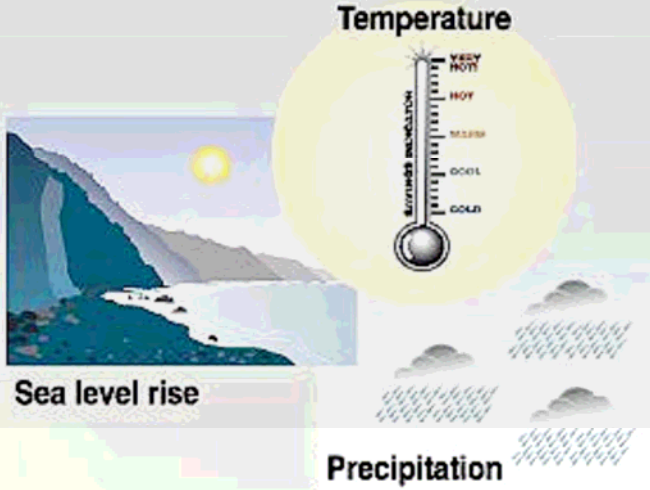
SIERRA NEVADA ALLIANCE

Keeping light in the range.

Potential climate changes impact



Impacts on...

Health

Weather-related mortality

Infectious diseases

Air-quality respiratory illnesses

Agriculture

Crop yields

Irrigation demands

Forest

Forest composition

Geographic range of forest

Forest health and productivity

Water resources

Water supply

Water quality

Competition for water

coastal areas

Erosion of beaches

Inundation of coastal lands

additional costs to protect coastal communities

Species and natural areas

Loss of habitat and species

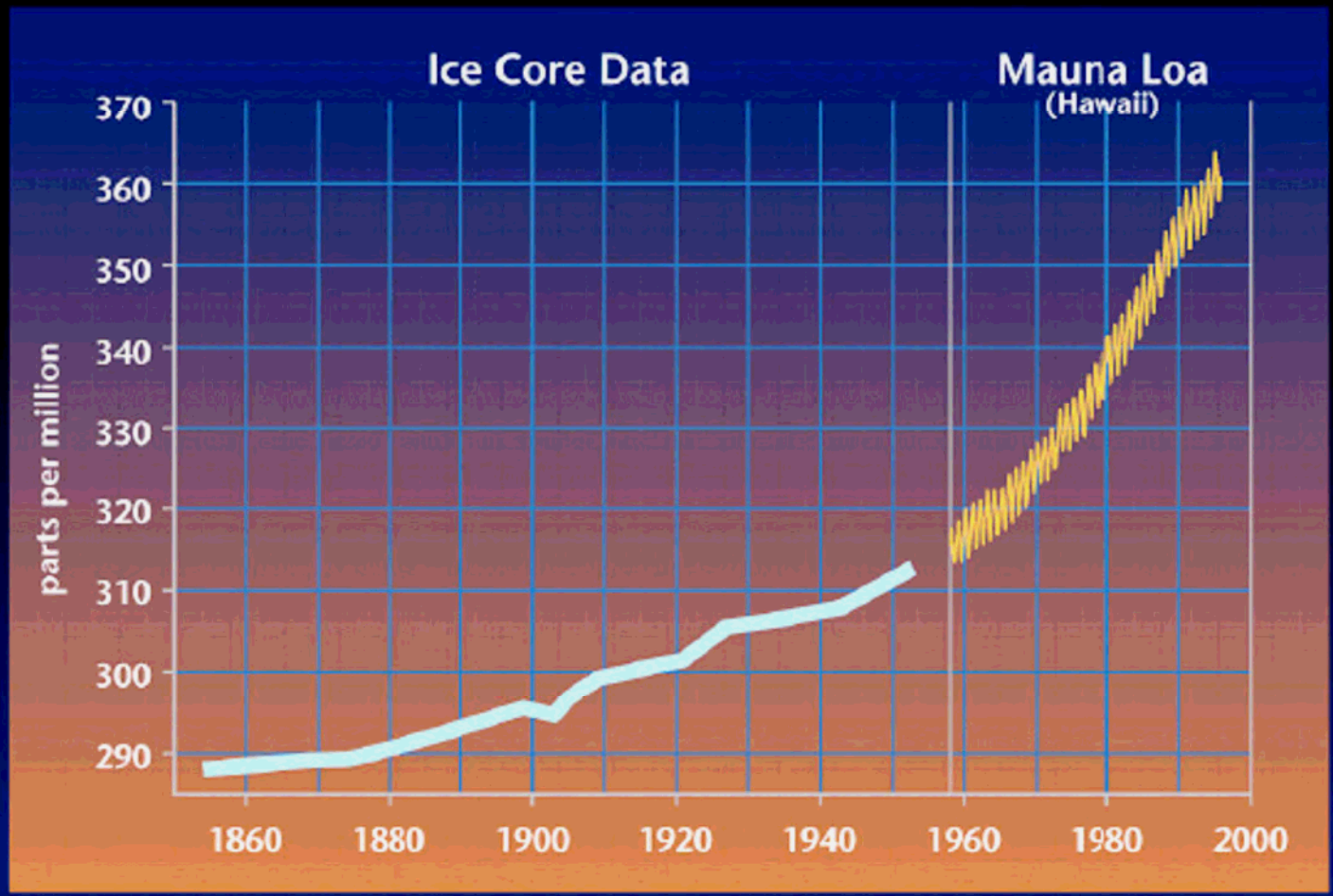
Cryosphere: diminishing glaciers

GRID Arendal UNEP

GRAPHIC DESIGN : PHILIPPE REKACEWICZ

Source: United States environmental protection agency (EPA).

Carbon Dioxide Concentrations

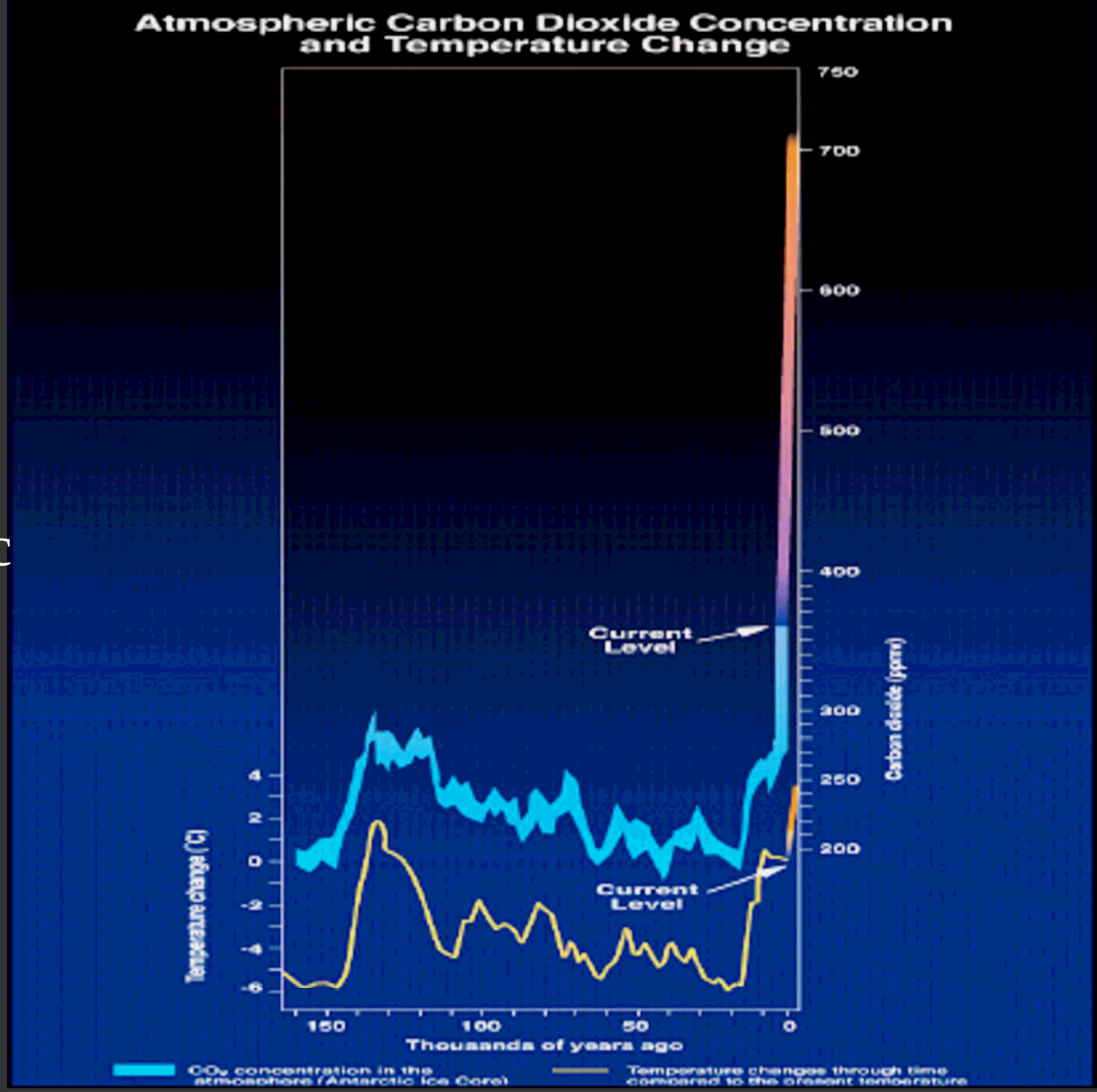


- Higher temperatures caused by rising CO2 are causing a reduction in the moisture content of soils in semi-arid parts of the world, such as, the southern states of the US where soil moisture is falling by up to 40 percent.

