

Effects of Climate Change on Water Availability

Prof. Minghua Zhang

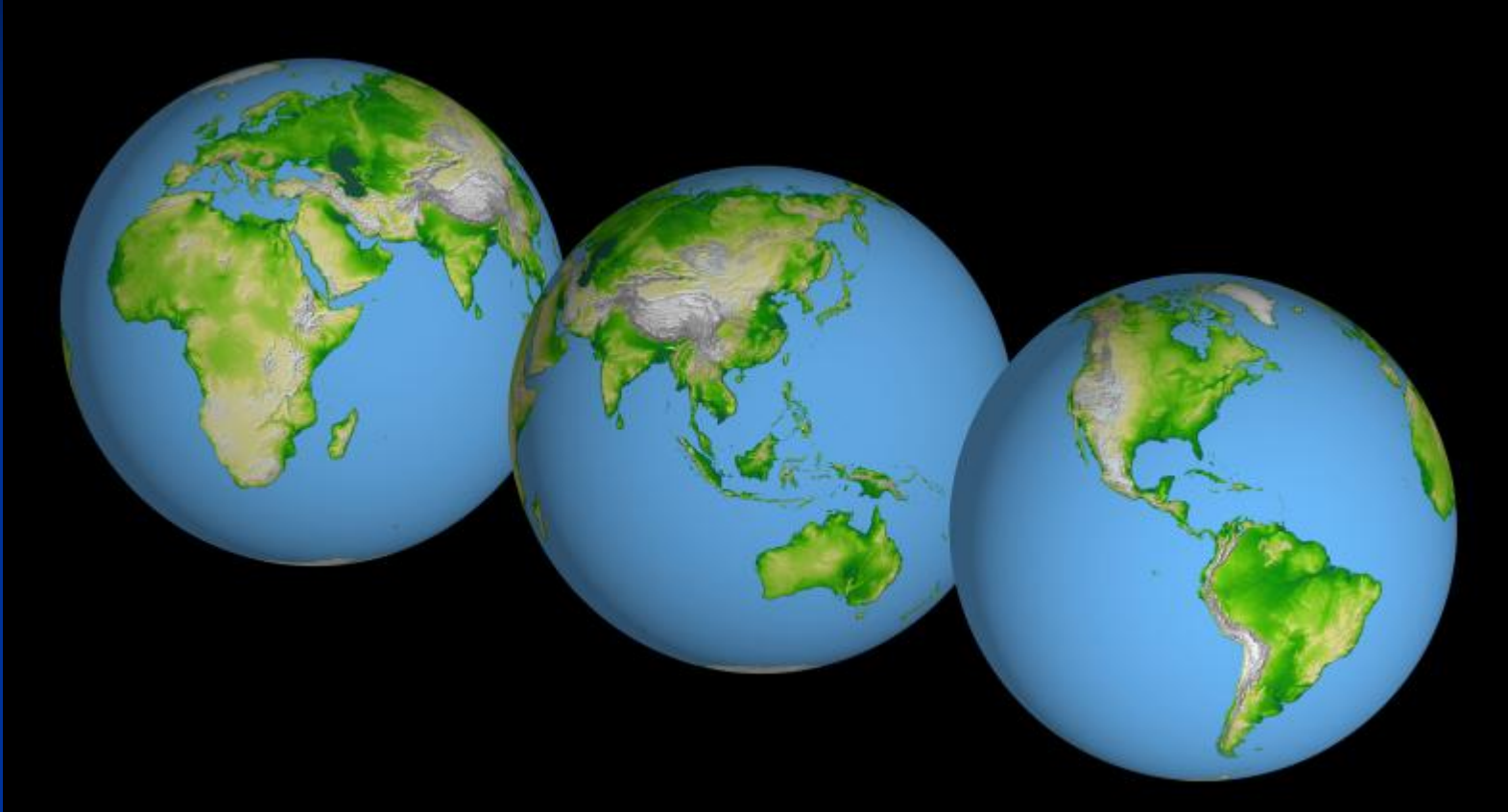
Director

Institute for Terrestrial and Planetary Atmospheres

School of Marine and Atmospheric Sciences

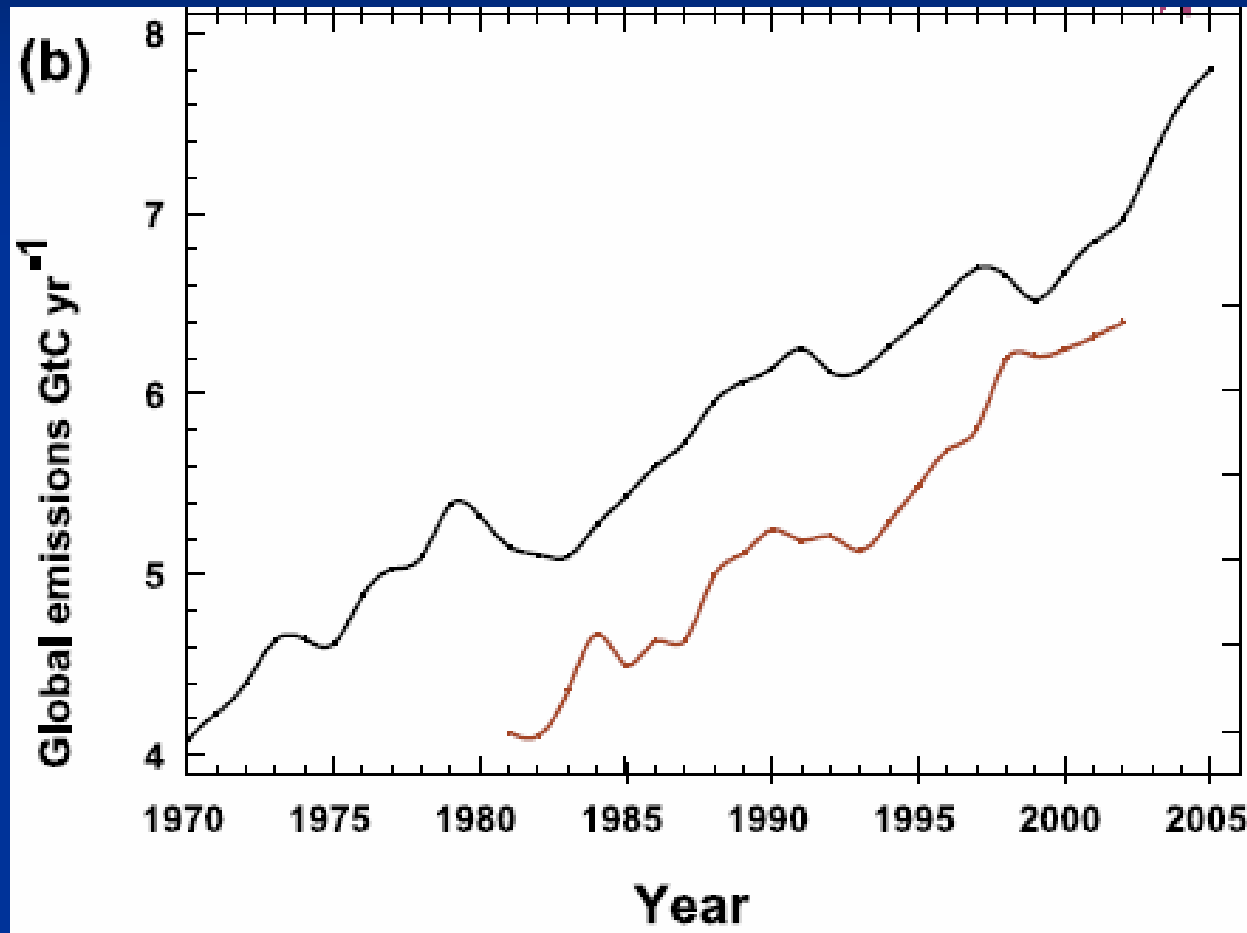
Stony Brook University

