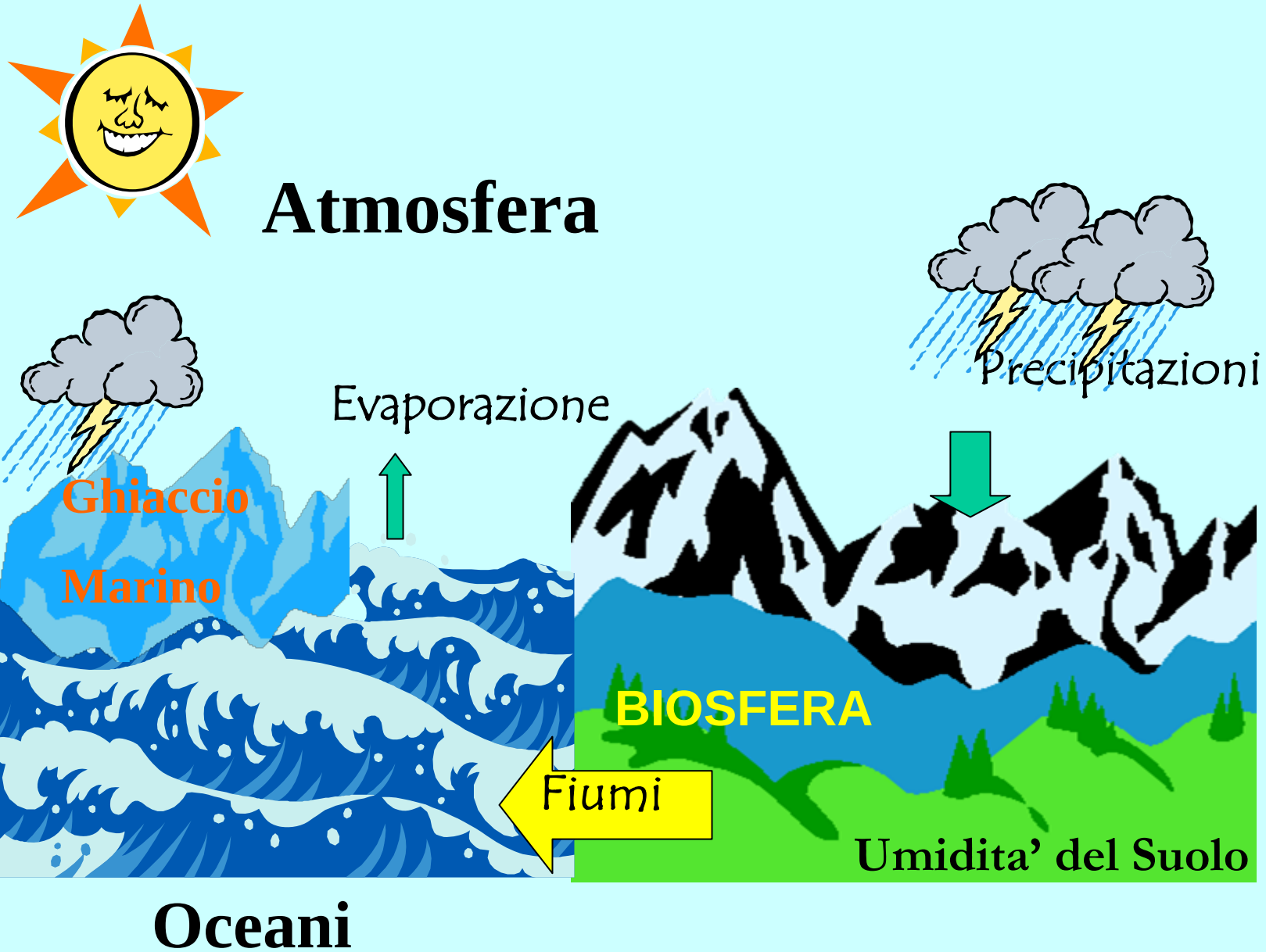
A Global Challenge

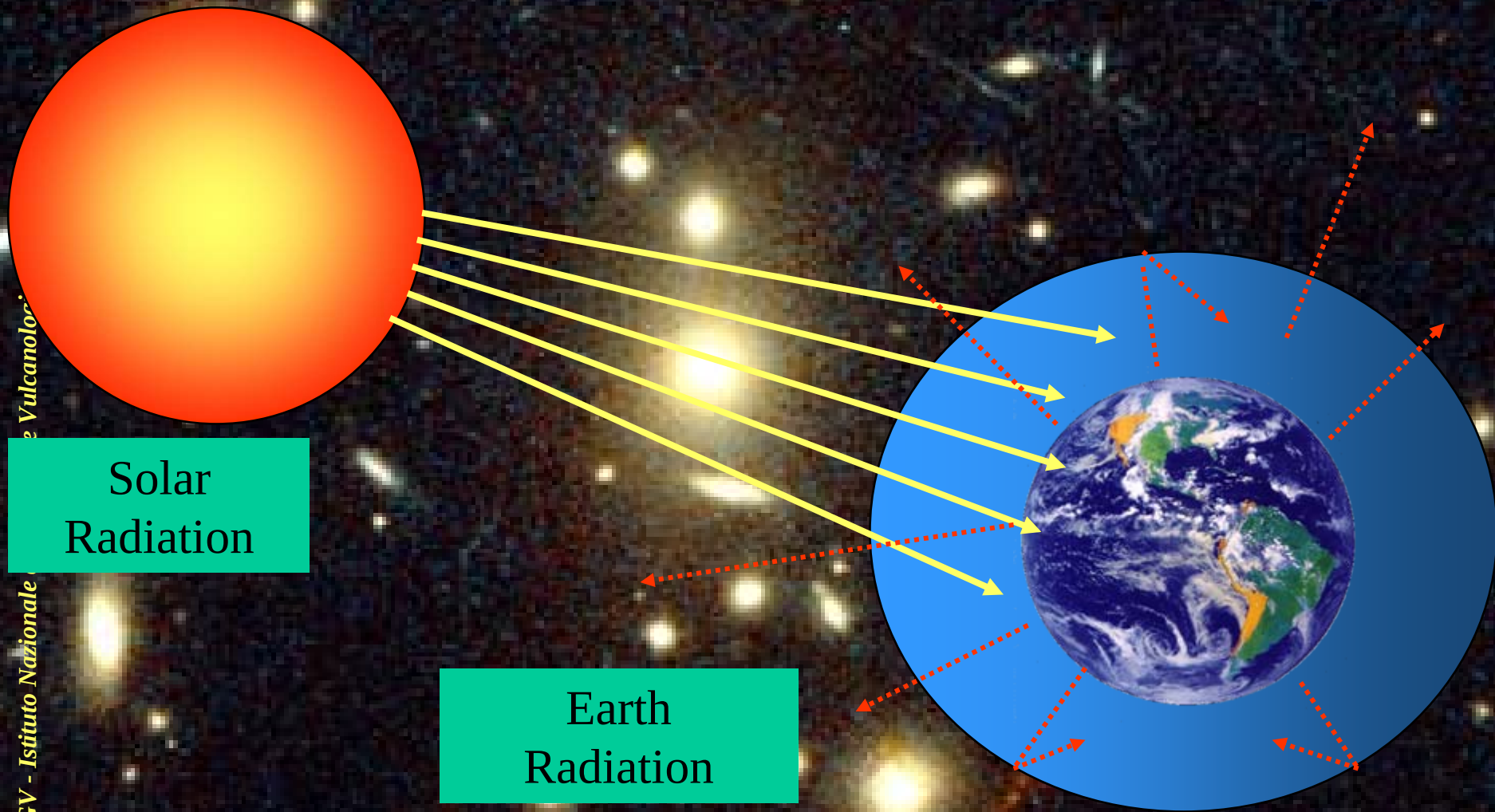
Antonio Navarra
INGV
Centro EuroMediterraneo
per i cambiamenti climatici

