Incorporating Climate Change Impacts in Probabilistic Performance Assessment Models

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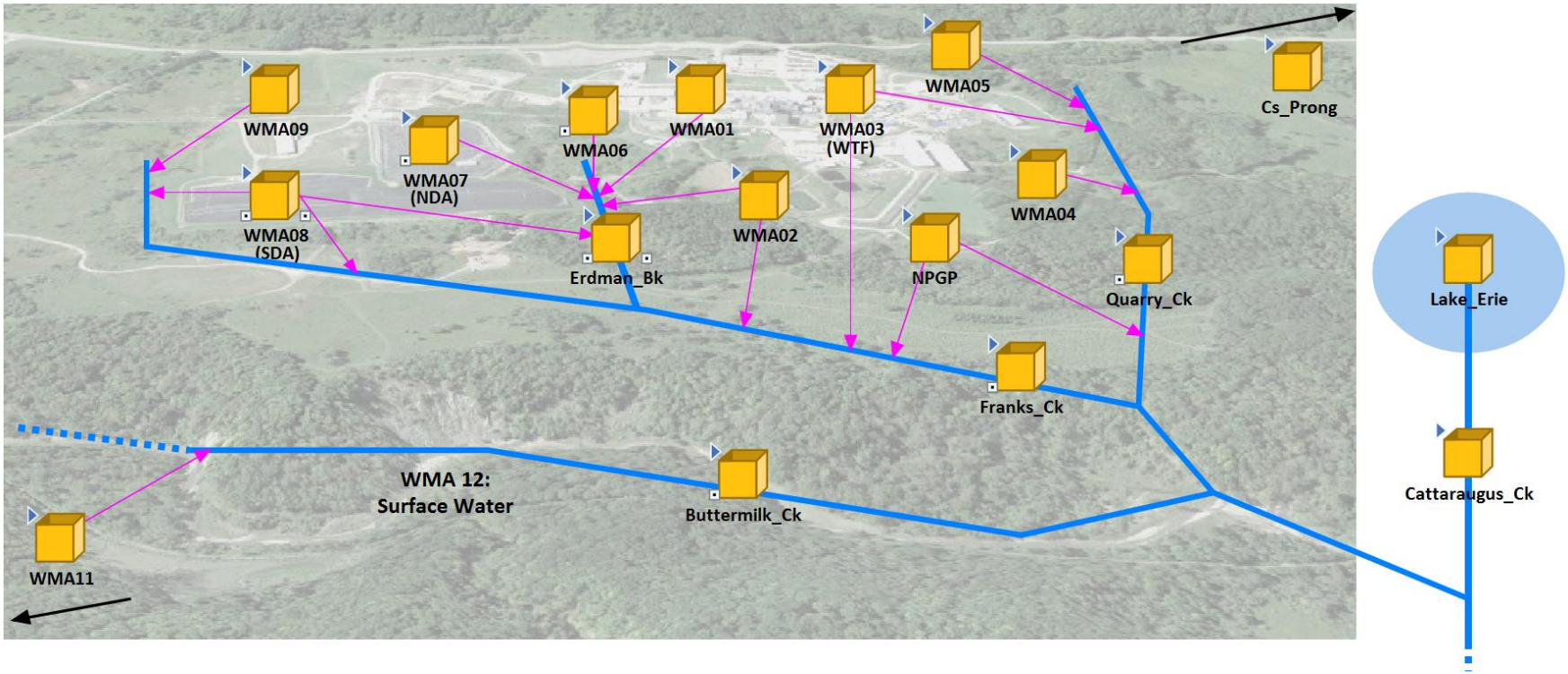
session
Emergency Planning and Response for Weather Events Session

Topics

- Erosion modeling at West Valley
- Climate change
- Incorporating climate change into erosion modeling

Probabilistic Performance Assessment



- The PPA GoldSim model is a model of radiological dose to humans and other animals, not an erosion model
- Erosion is one phenomenon that impacts predicted radiological dose