<http://atmsci.msrc.sunysb.edu>



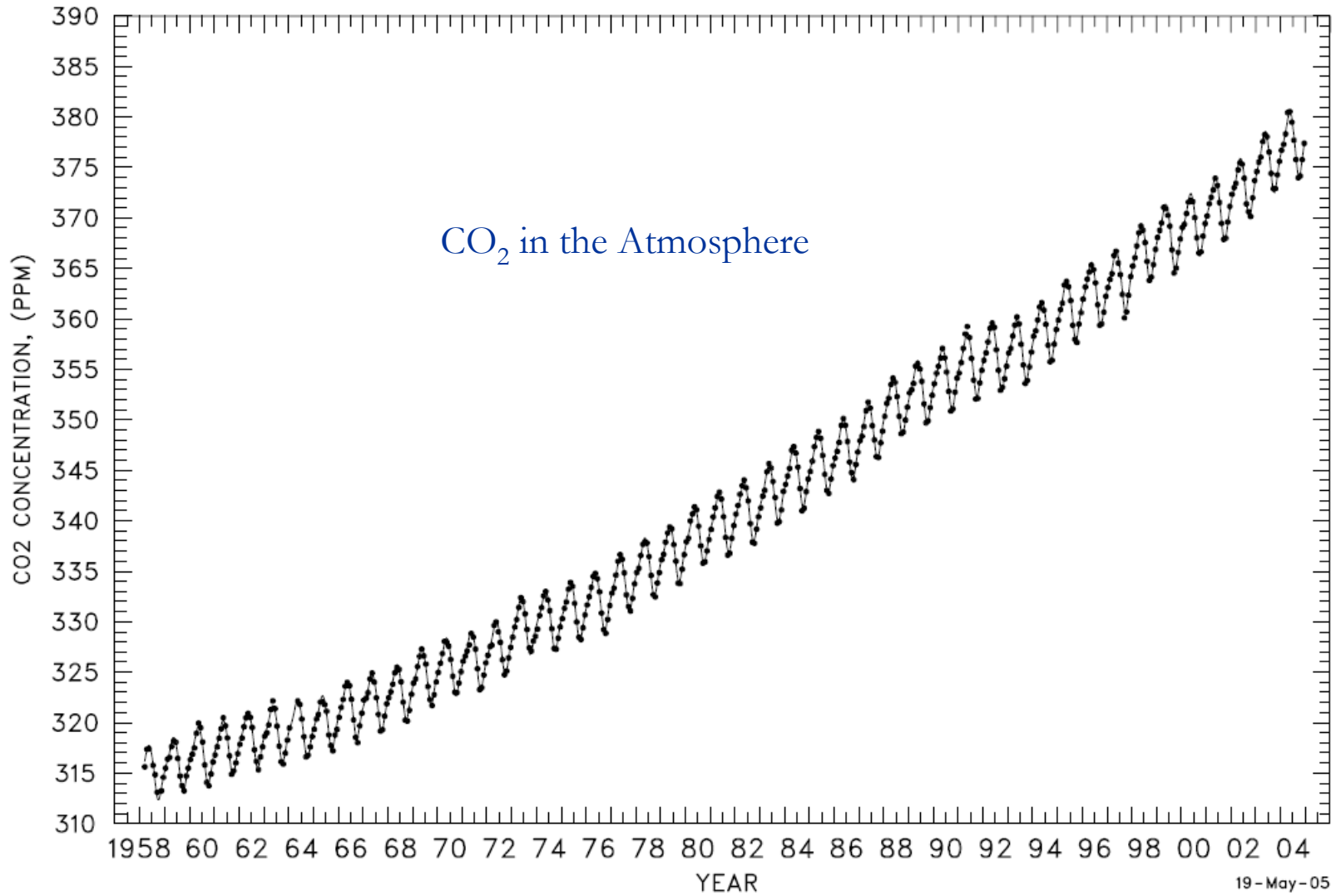


Annual CO₂ Emission from fossil fuel burning and cement production



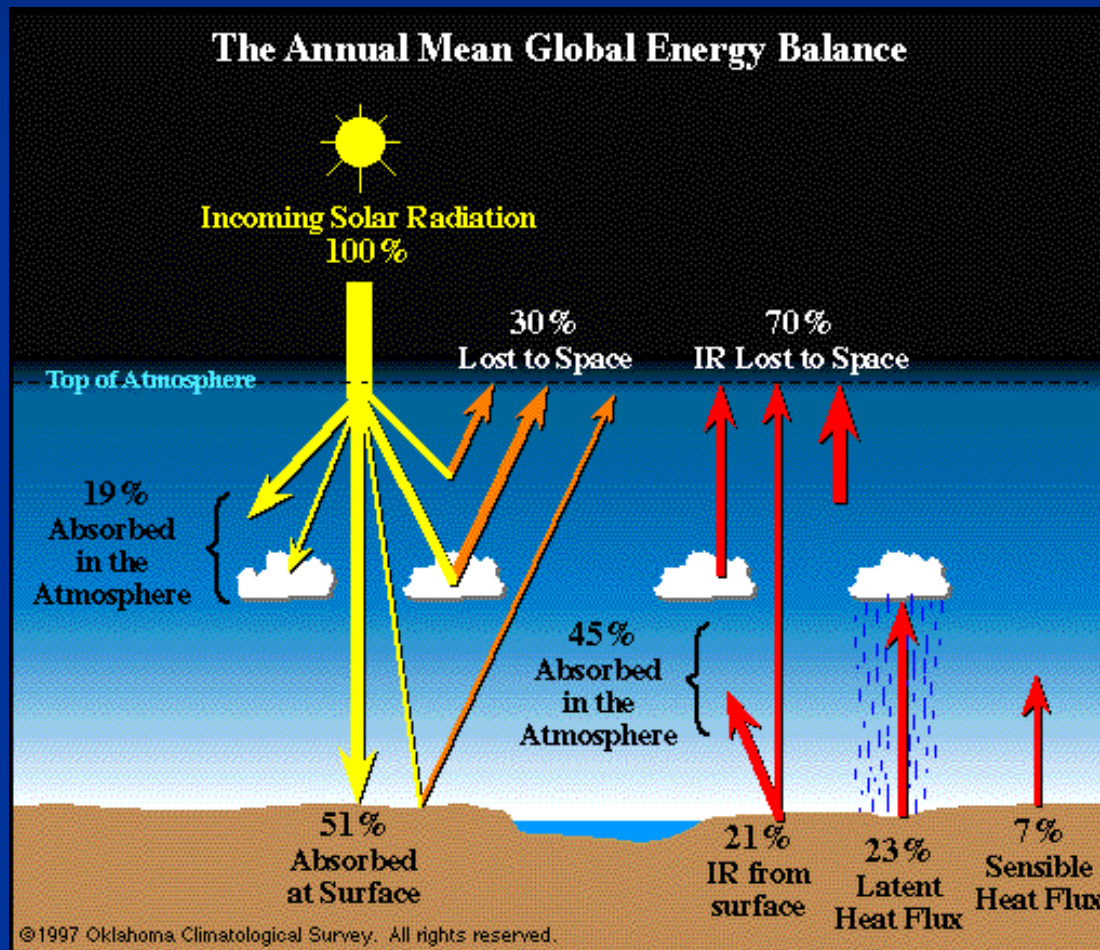
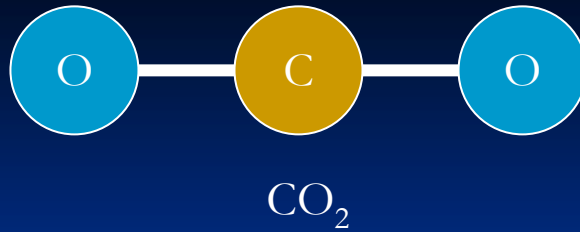
MAUNA LOA OBSERVATORY, HAWAII
MONTHLY AVERAGE CARBON DIOXIDE CONCENTRATION