Climate Change 2001: Synthesis Report: Summary for Policymakers: An Assessment of the Intergovernmental Panel on Climate Change,"

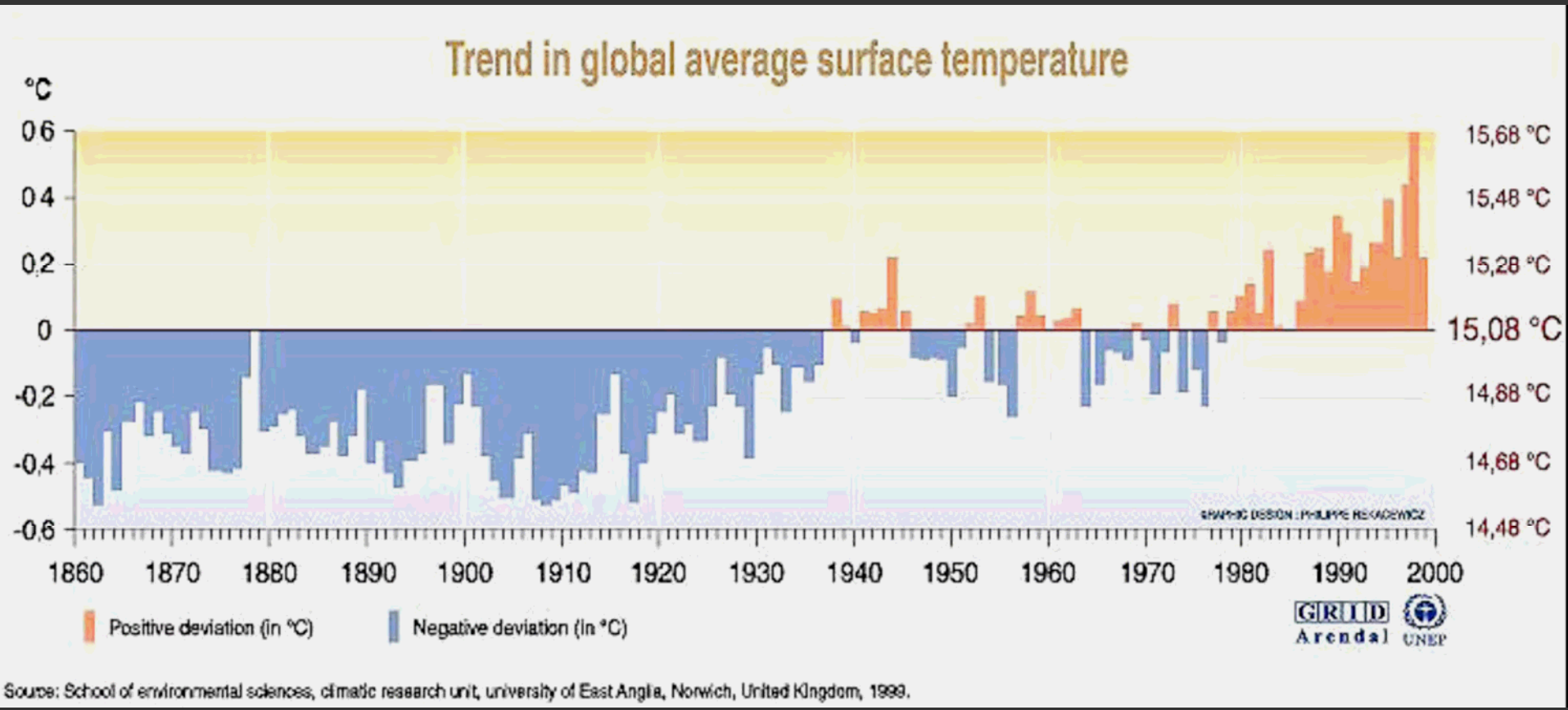
Global Impacts

Clear correlation between temperatures and atmospheric CO_2 levels over the last 160,000 years

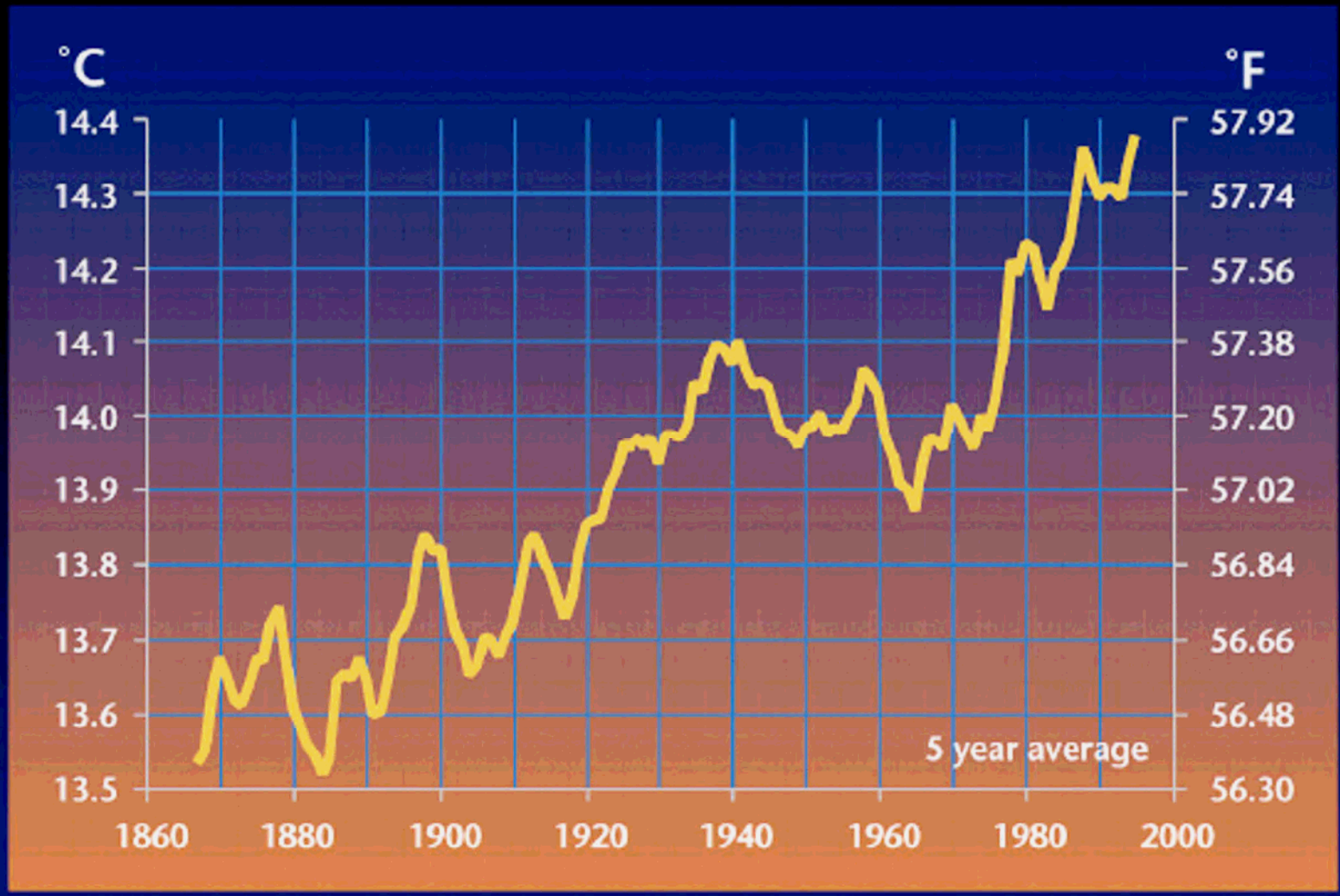


Climate Change 2001: Synthesis Report: Summary for Policymakers: An Assessment of the Intergovernmental Panel on Climate Change,"