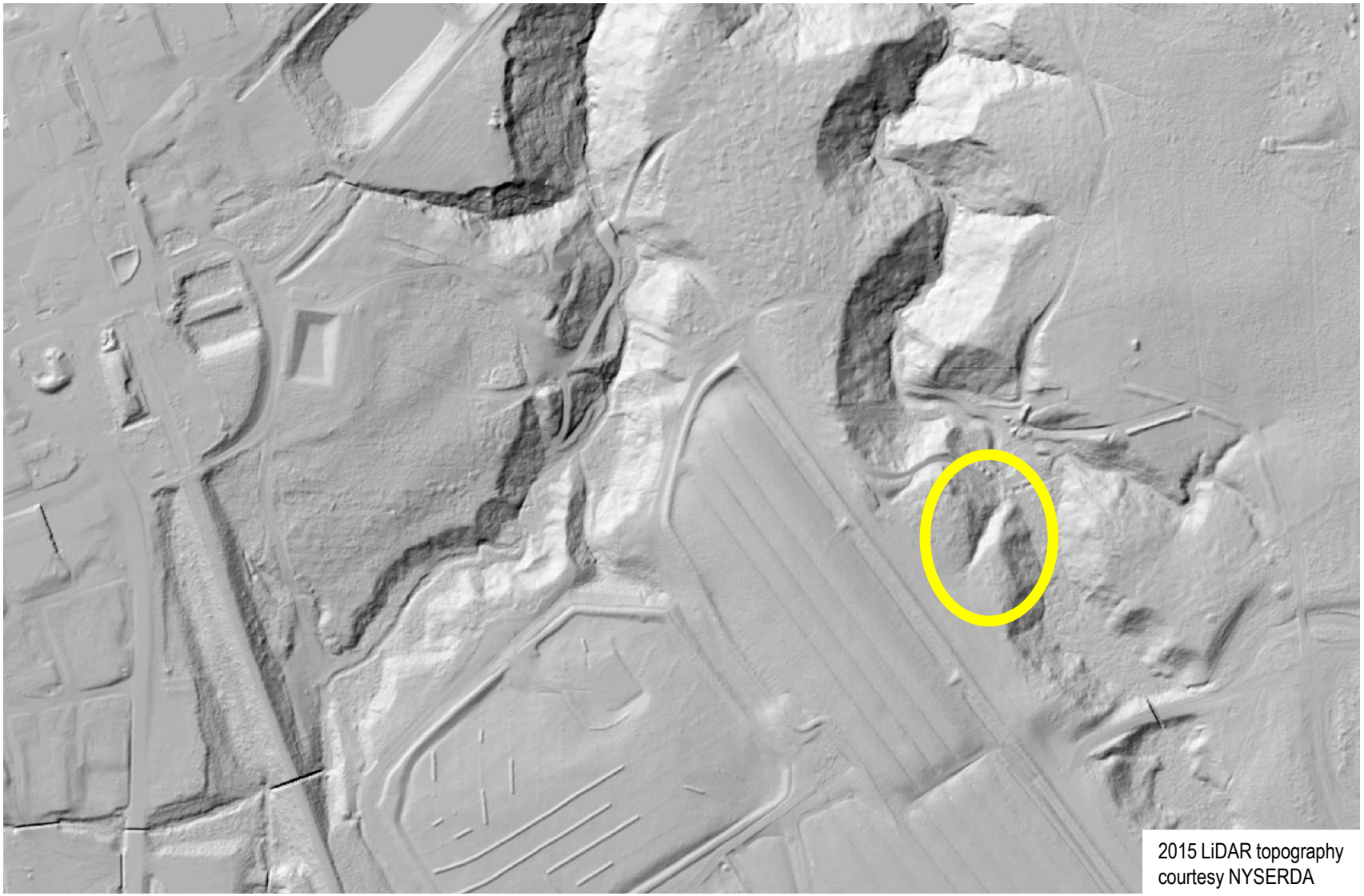
Probabilistic Modeling

- Explicitly incorporate uncertainty from state of the science
- It's ok to make conservative decisions, not ok to build conservative models

Example: Northern SDA Trenches

2015 orthoimage
courtesy NYSERDA

Example: Northern SDA Trenches



2015 LiDAR topography courtesy NYSERDA

Implementing Erosion in the West Valley PPA Model

- Rate of gully migration from adjacent creek reach towards Facility (L/T)

Data Sources for Erosion

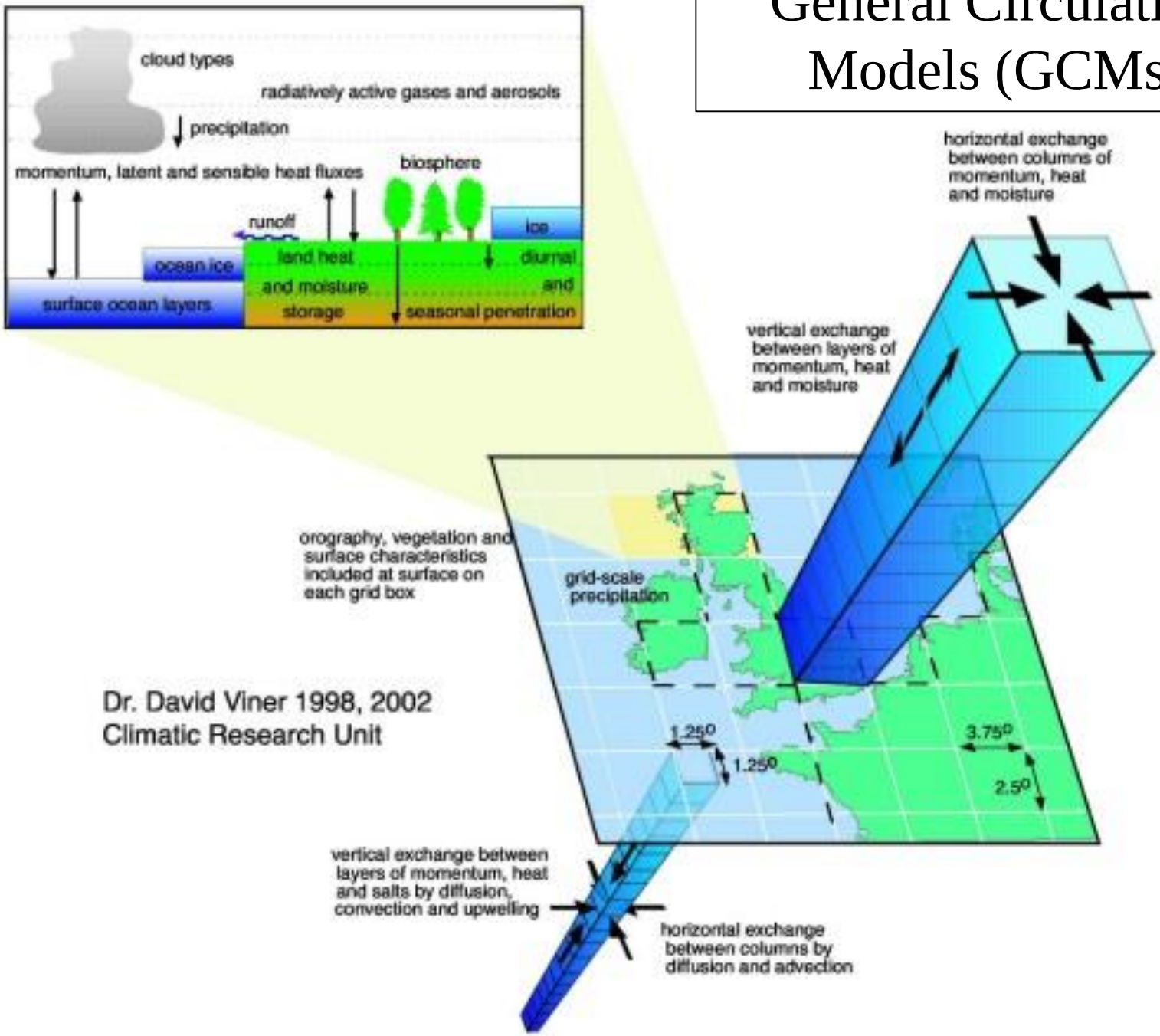
- Lidar Data
- Aerial Photographs
- Landscape Evolution Models: Ingest historical weather data to explicitly simulate erosion