MLO-145

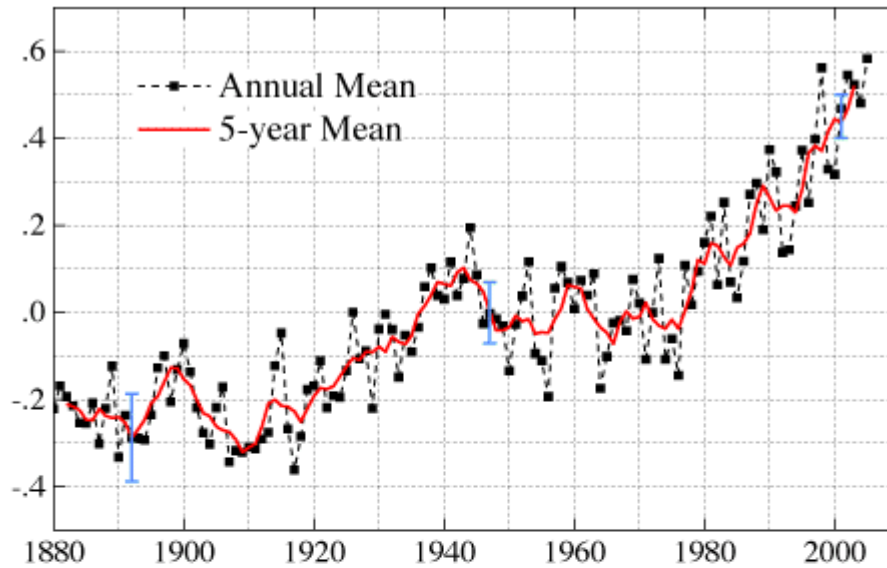


CO₂ in the Atmosphere

19-May-05



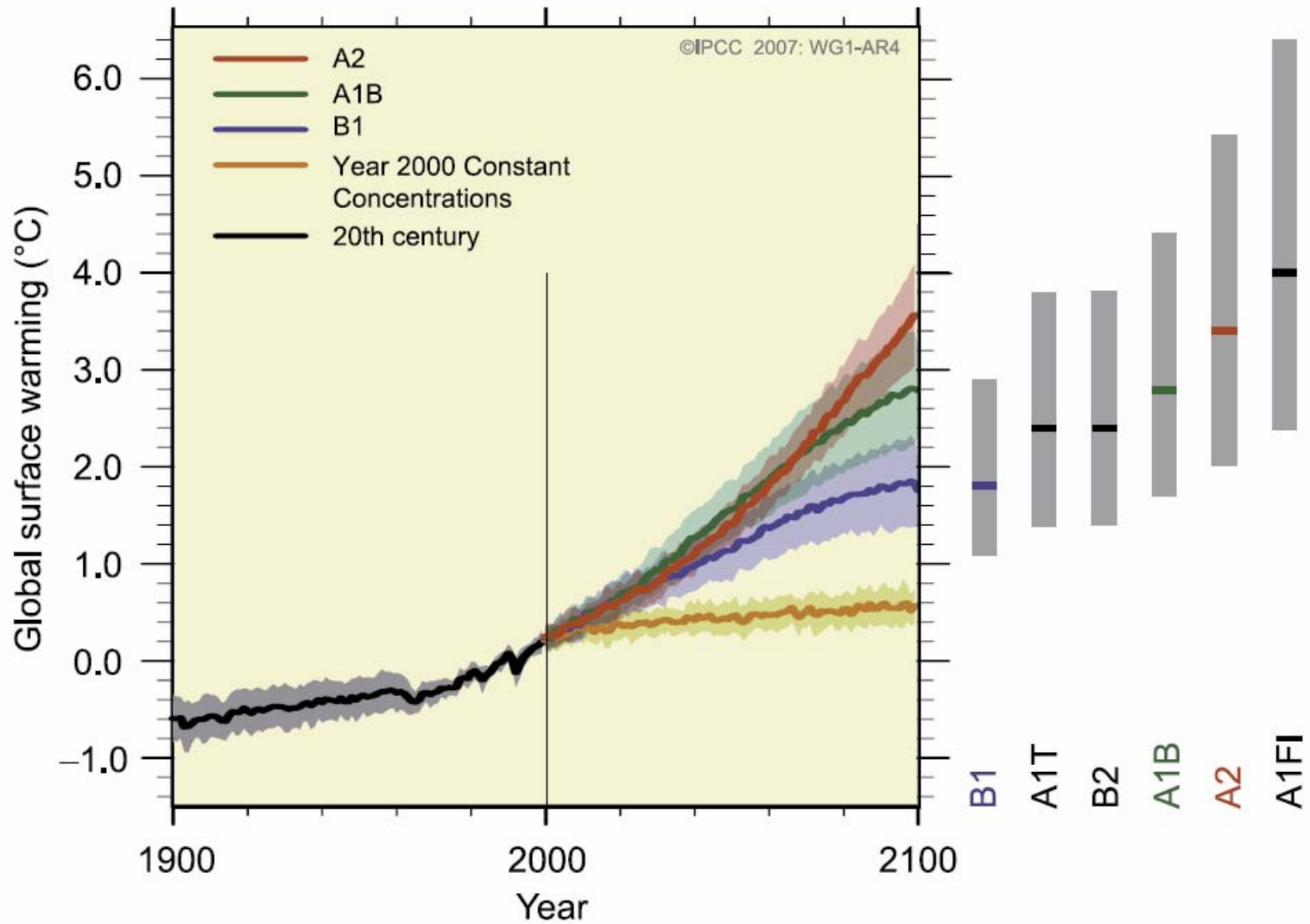
(a) Global-Mean Surface Temperature Anomaly ($^{\circ}\text{C}$)



IPCC 2007 Executive Summary:

Most of the observed increase in global average temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations.

