to second, day, month…

Should we stop (limit) emitting CO_2 now?

Some people thinks we should keep emitting CO_2 before climate change causes real problems and spend money to deal with them in the future because the money we spend now may make compound interest if we use them other ways.



If climate sensitivity is 2K, they get the result that we should not stop emitting CO2 now.

What's the problem in it?