Climate Change

- Future scenarios of climate come from the Intergovernmental Panel on Climate Change (IPCC) analyses

- These scenarios are generated using both complex models and assumptions about the future (i.e. year 2100)

General Circulation Models (GCMs)



Climate Change

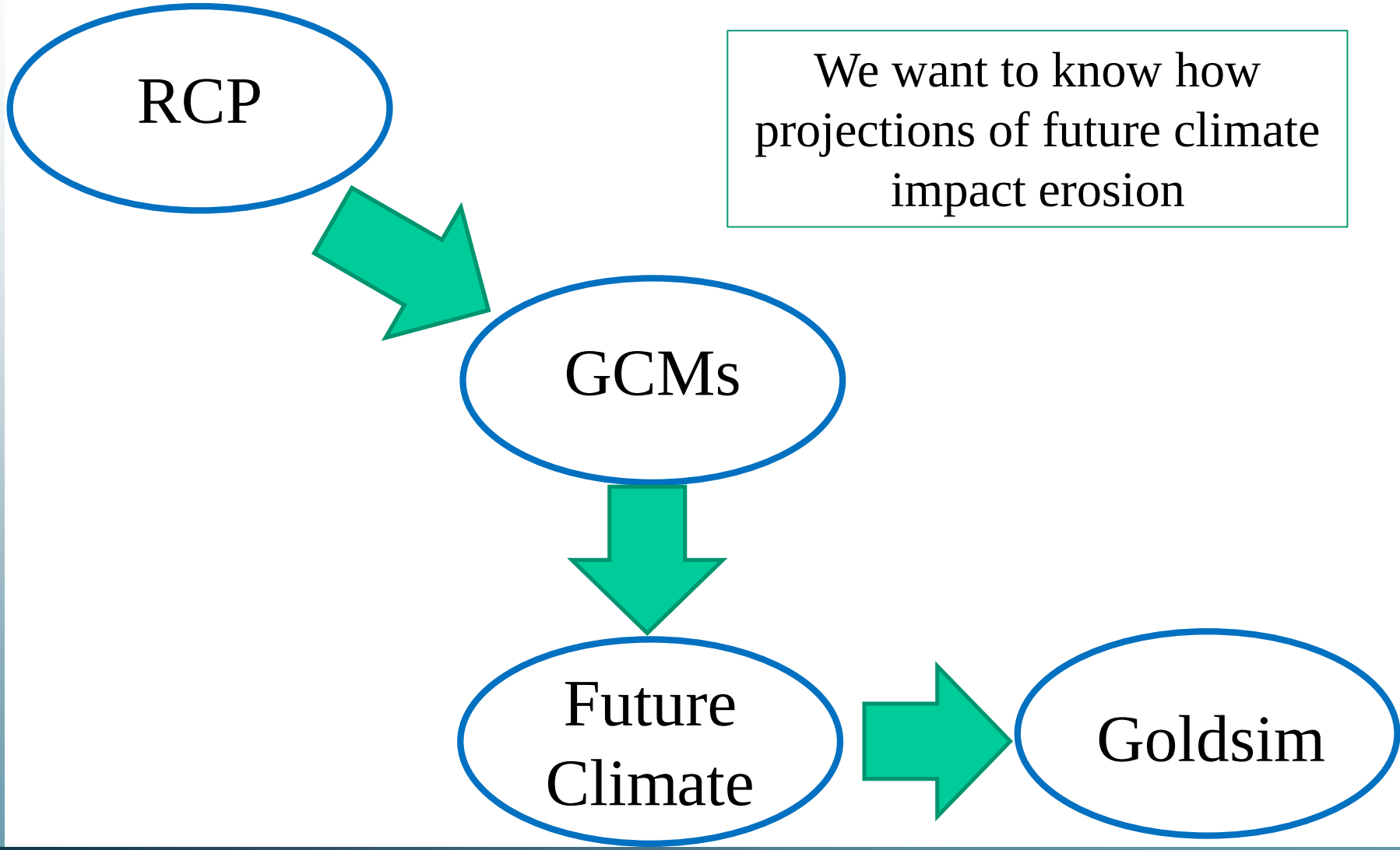
- Landscape Evolution Models (LEMs) use output from General Circulation Models (GCMs) to simulate impacts of increased precipitation on future erosion rates