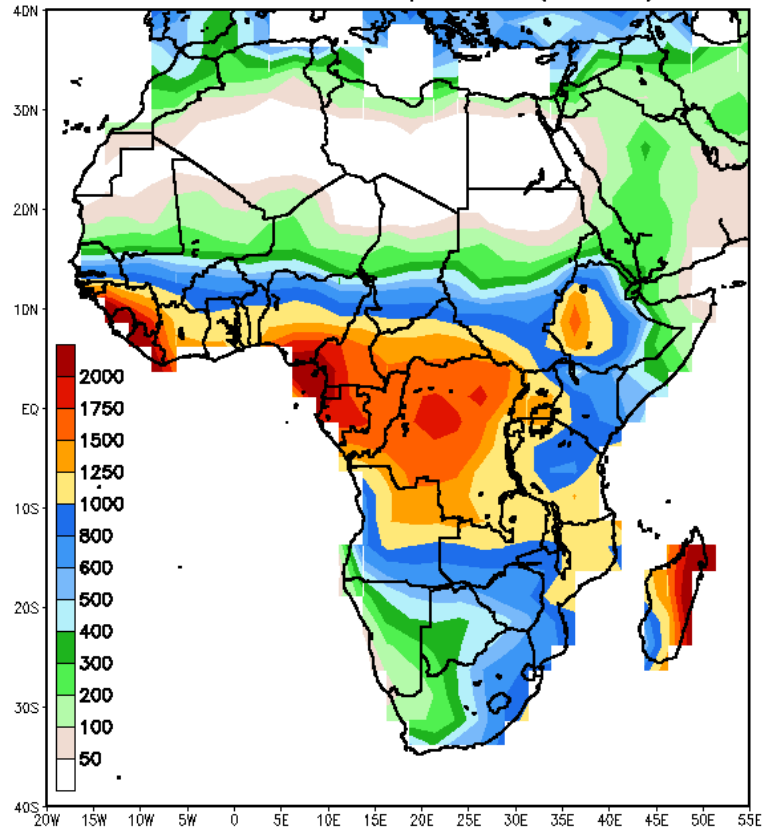
MULTI-MODEL AVERAGES AND ASSESSED RANGES FOR SURFACE WARMING

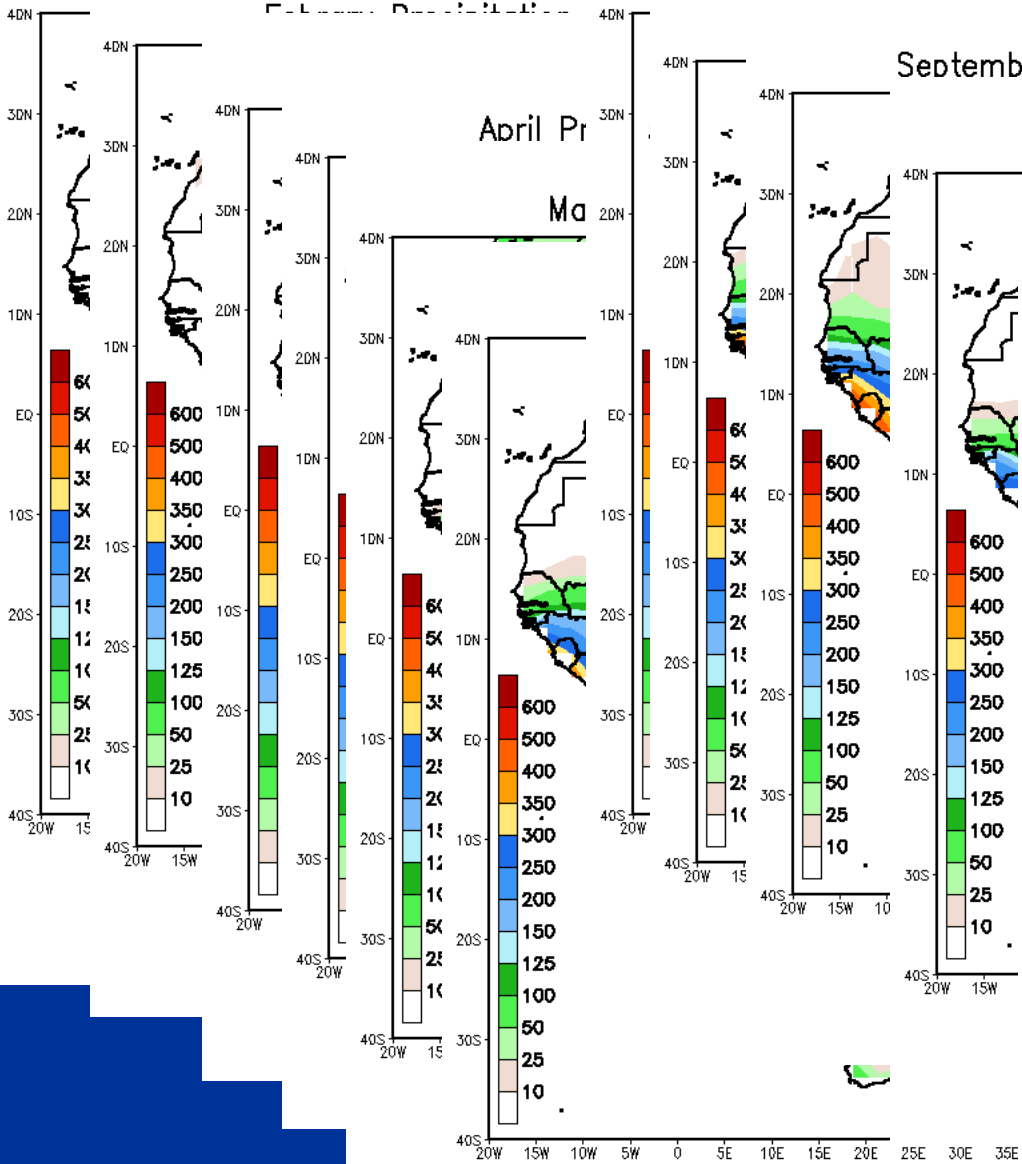




Rainfall Features

Annual Total Precipitation (in mm)