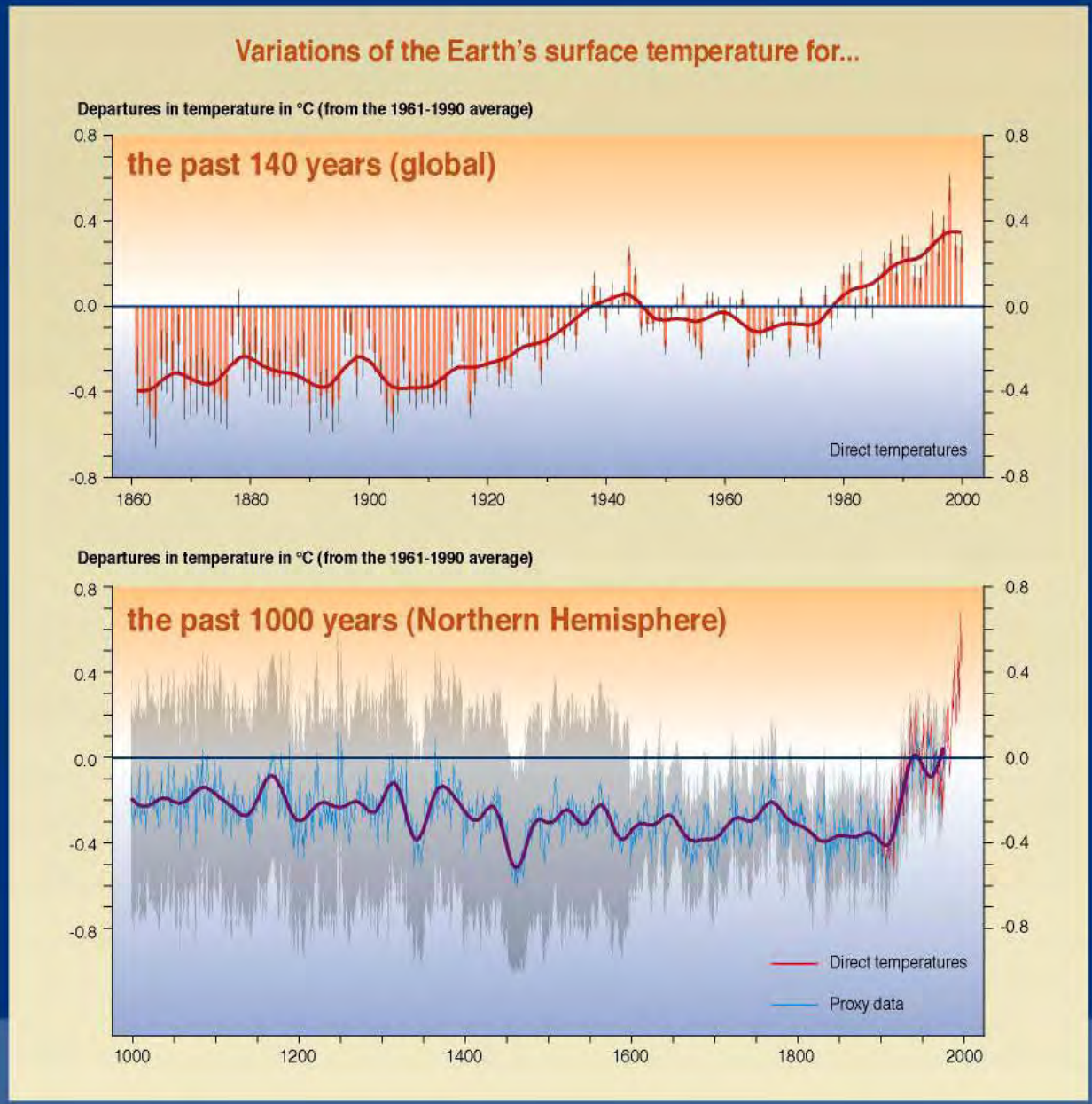
Scientists have found that the average global surface temperature has risen 1.1 degrees Fahrenheit in the last 100 years, with most warming occurring in the time periods between 1910 and 1945 and 1976 to the present.



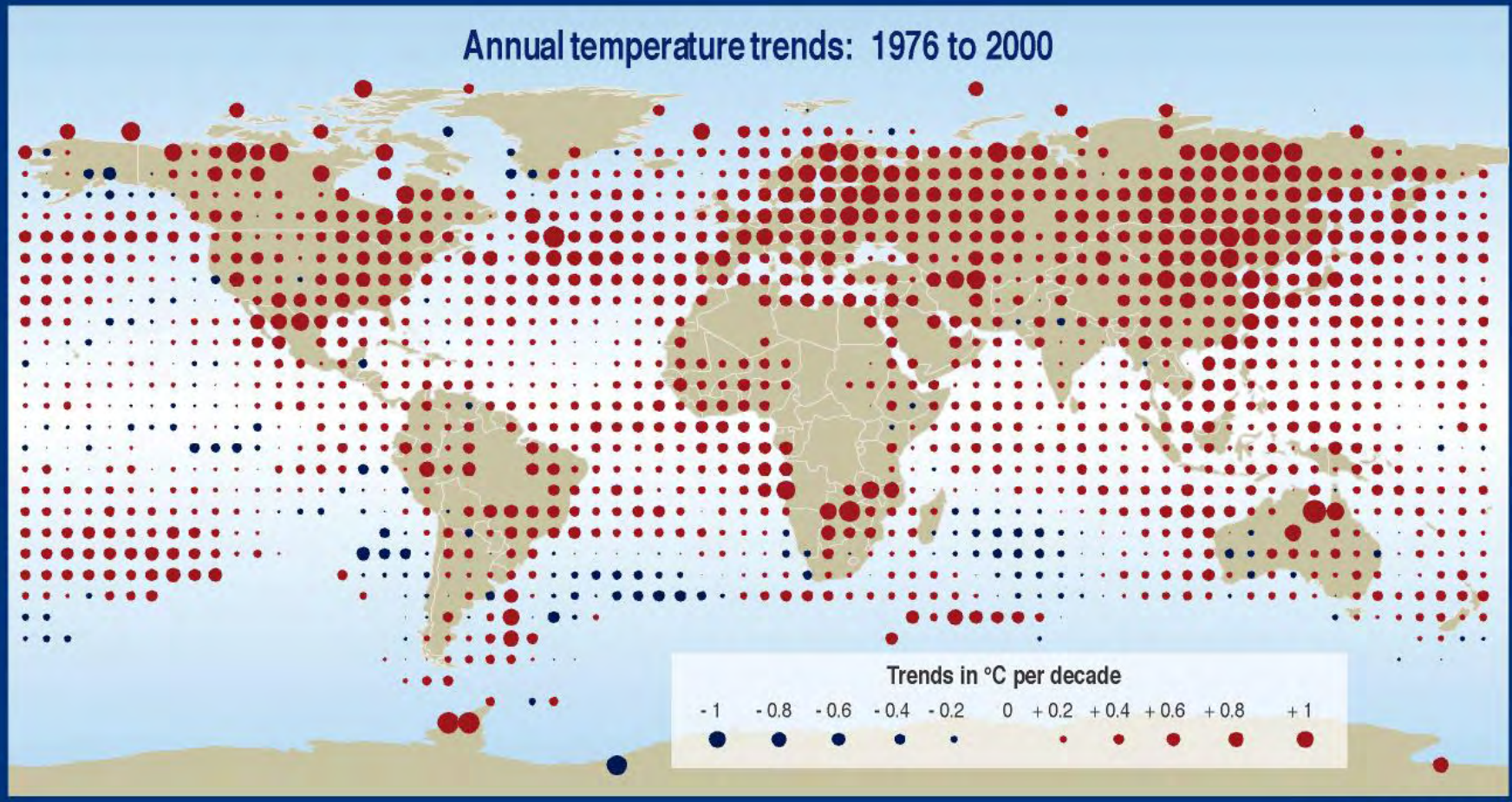
Global Average Temperature



Climate Change 2001: Synthesis Report: Summary for Policymakers: An Assessment of the Intergovernmental Panel on Climate Change,"