- GCMs require inputs about future population, energy use, and land use

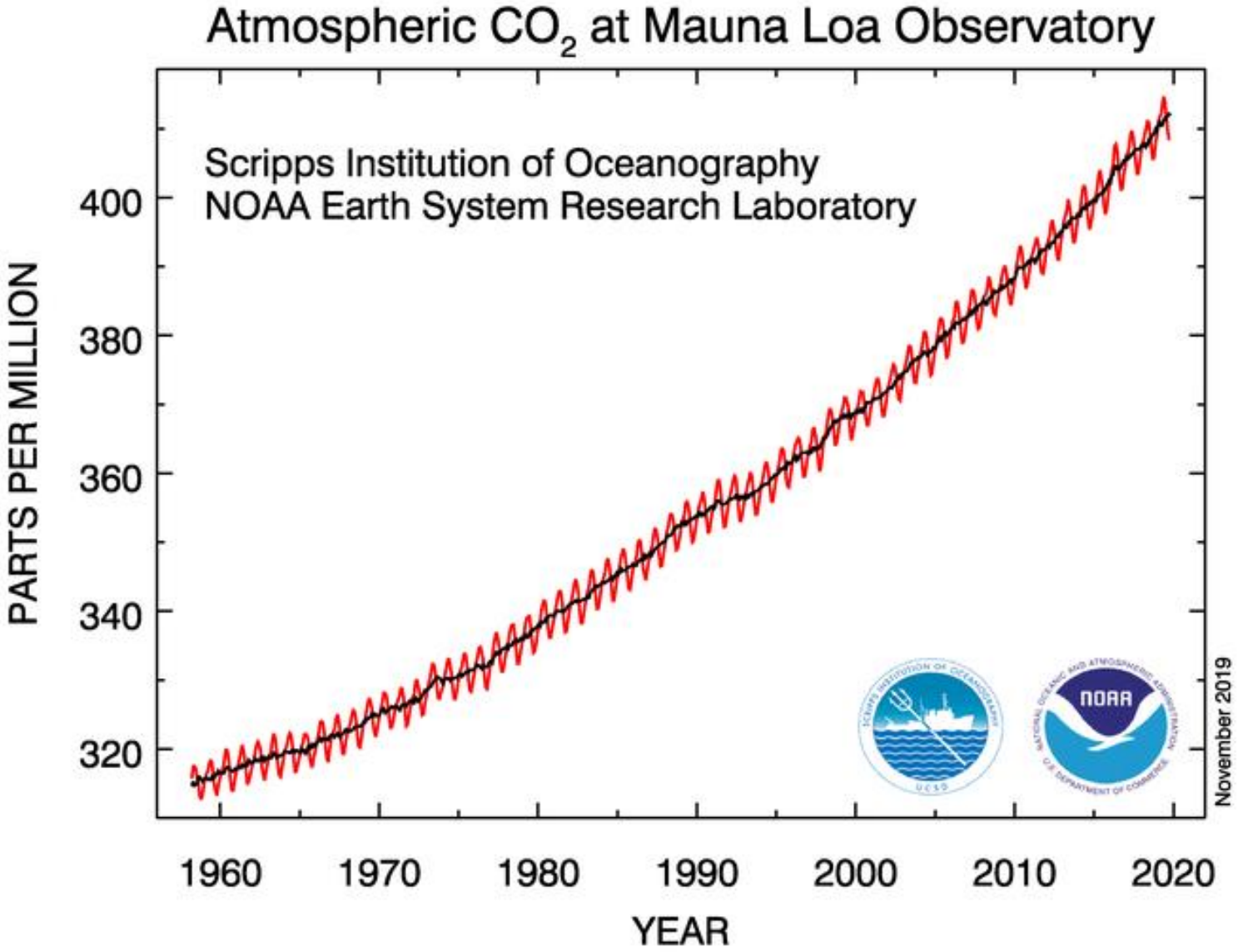
Representative Concentration Pathways (RCPs)

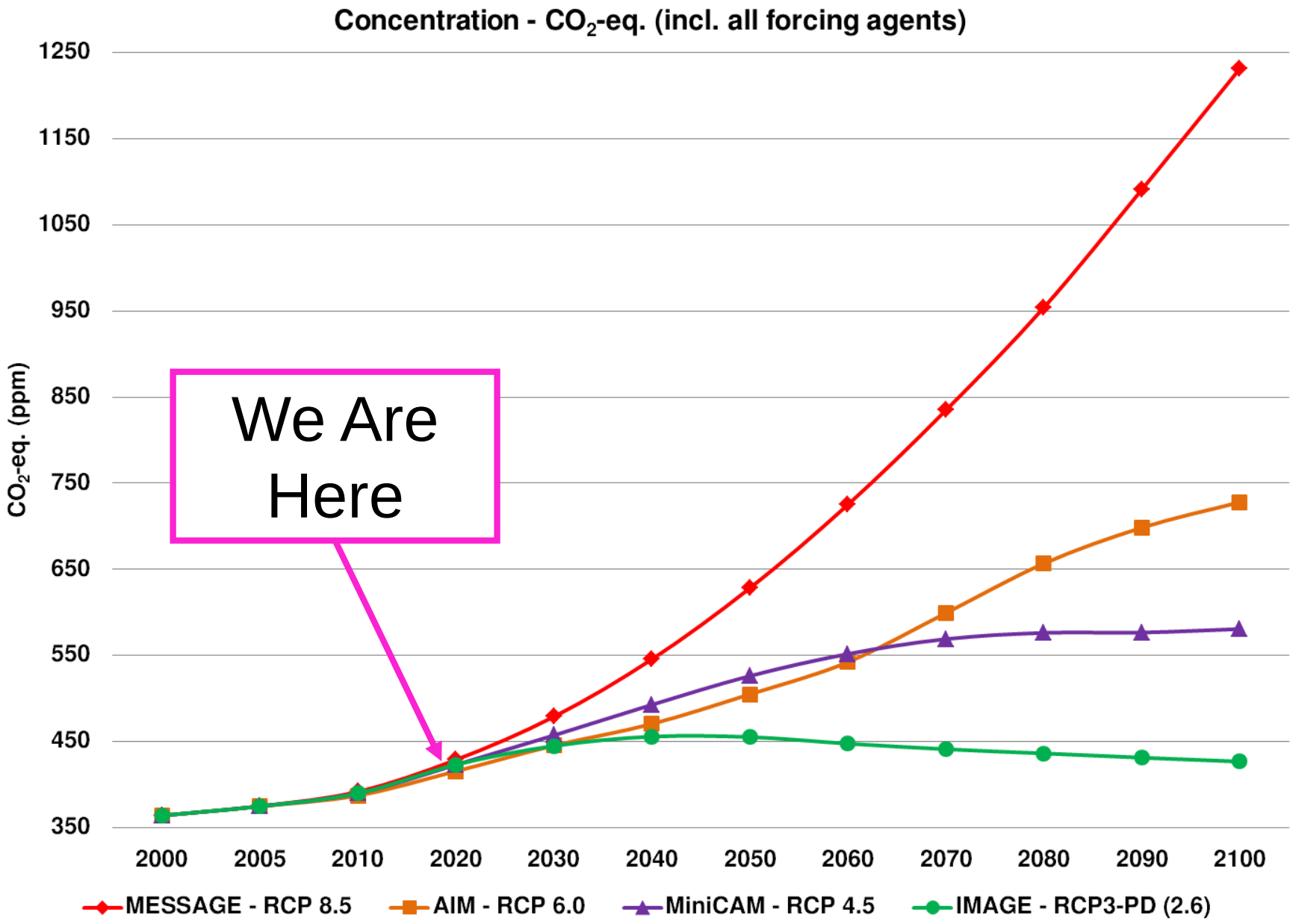
- RCPs are collections of assumptions and their impacts on greenhouse gases
  - population growth
  - energy use patterns
  - land use change