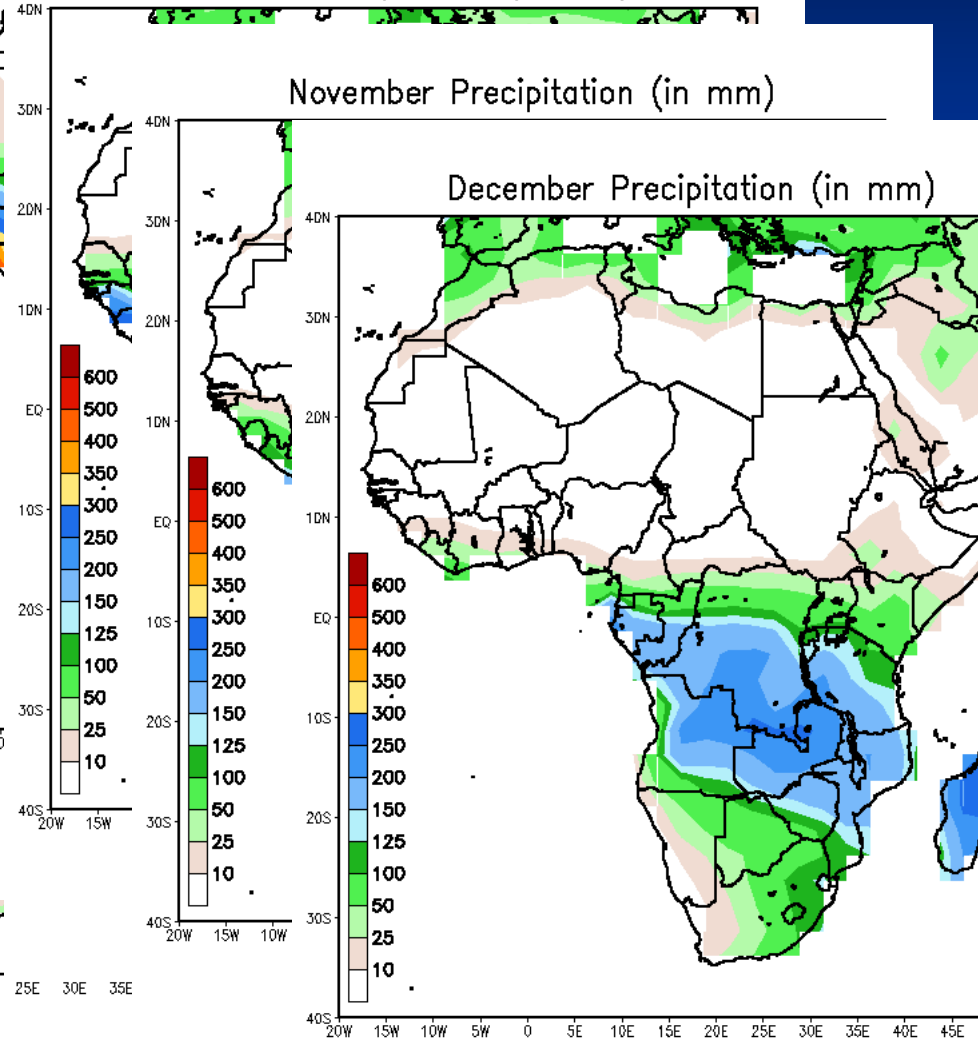


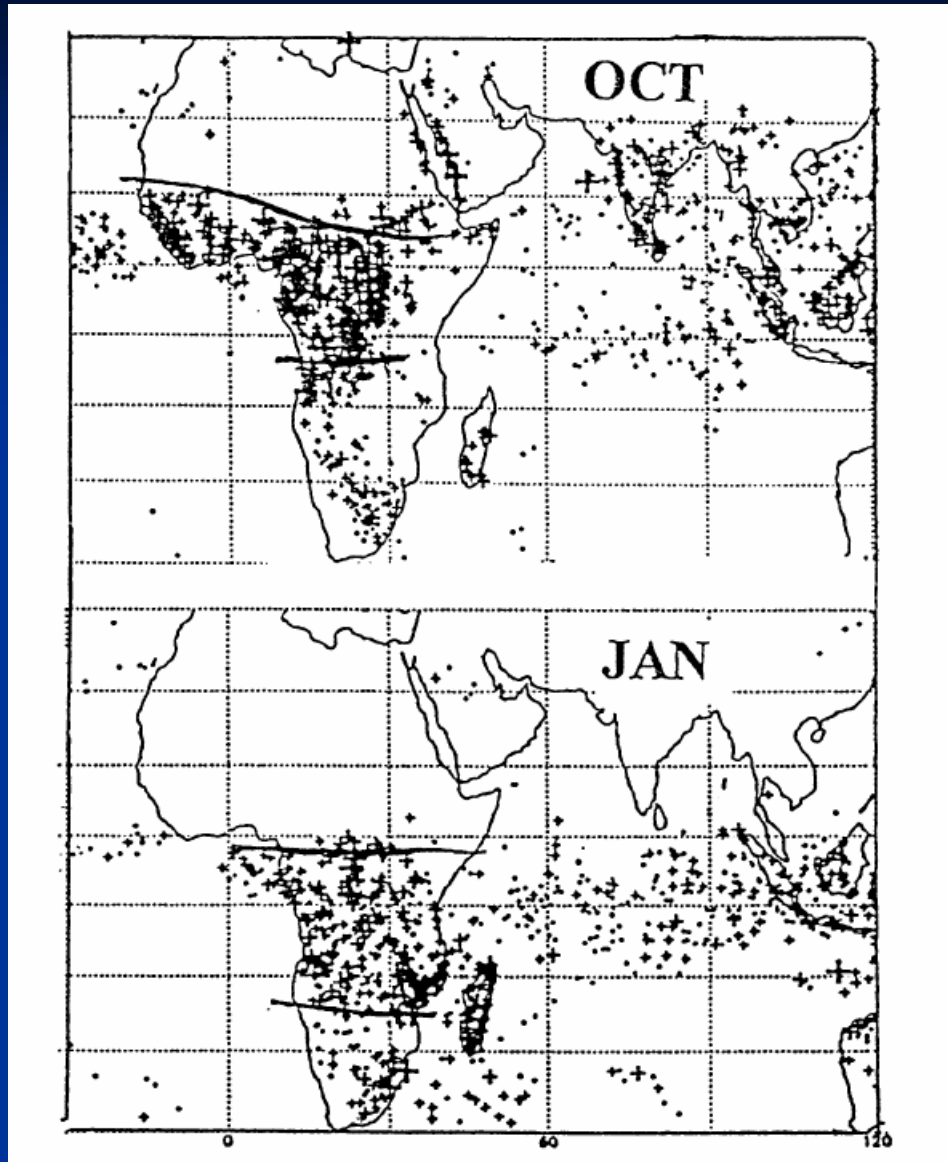
September Precipitation (in mm)

October Precipitation (in mm)

November Precipitation (in mm)

December Precipitation (in mm)

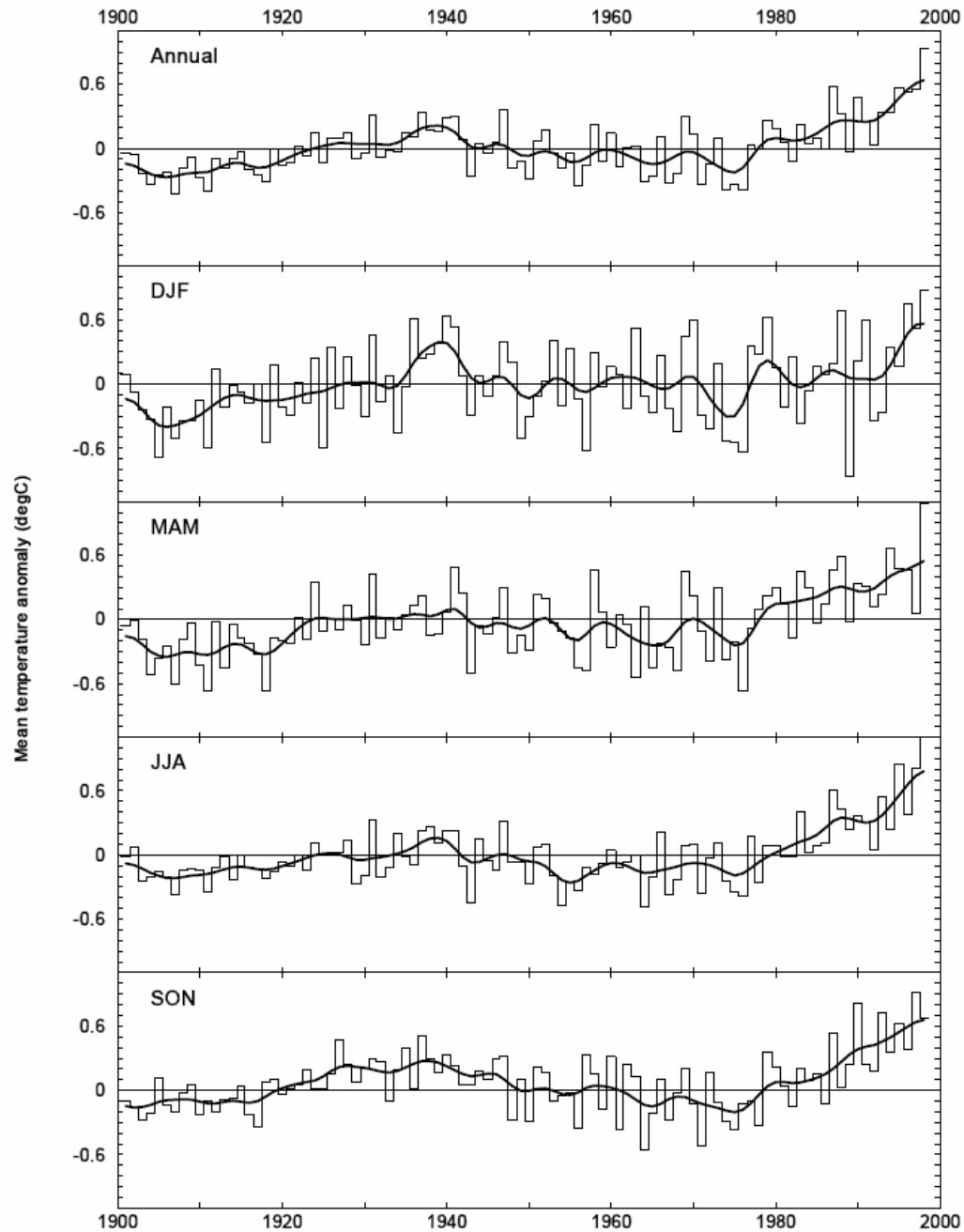




(Nicholson and Grist 2003)