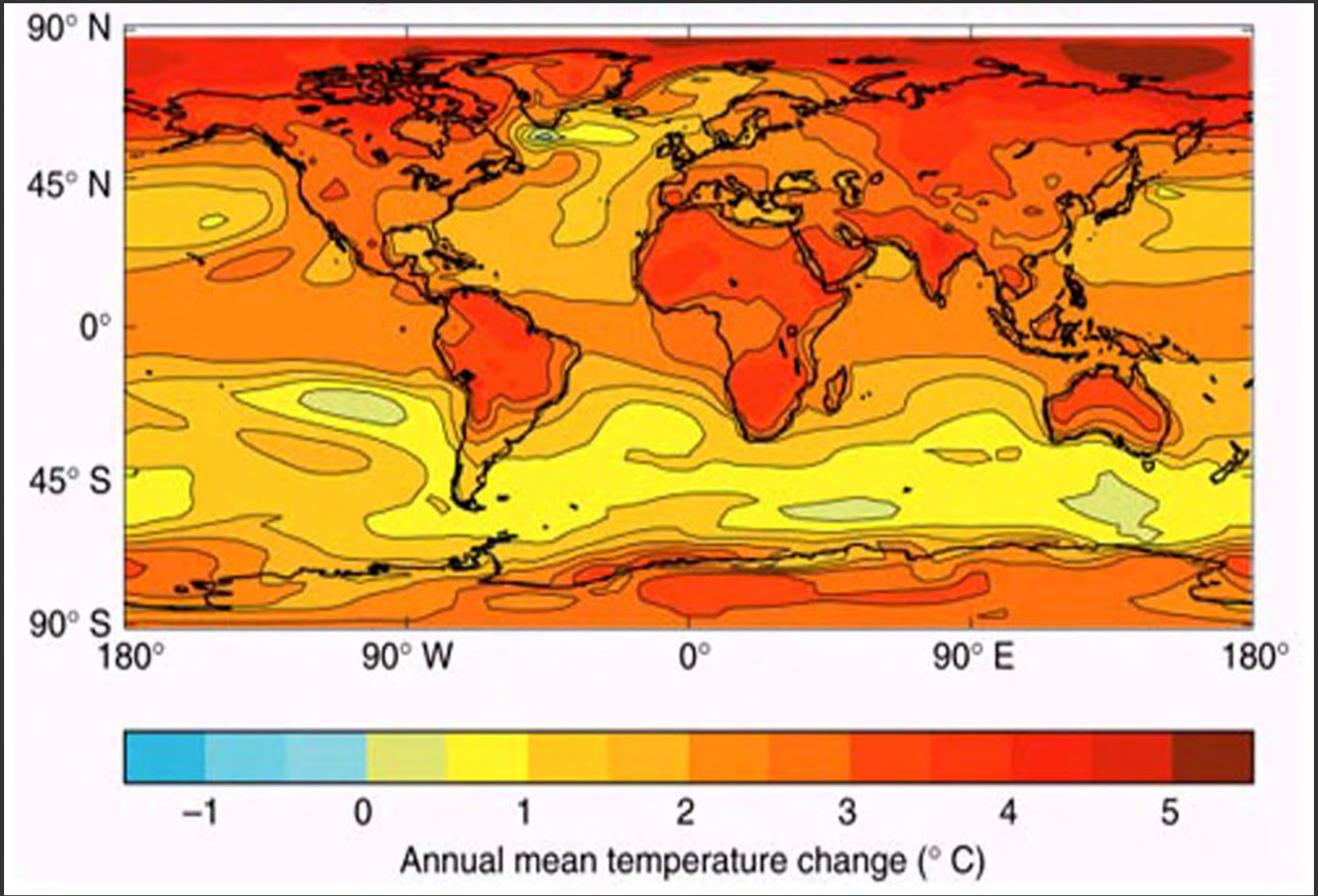


SYR - FIGURE 2-3



SYR - FIGURE 2-6b

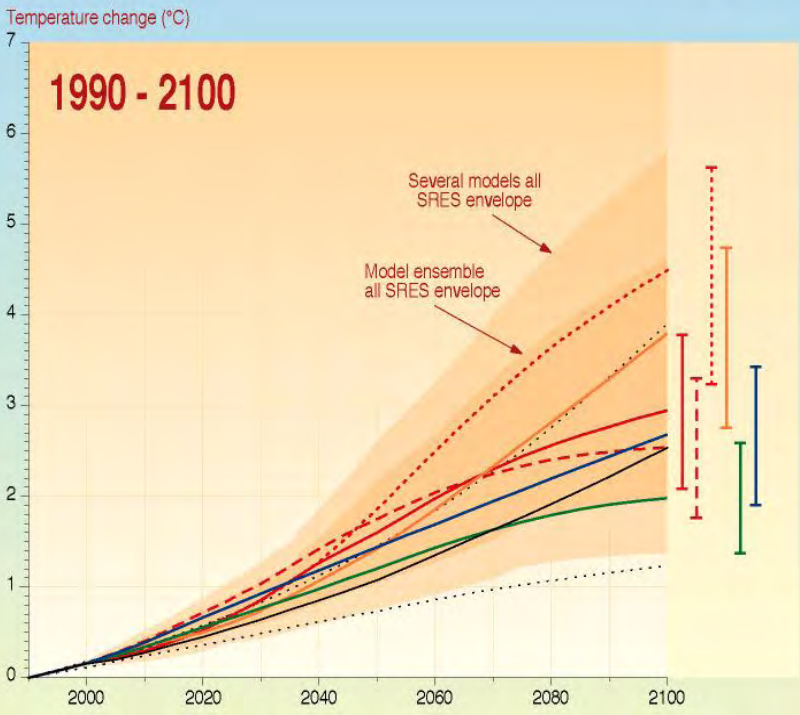
Projected Changes in Annual Temperatures for the 2050s

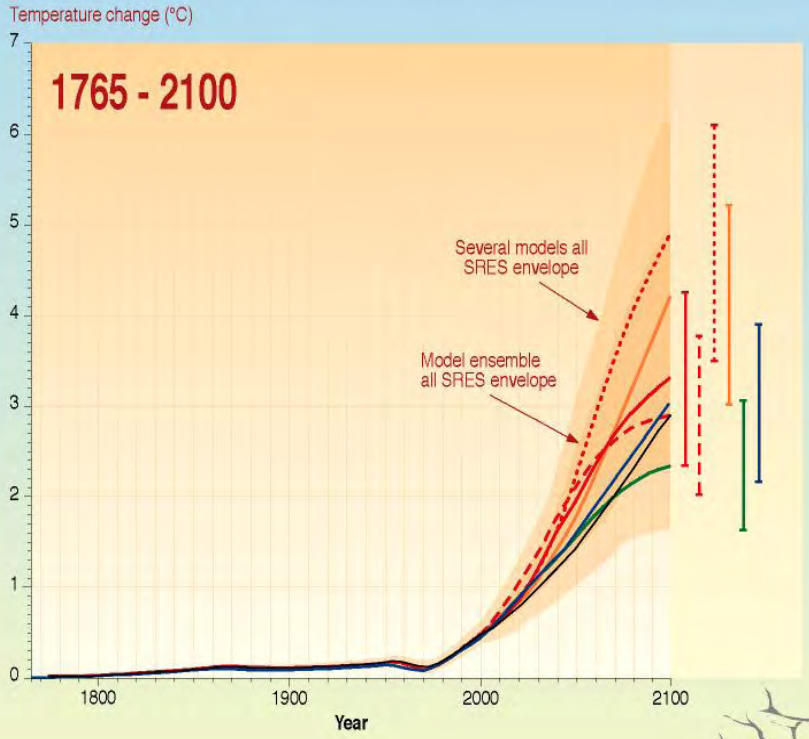


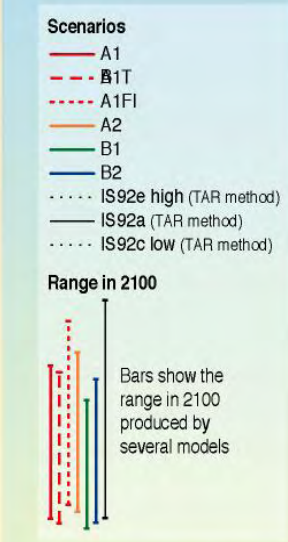
The projected change is compared to the present day with a ~1% increase per year in equivalent CO_2

Source: The Met Office. Hadley Center for Climate Prediction and Research

Temperature change (1760 - 2100)







WG1 TS FIGURE

Polar Ice

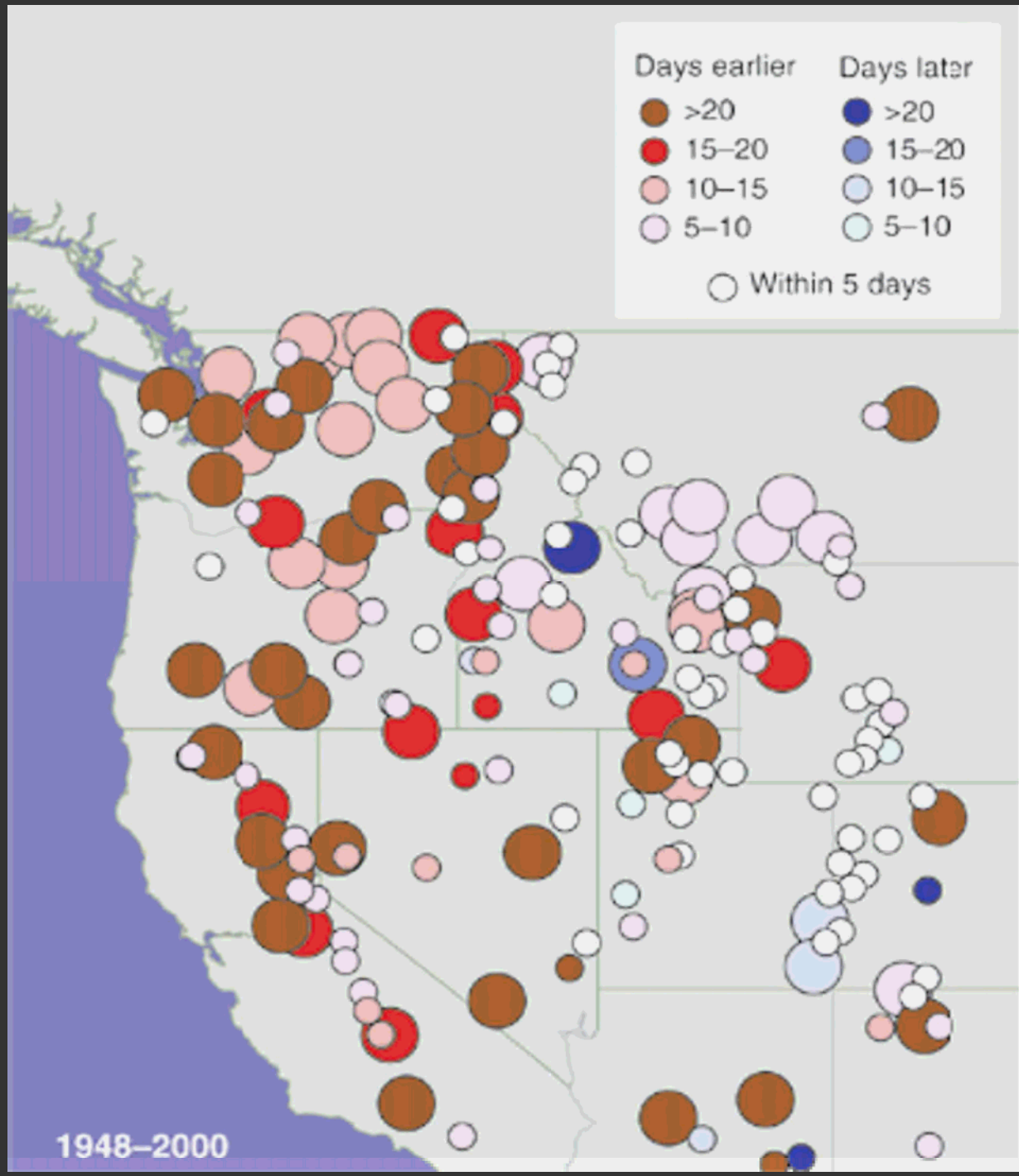
GLOBAL IMPACTS

Climate Change 2001: Synthesis Report: Summary for Policymakers: An Assessment of the Intergovernmental Panel on Climate Change,"