Data Flow

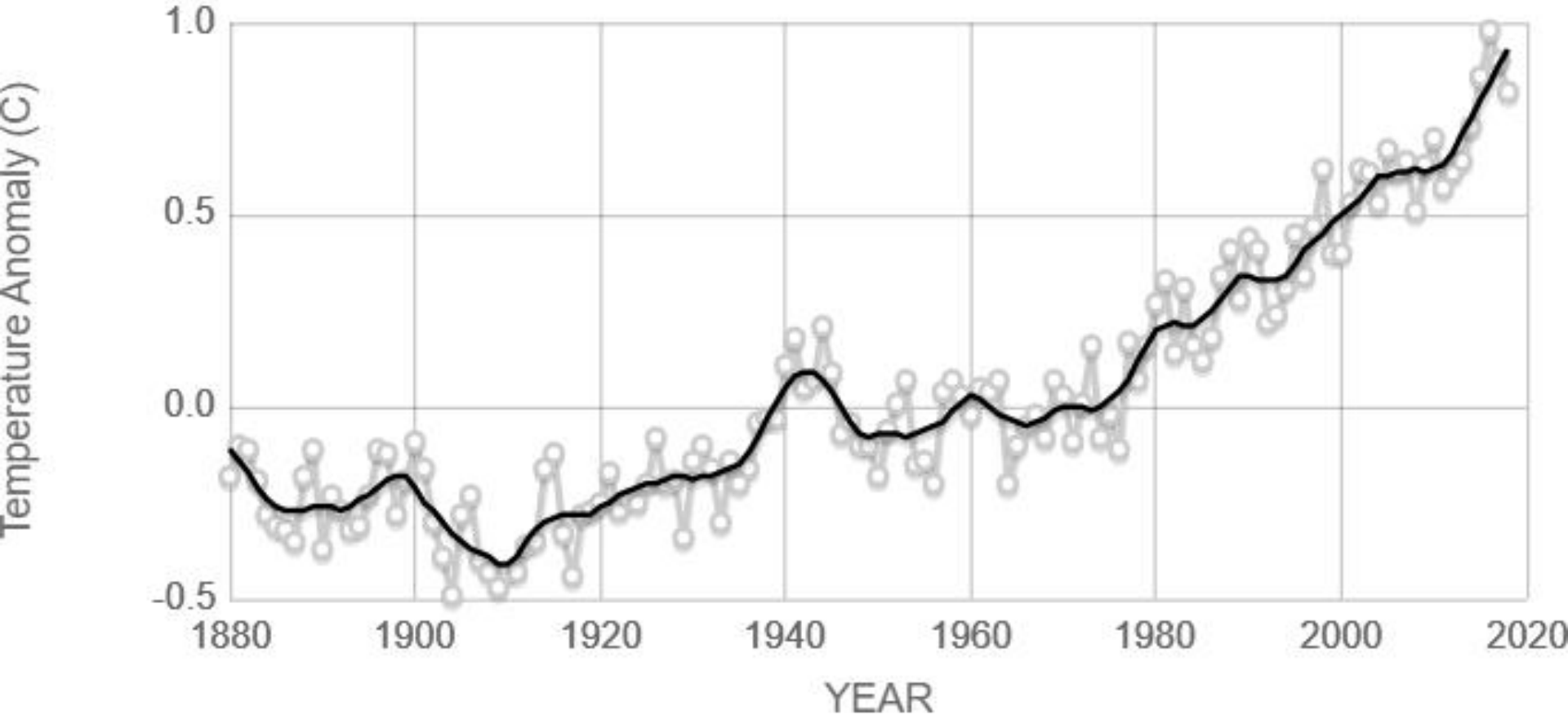


We want to know how projections of future climate impact erosion


Atmospheric CO_2 at Mauna Loa Observatory
Scripps Institution of Oceanography
NOAA Earth System Research Laboratory
PARTS PER MILLION
400
380
360
340
320
1960
1970
1980
1990
2000
2010
2020
YEAR
November 2019