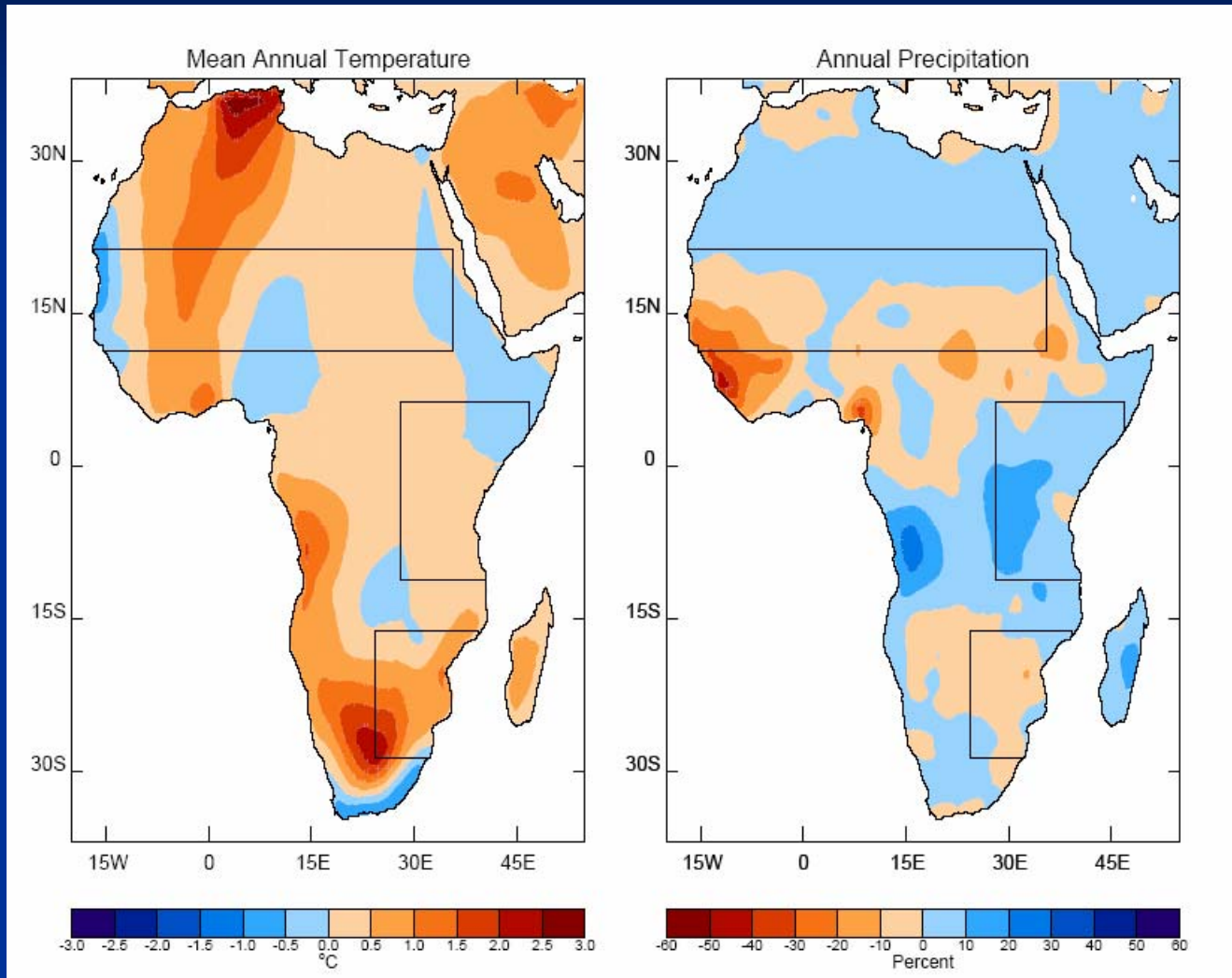
Changes in the Last Century

Continent Average Temperature

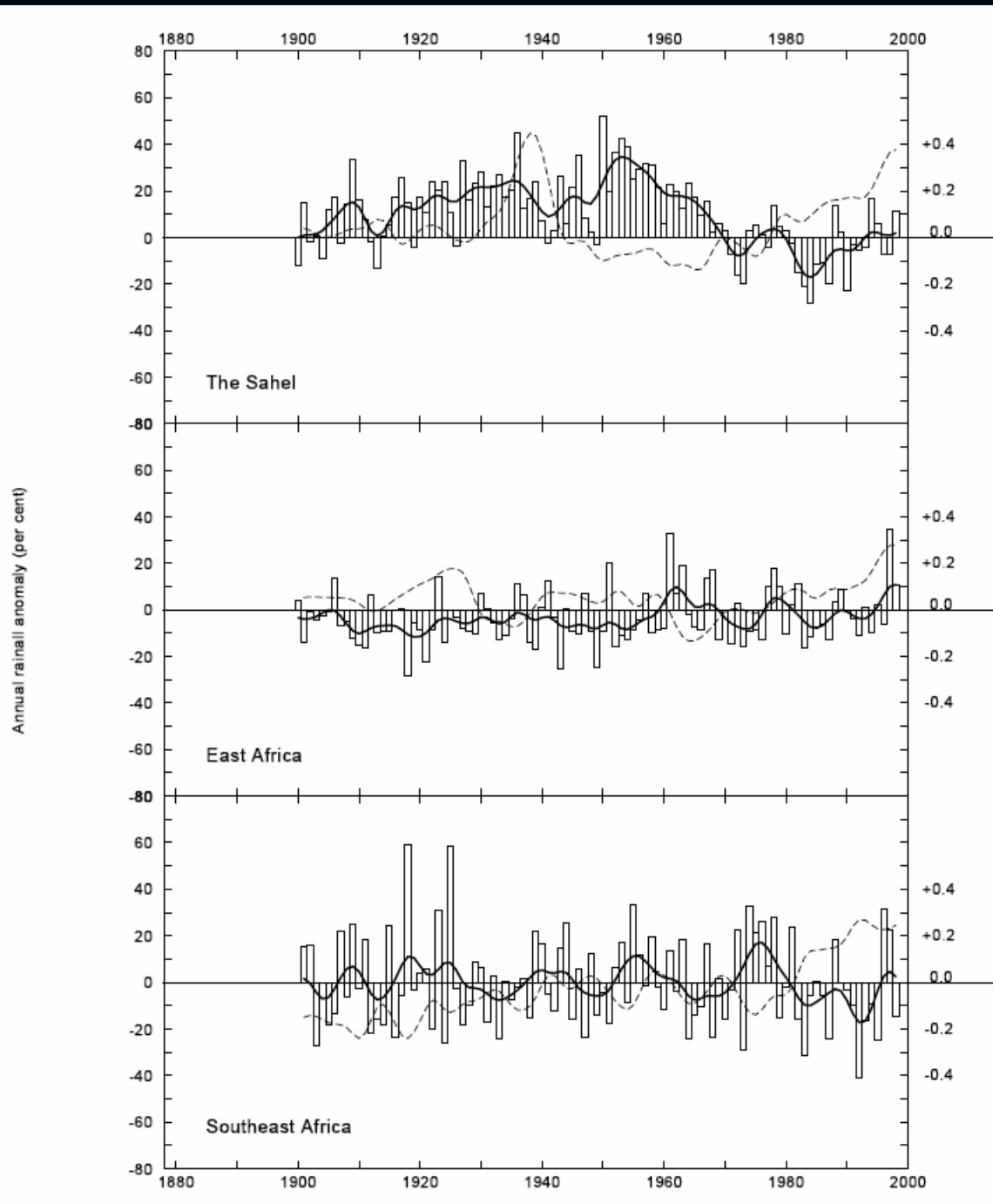


(Hulme et al. 2003)