Extent of ice melt in Greenland,1992 and 2002

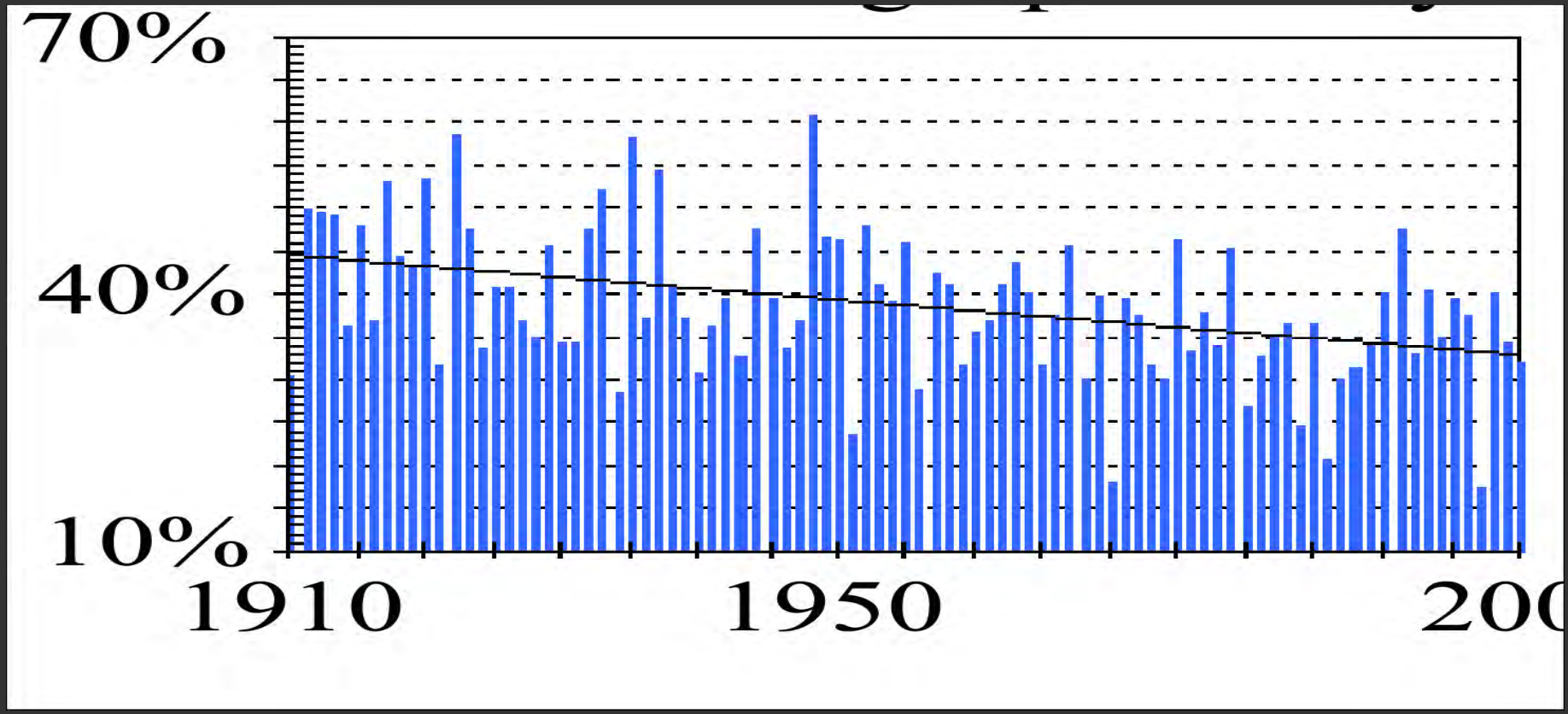
Source: Arctic Climate Impact Assessment 2004

The fraction of the annual runoff from the central Sierra that occurs in late spring has been decreasing for approximately the past 50 years.



"Large-scale atmospheric forcing of recent trends toward early snowmelt in California": J. Clim. 8, 606-623. Dettinger and Cayan 1995

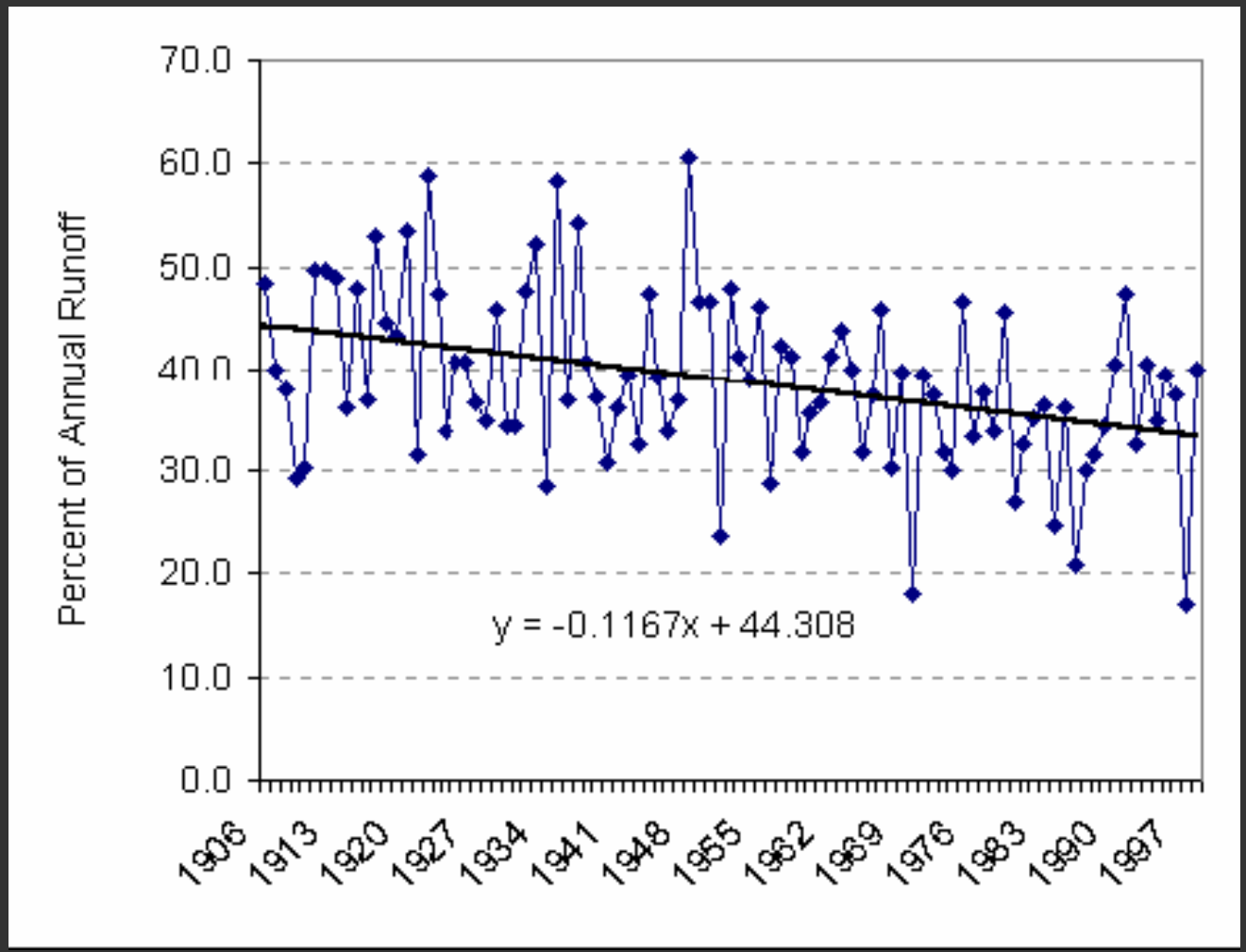
SIERRA IMPACTS



12% less spring and summer snowmelt in the Sacramento River than 100 years ago.