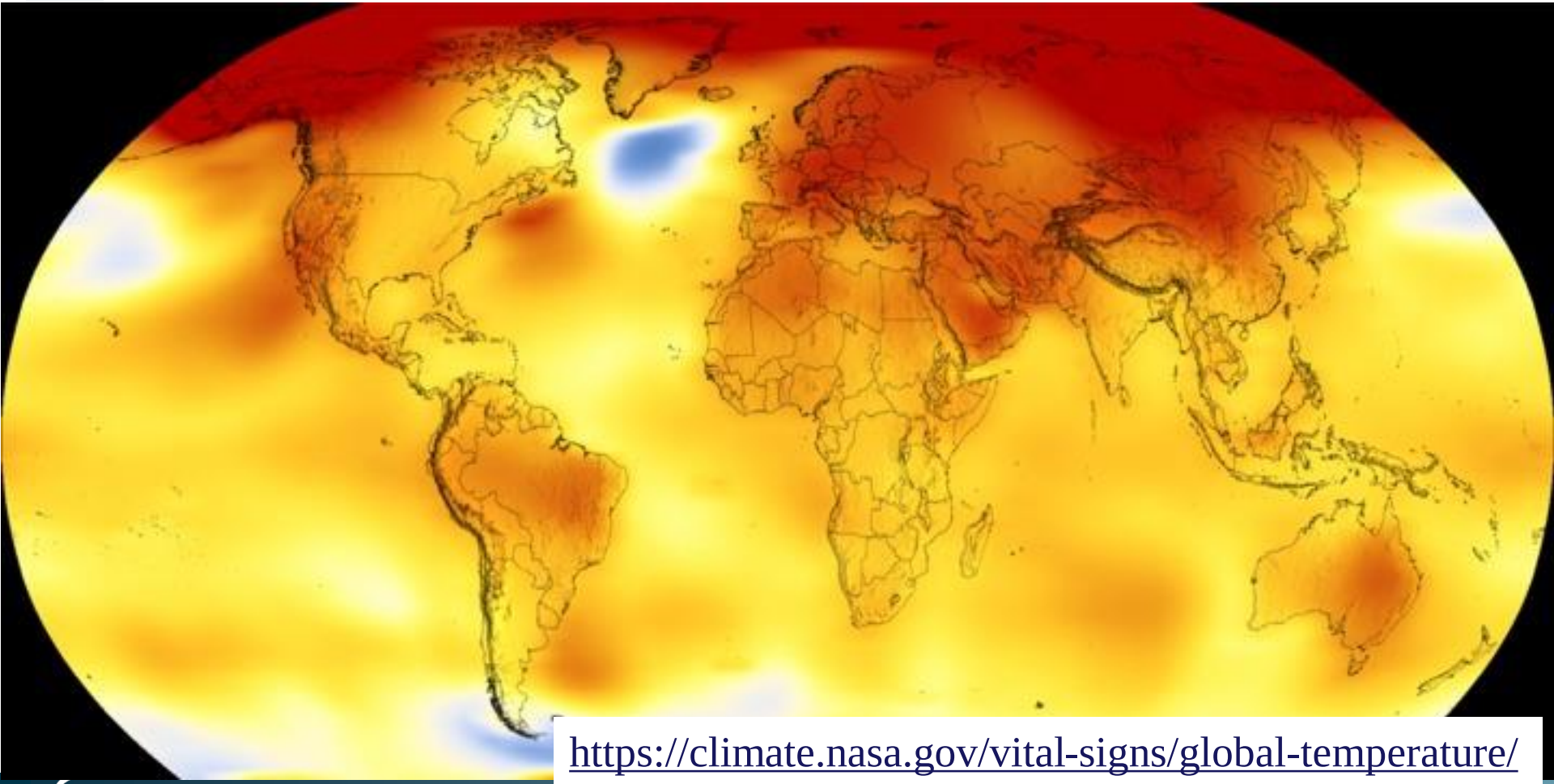

Concentration - CO_2-eq. (incl. all forcing agents)
1250
1150
1050
950
850
750
650
550
450
350
CO_2-eq. (ppm)
We Are Here
2000
2005
2010
2020
2030
2040
2050
2060
2070
2080
2090
2100
MESSAGE - RCP 8.5
AIM - RCP 6.0
MiniCAM - RCP 4.5
IMAGE - RCP3-PD (2.6)