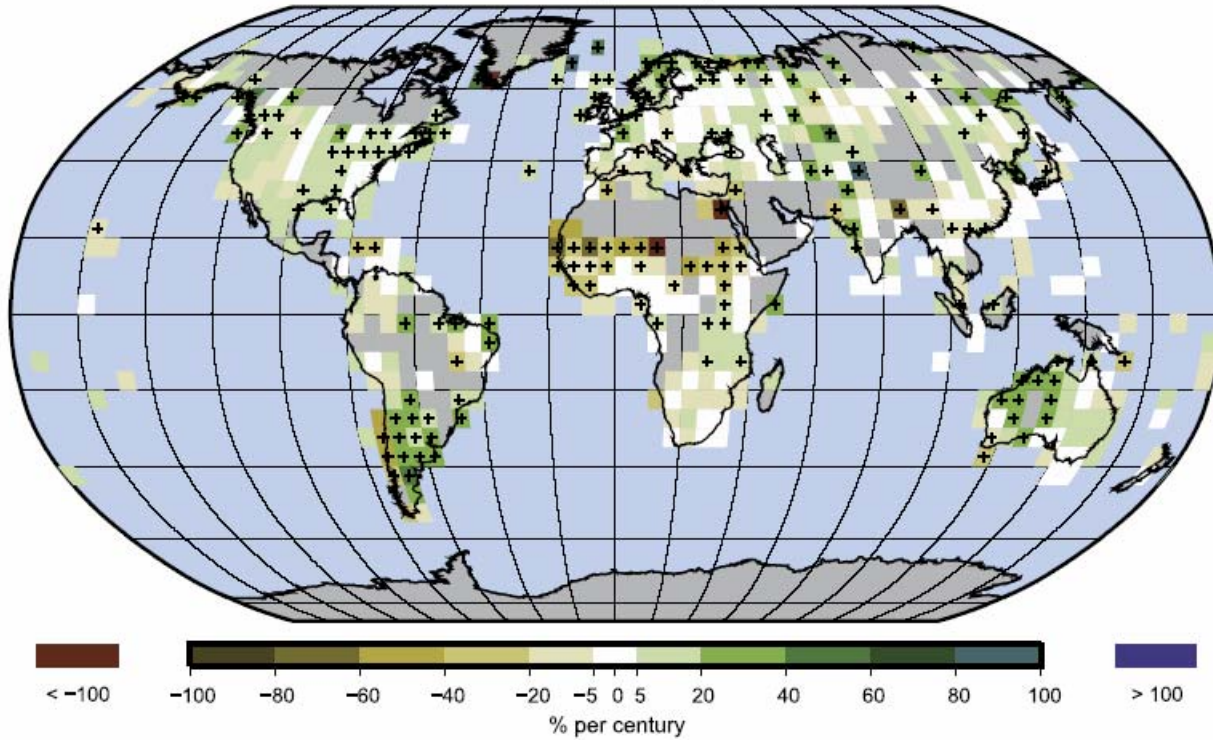
Temperature and Precipitation Change Since 1900



Temperature Precipitation Change Since 1900



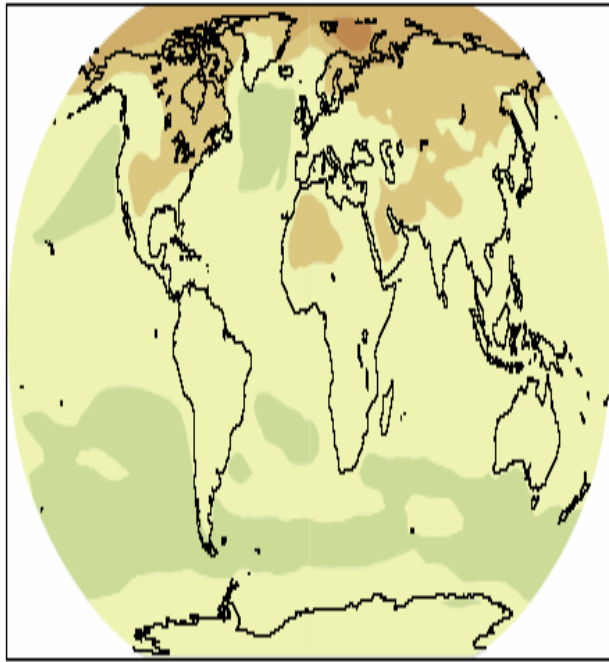
Trend in Annual Precipitation, 1901 to 2005



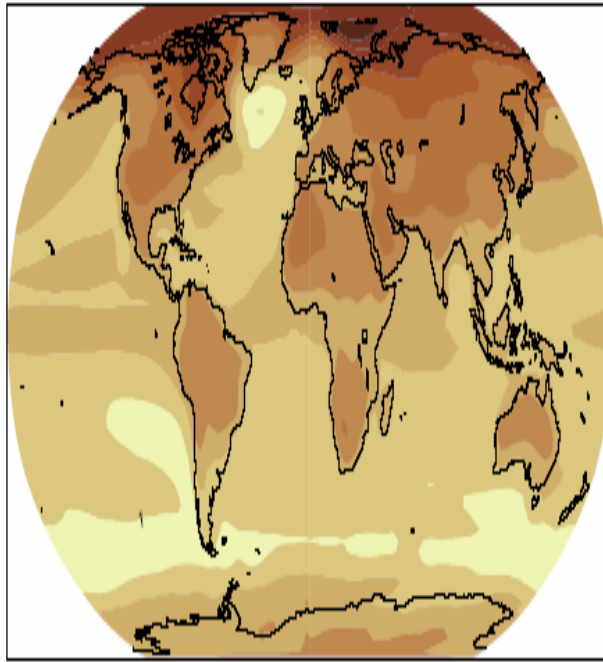
Projection for the Future

Projected Temperature Change

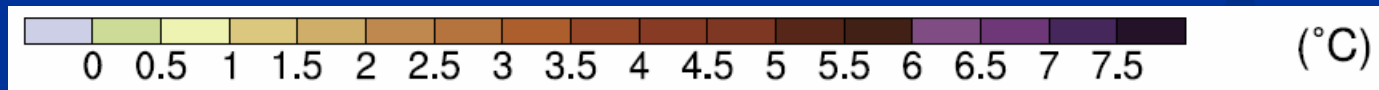
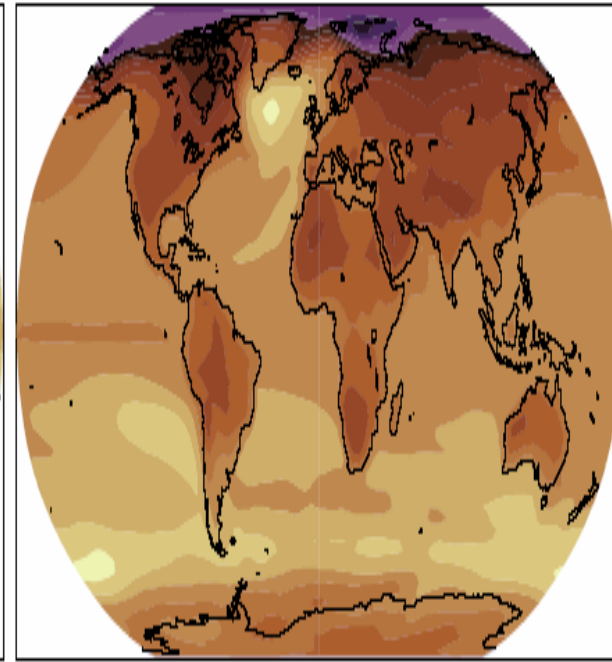
A1B: 2011-2030