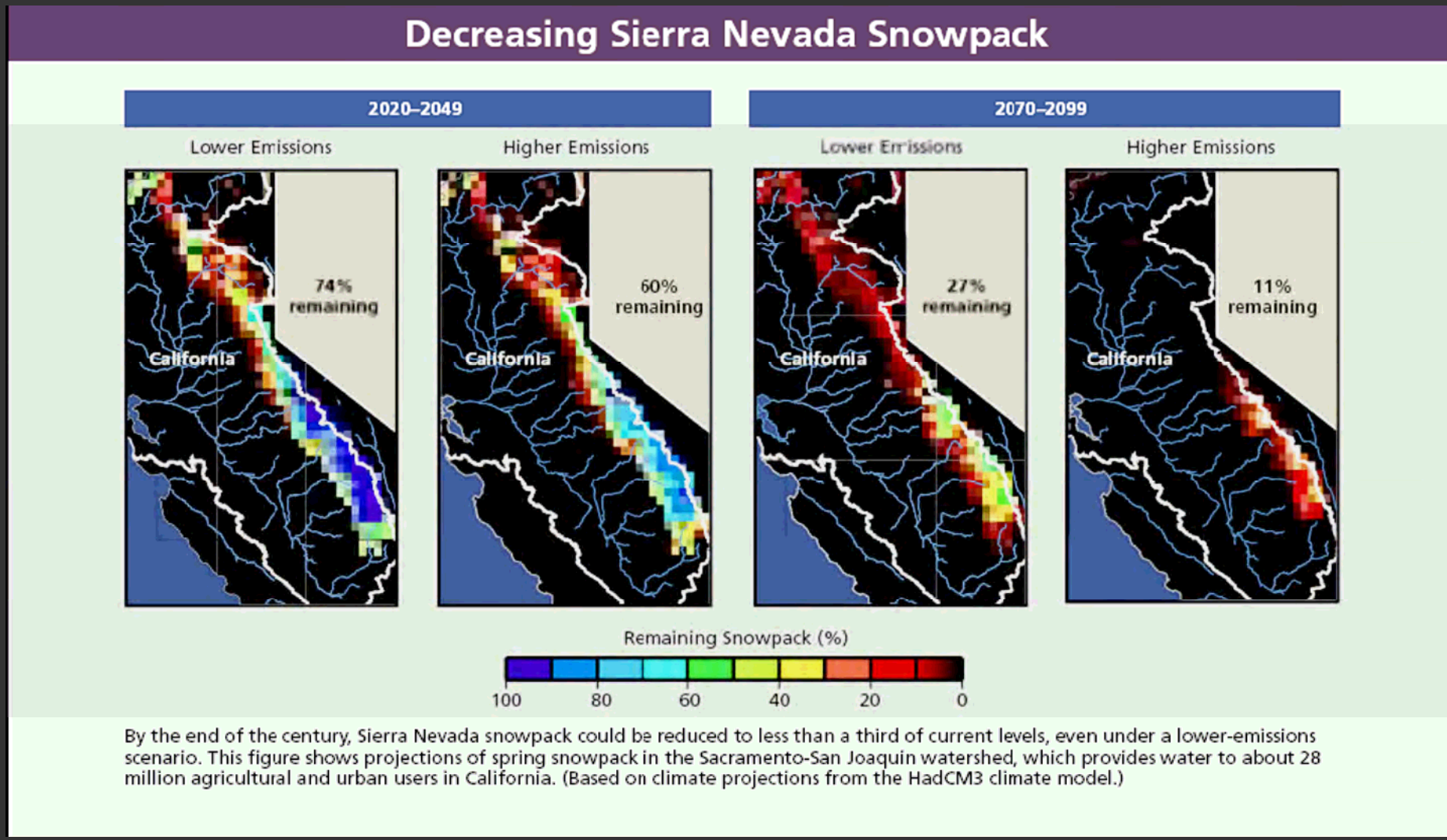
"Large-scale atmospheric forcing of recent trends toward early snowmelt in California": J. Clim. 8, 606-623. Dettinger and Cayan 1995

Sacramento River Index
April to July Runoff
(as Percent of Annual Runoff)



•"Large-scale atmospheric forcing of recent trends toward early snowmelt in California": J. Clim. 8, 606-623. Dettinger and Cayan 1995

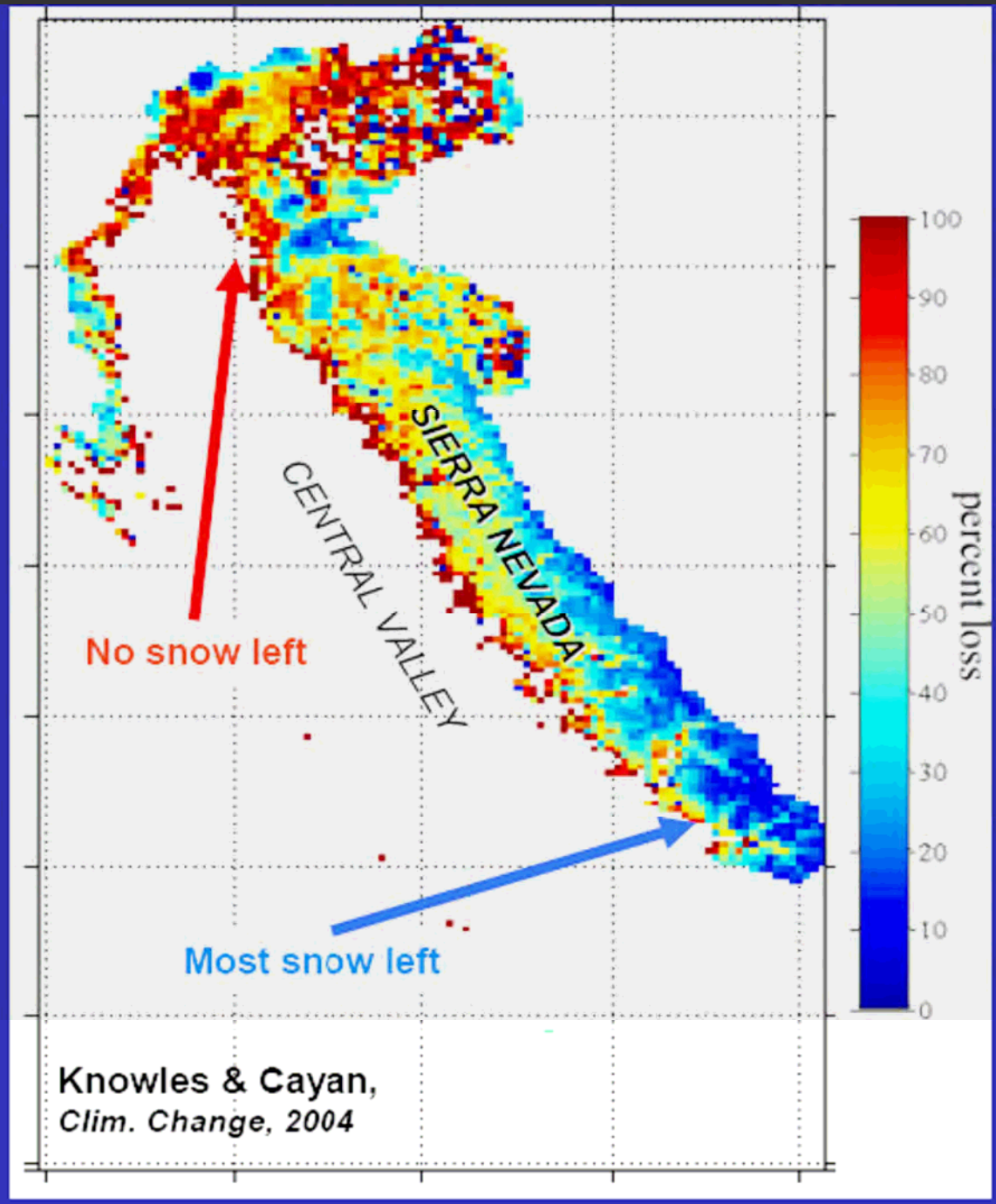
- The Sierra Nevada ski season could be shortened by three to six weeks by 2050. By the end of the century the ski season could be shortened by 7 to 15 weeks.