Global Surface Temperature Anomalies Relative to 1951-1980



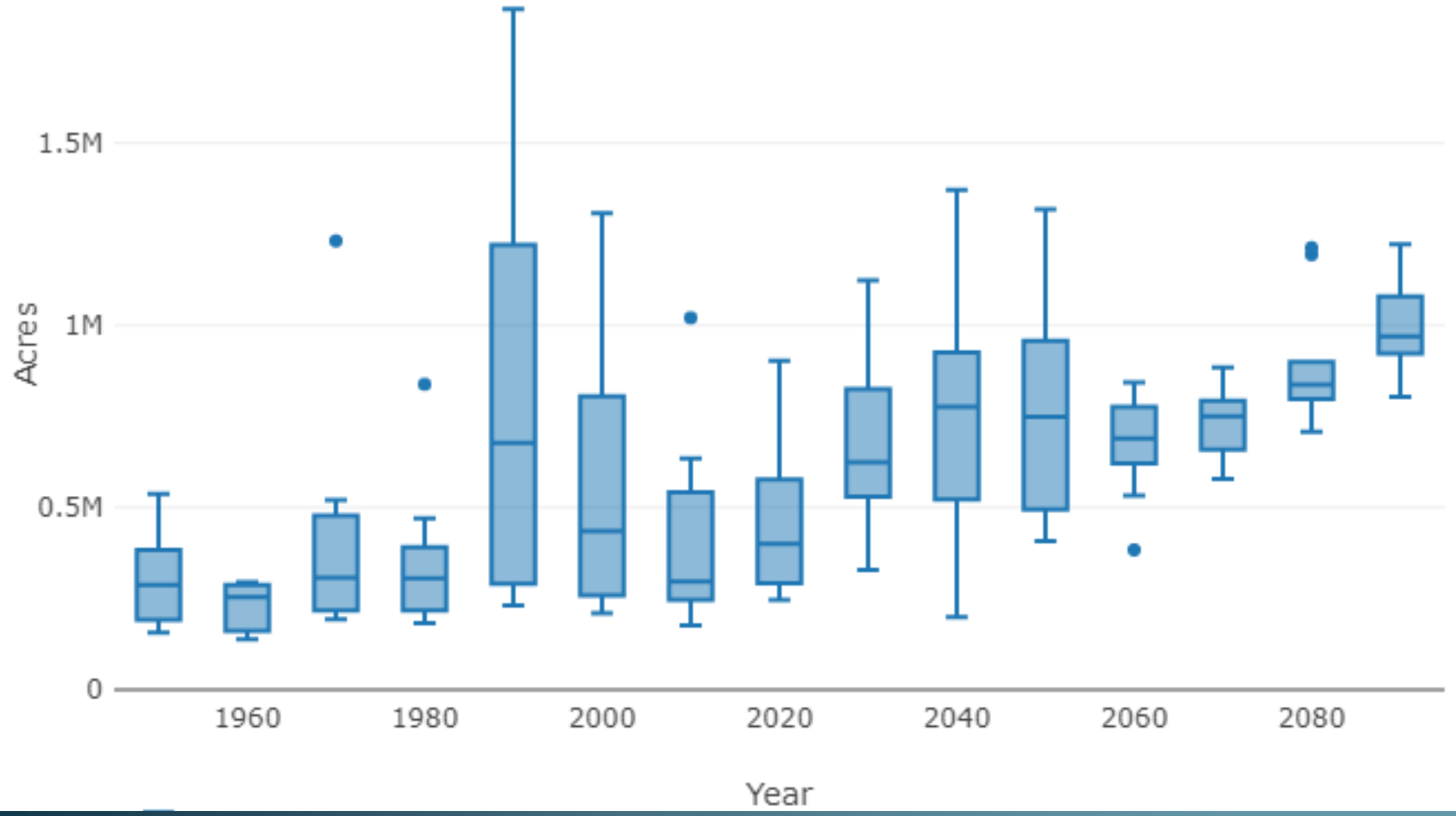
Source: climate.nasa.gov

Current 5-yr Average Surface Temperature Anomaly

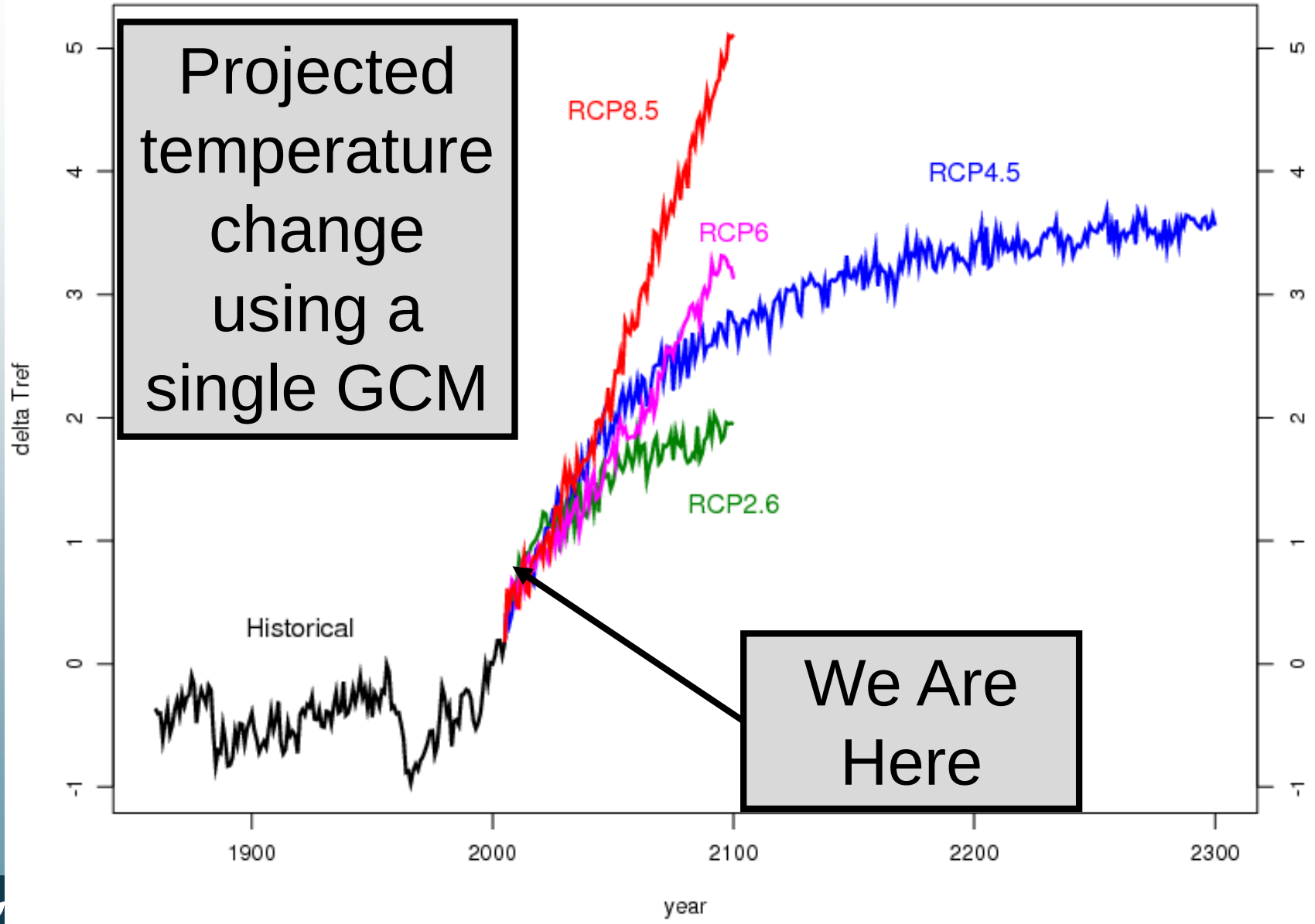


https://climate.nasa.gov/vital-signs/global-temperature/

Historical and Projected Area Burned in Alaska RCP 8.5



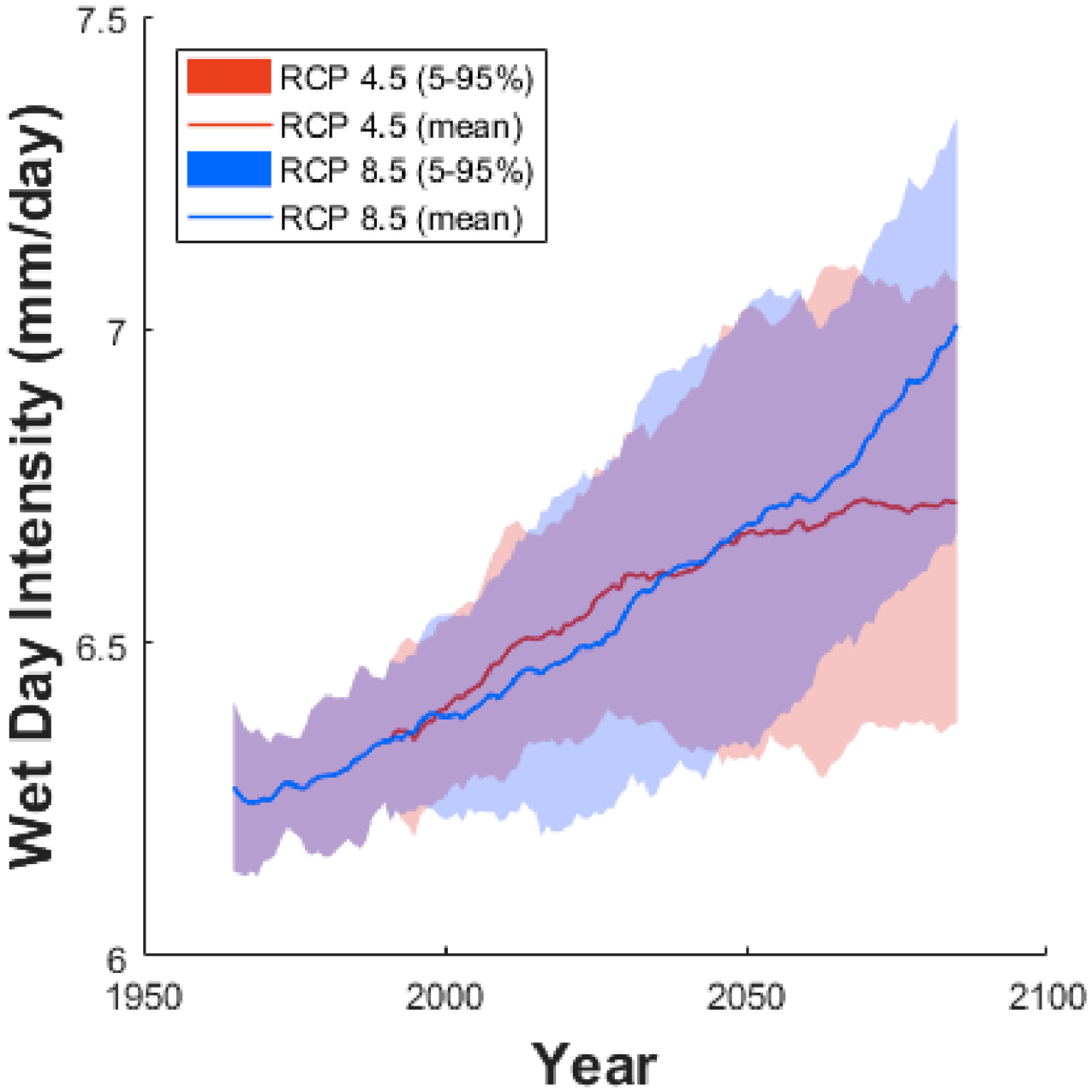
Projected Temperature Change



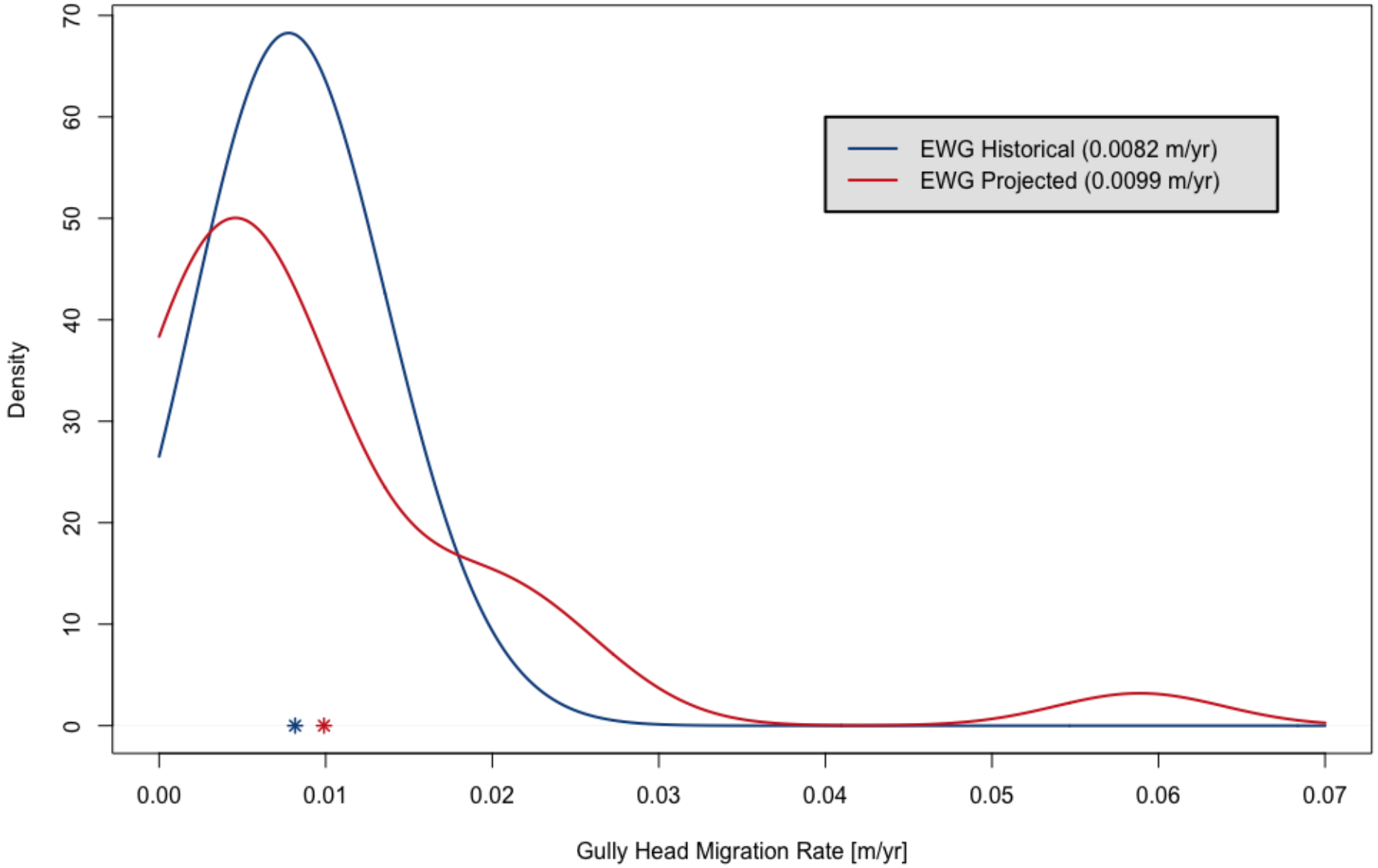
Climate Change

- Climate change was depicted out to 2100 (RCP8.5)

- RCP 8.5 corresponds to
  - Same number of days of precipitation
  - *Increase in intensity of precipitation events*
  - Increase in the annual precipitation total


RCP 4.5 (5-95%)
RCP 4.5 (mean)
RCP 8.5 (5-95%)
RCP 8.5 (mean)
Wet Day Intensity (mm/day)
7.5
7
6.5
6
1950
2000
2050
2100
Year

EWG Gully Head Migration Rates



Gully Head Migration Rate

- Historical aerial image estimate is 0.117 m/yr
- Adjusted for impacts of climate change using LEM information yields 0.141 m/yr, a 21% increase

Summary

- Incorporating climate change provides the information needed to ensure adaptability
- More realistic estimates of projected future risks are developed