A1B: 2046-2065



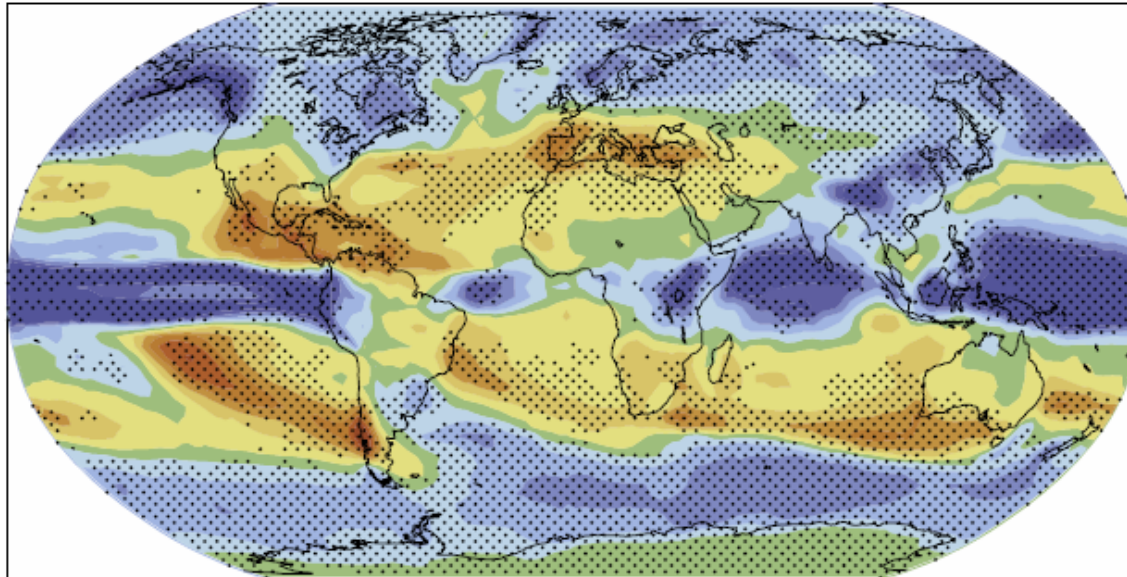
A1B: 2080-2099



(IPCC 2007)

Projected Precipitation Change for Years 2080-2099

a) Precipitation

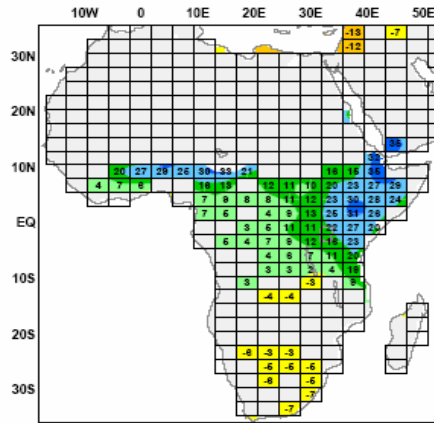


Seasonal Dependence of Rainfall Change

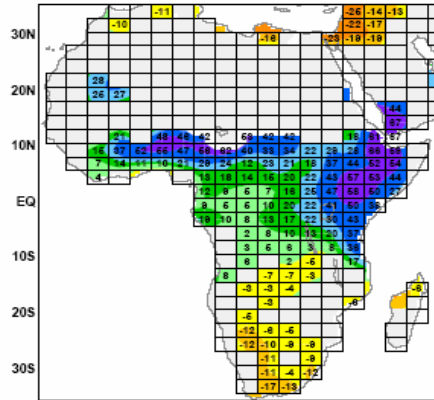
Projected Precipitation Change

(DJF)

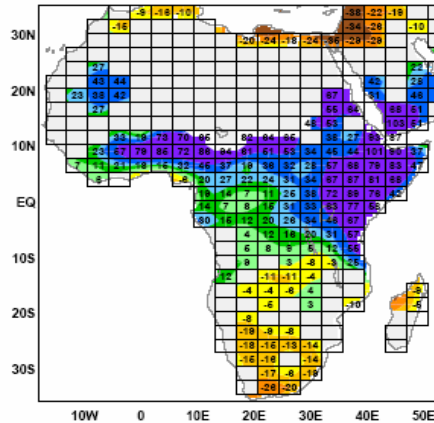
2020s



2050s

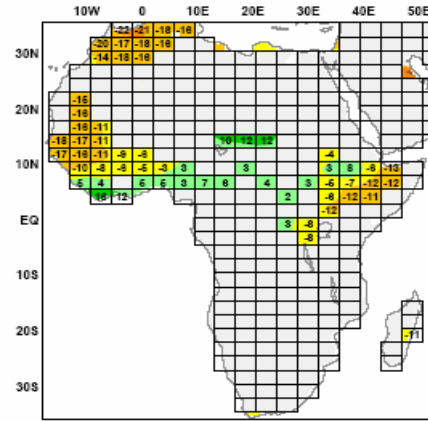


2080s

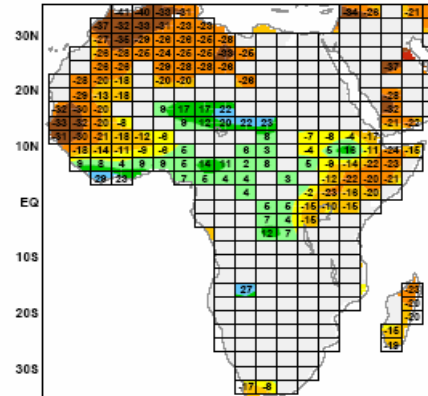


(JJA)

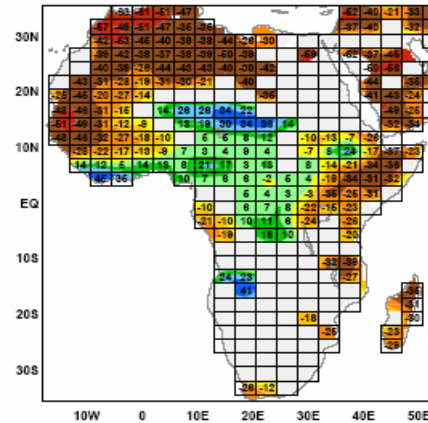
2020s



2050s

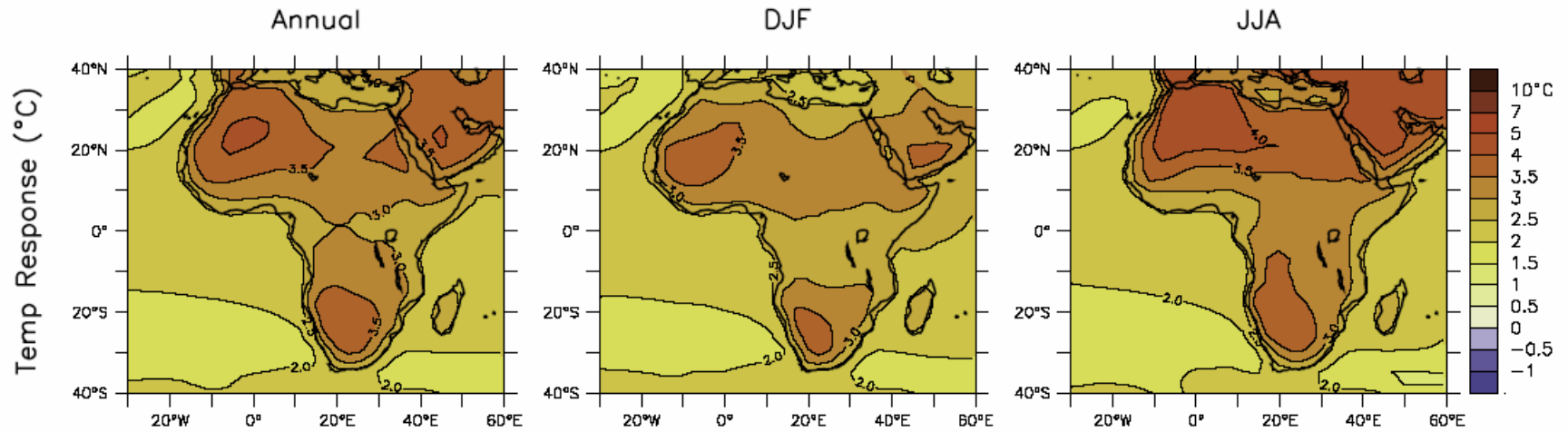


2080s



(Hulme et al. 2007)

Projected Temperature Change for Years 2080-2099



(IPCC 2007)

The Message

1. Past Changes

Dominated by interannual and decadal variations

2. Future Changes:

Wet season wetter

Dry season drier

Warmer all seasons