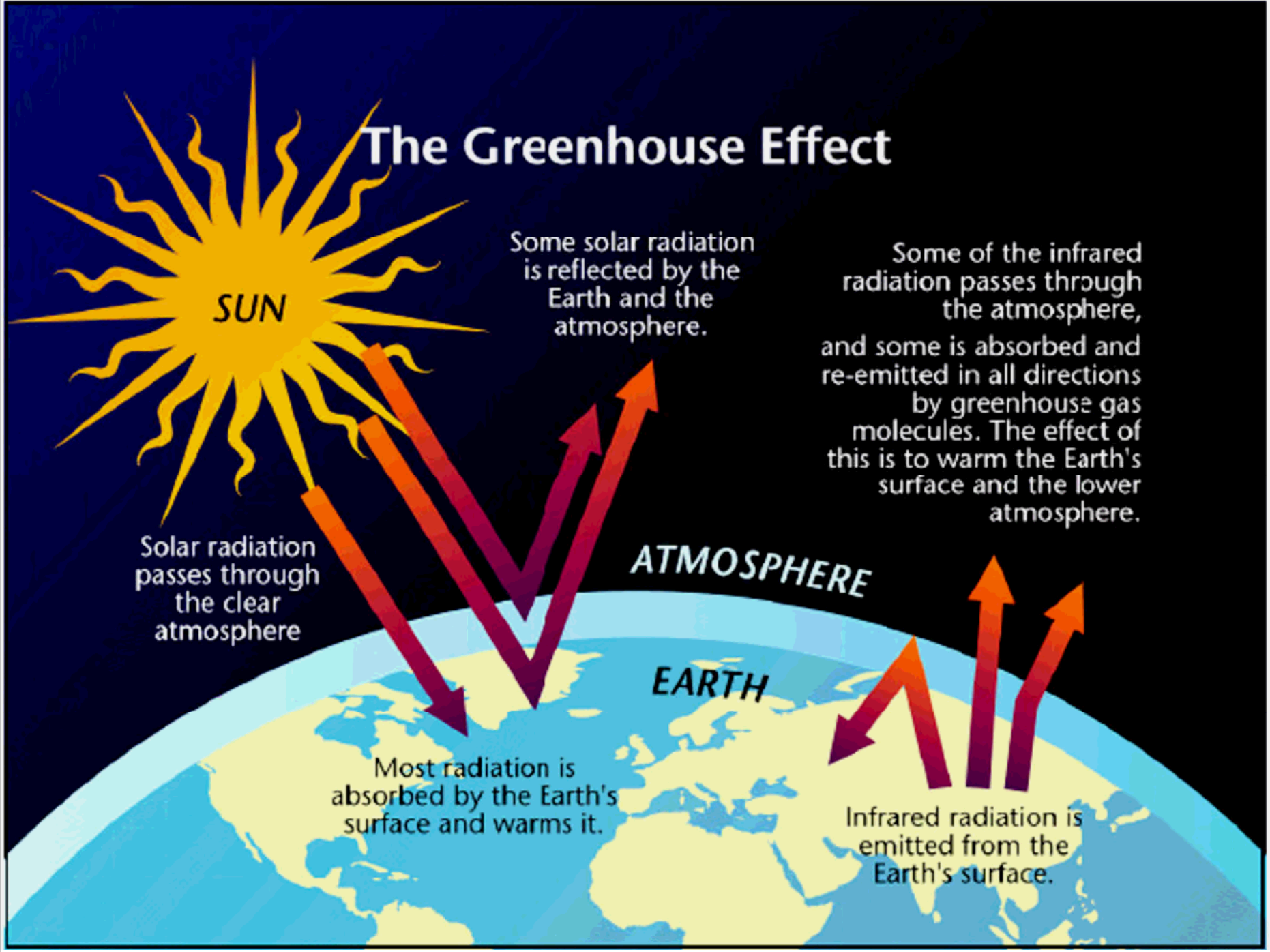


By the end of the century, Sierra Nevada snowpack could be reduced to less than a third of current levels, even under a lower-emissions scenario. This figure shows projections of spring snowpack in the Sacramento-San Joaquin watershed, which provides water to about 28 million agricultural and urban users in California. (Based on climate projections from the HadCM3 climate model.)

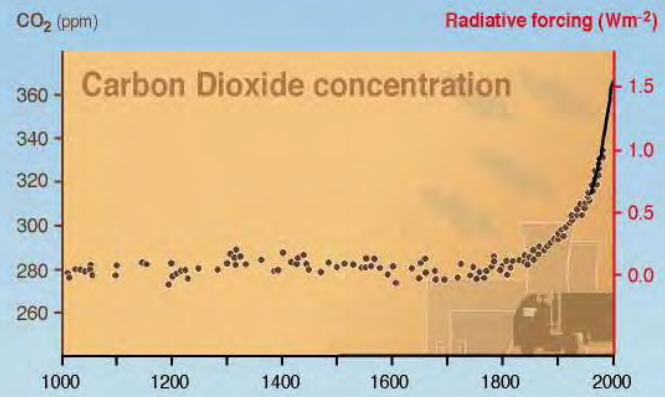
"Climate Change in California: Choosing our Future" Union Of Concerned Scientists. 2004

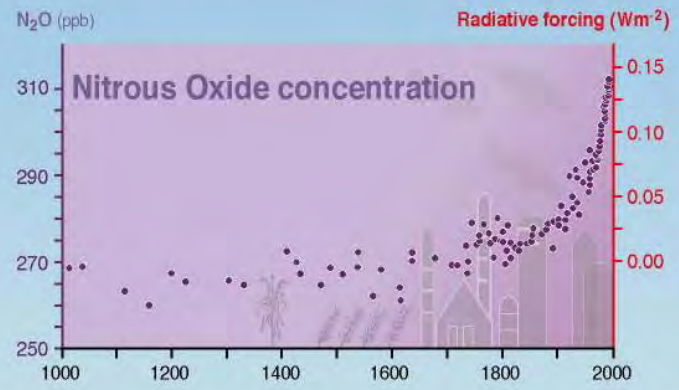
By the middle of the 21st Century, *even in one of the coolest scenarios*, earlier snowmelts & major reductions in snowpacks of the Sierra Nevada are projected…

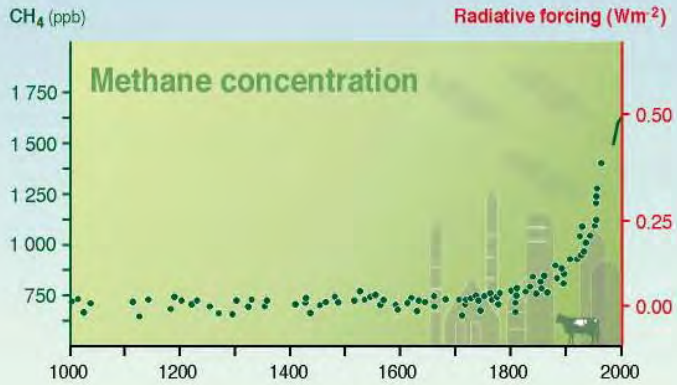


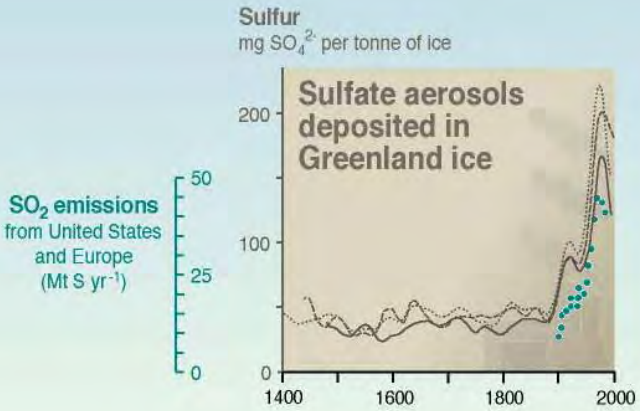

The Greenhouse Effect
SUN
Some solar radiation is reflected by the Earth and the atmosphere.
Some of the infrared radiation passes through the atmosphere,
and some is absorbed and re-emitted in all directions by greenhouse gas molecules. The effect of this is to warm the Earth's surface and the lower atmosphere.
Solar radiation passes through the clear atmosphere
ATMOSPHERE
EARTH
Most radiation is absorbed by the Earth's surface and warms it.
Infrared radiation is emitted from the Earth's surface.

Indicators of the human influence on the atmosphere during the Industrial era



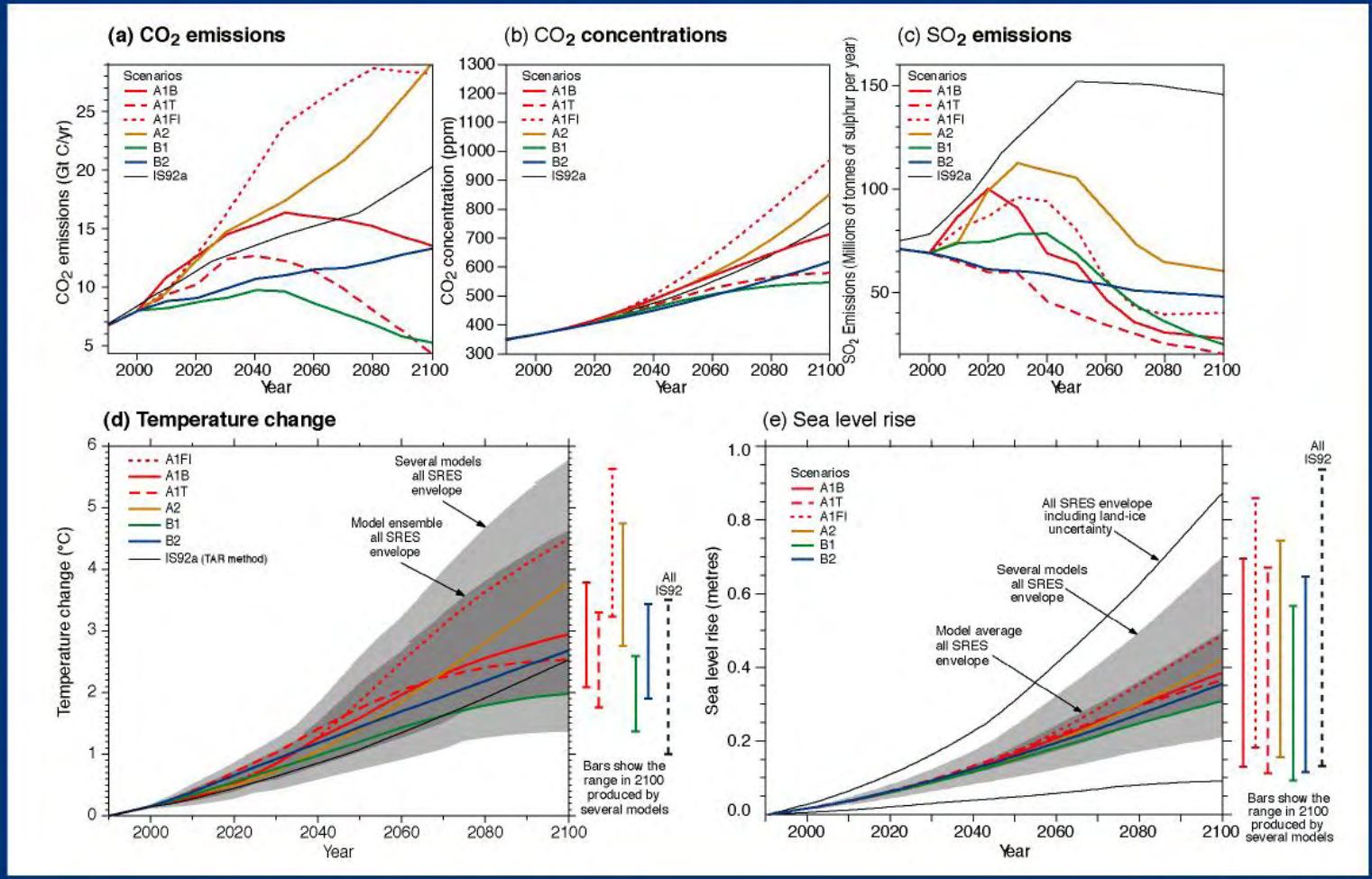






SYR -
WG1 F

The global climate of the 21st century



WG1 - SPM FIGURE 5

California's Environment at Risk

WATER IMPACTS

These are the possible climate changes in California over the next few decades

WARMER
Average temperatures up by 5 - 6°F in winter and 1 - 2°F in summer.

WETTER
Higher temperatures = more evaporation = precipitation, mostly as rain rather than snow.

EXTREME EVENTS
Bigger and/or more frequent winter storms, with more severe summer droughts.

SEA-LEVEL RISE
8 - 12 inches by 2100 (3 times the historical rate measured in San Francisco).

CLIMATE VARIABILITY
Increasing evidence suggests more frequent El Niños with stronger La Niña cold phases.

leading to

LESS WATER WHEN IT'S NEEDED

MORE WATER AT THE WRONG TIME

and

DROUGHTS
Worse drought conditions likely, due to more evaporation in summer and smaller snow pack in winter.

EFFECTS ON FISH
Effects on fish and other stream life from warmer water and decreased stream flow.

WILDFIRES
Higher risk of wildfires, especially if fire weather (Santa Ana wind) becomes common.

TOXIC ORGANISMS
Possibly increased problems with toxic organisms in coastal waters from highest run-off.

PESTS
Improved conditions for insects and rodents from increased winter moisture.

LAKE POLLUTION
Increased lake pollution possible, due to worse summer storms.

COASTAL CHANGES
Altered salinity and nutrient availability in coastal waters from reduced run-off and higher water temperatures.

FLOODS & SLIDES
More river flooding, slope failures and landslides from increased run-off in winter and spring.

COASTAL FLOODING
Storm surges, coastal flooding, beach erosion and cliff failures likely from more winter storms and sea-level rise.

SOIL EROSION
Soil erosion and fertility loss in upland areas, and nutrient enrichment downstream and murkiness in pristine lakes, from more run-off.

LESS CROP PROFIT
Decreased profitability of thirsty crops (e.g. cotton) and higher vulnerability of crops from long-lived plants (e.g. fruits and nuts).

EFFECTS ON FISHERIES
Changes in aquatic ecosystems, species and foodweb would affect recreational and commercial fisheries.

PROPERTY DAMAGE
Likely highest damages to private property and public infrastructure, affecting the real estate, construction, and insurance industries.

INDUSTRY COSTS
Likely higher costs and losses for tourism industry from damage to coastal areas.

INDUSTRY COSTS
Likely higher costs and losses for forestry, agriculture and tourism industries from soil fertility loss.

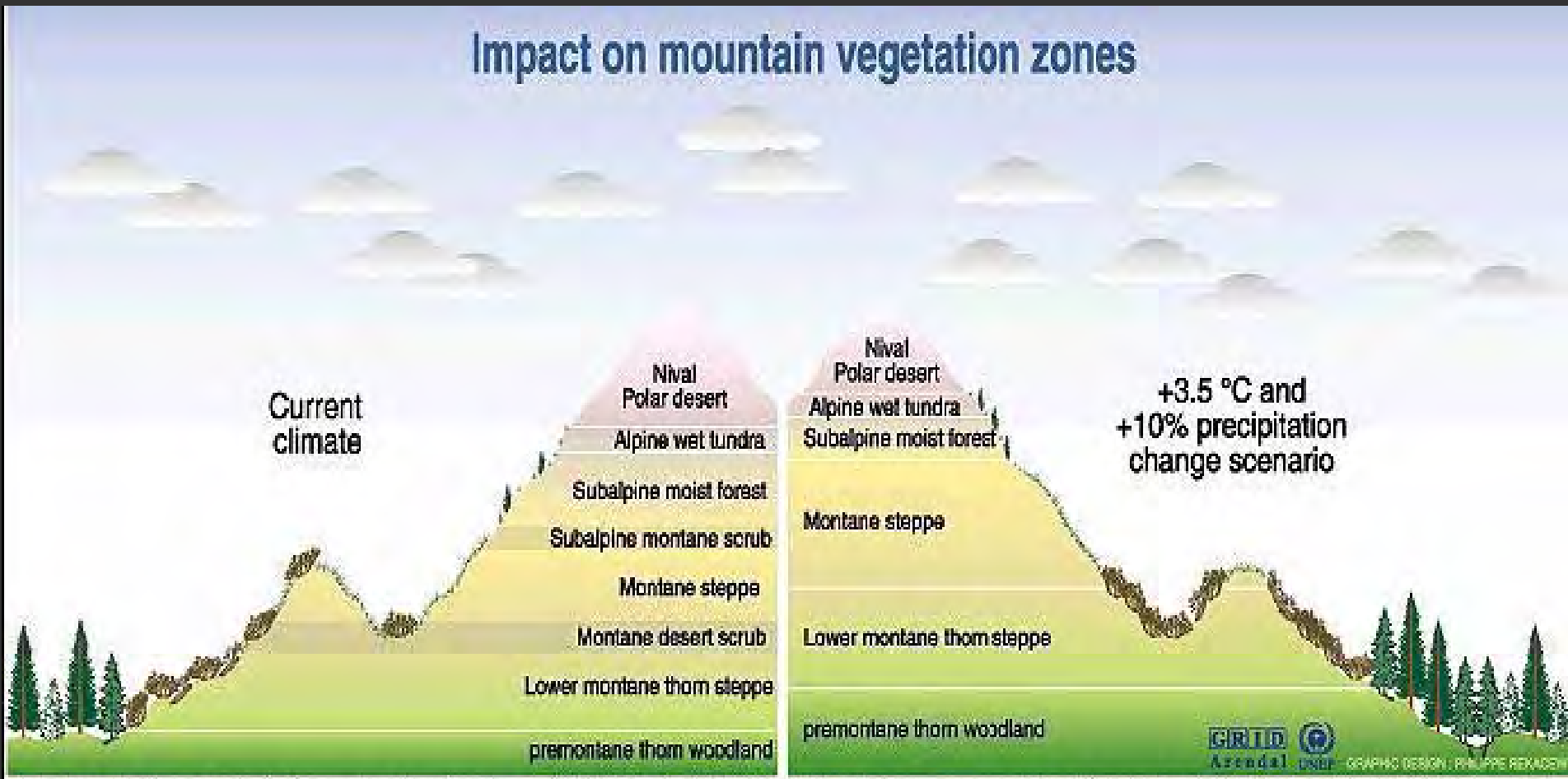
HIGHER WATER COSTS
Higher water prices and production costs and possibly more conflicts over use.

PROPERTY DAMAGE
Potentially highest losses to forestry and private homes.

REPAIR & PREVENTION COSTS
Likely higher costs to maintain, repair and expand levees, flood water storage facilities and emergency facilities.

DISEASE RISK
Increased risks of water- and vector-borne diseases (e.g., hantavirus and malaria) put higher pressure on public health care.

Impact on mountain vegetation zones



Sources: Martin Benitson, Mountain environments in changing climates, Routledge, London, 1994; Climate change 1995, Impacts, adaptations and migration of climate change, contribution of working group 2 to the second assessment report of the Intergovernmental panel on climate change (IPCC), UNEP and WMO, Cambridge press university, 1996.