INGV= Istituto Nazionale di Geofisica e Vulcanologia - Italy

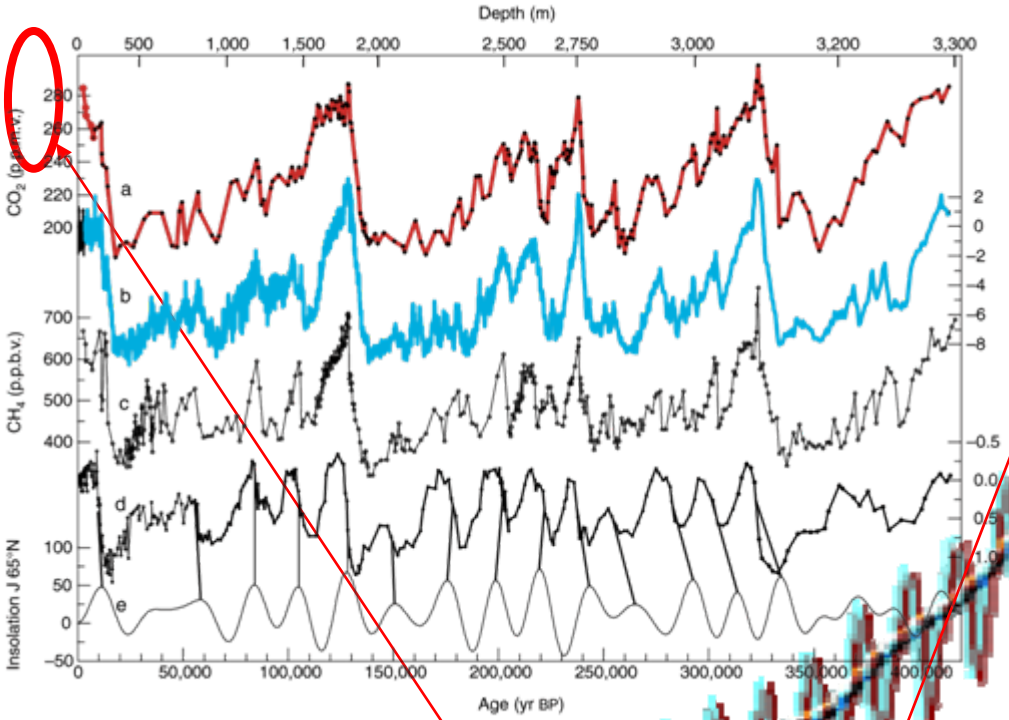
Il Sistema Clima



The Climate Machine



Carbon dioxide



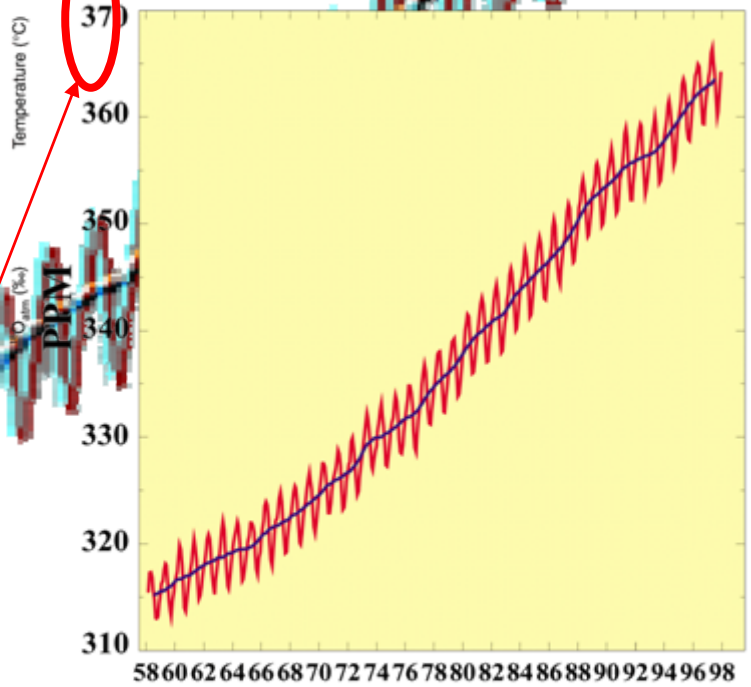
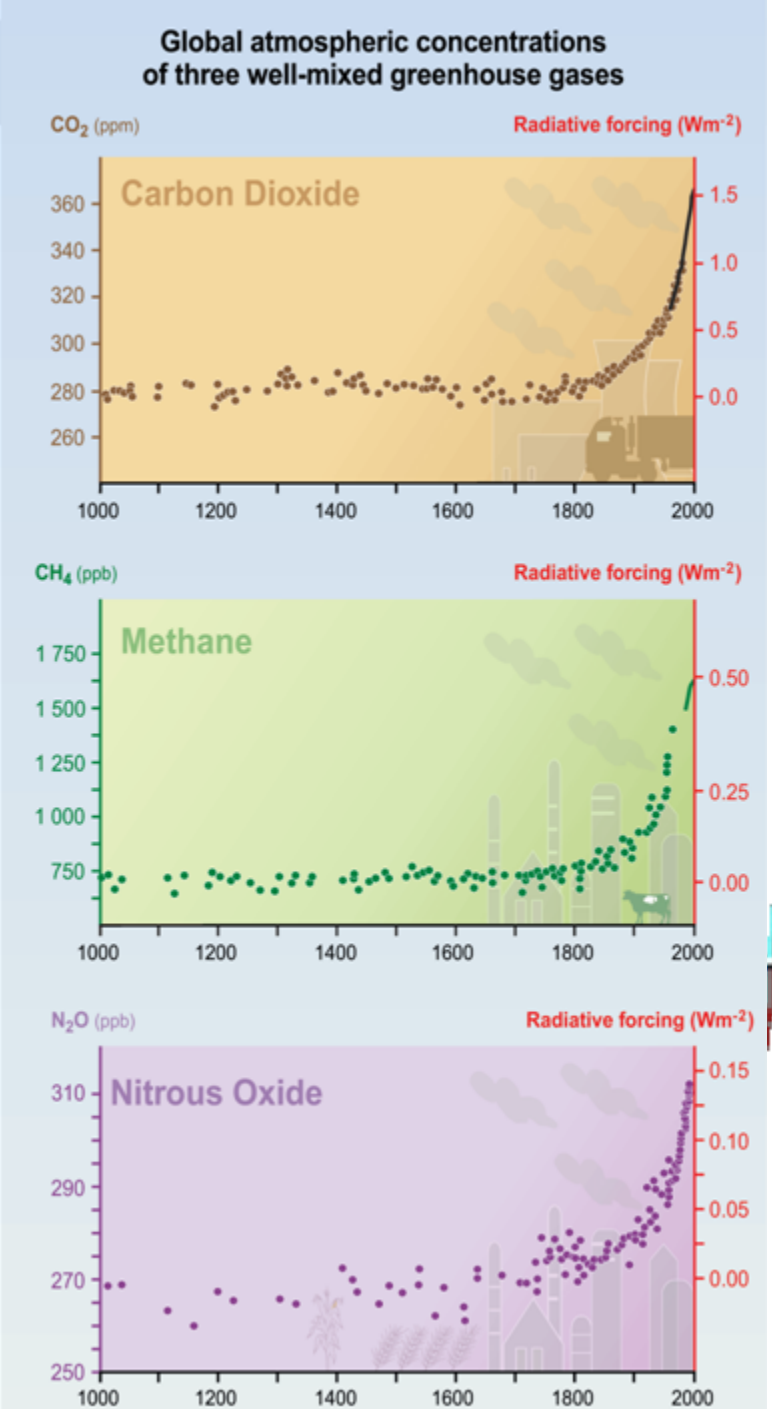
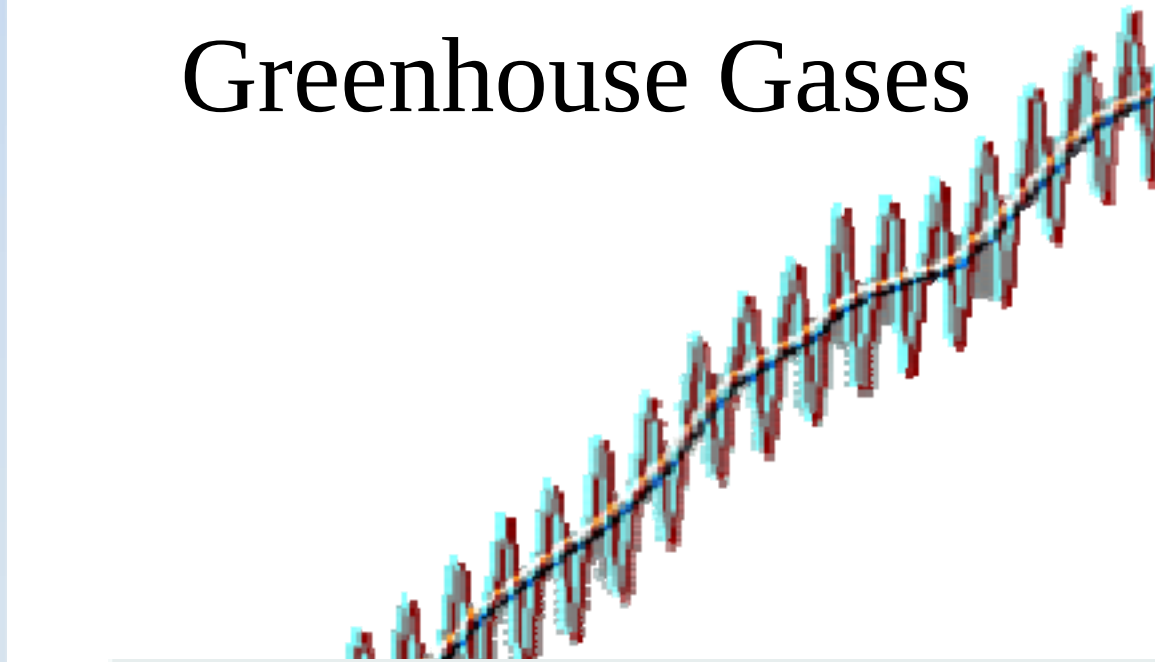


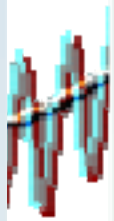
FIG. 17. Monthly mean carbon dioxide concentrations (red curve, ppm) measured at Mauna Loa, HI. Blue line is the 12-month running mean. The data through 1973 are from C. D. Keeling at Scripps Institute of Oceanography. [Analysis provided by CMDL.]

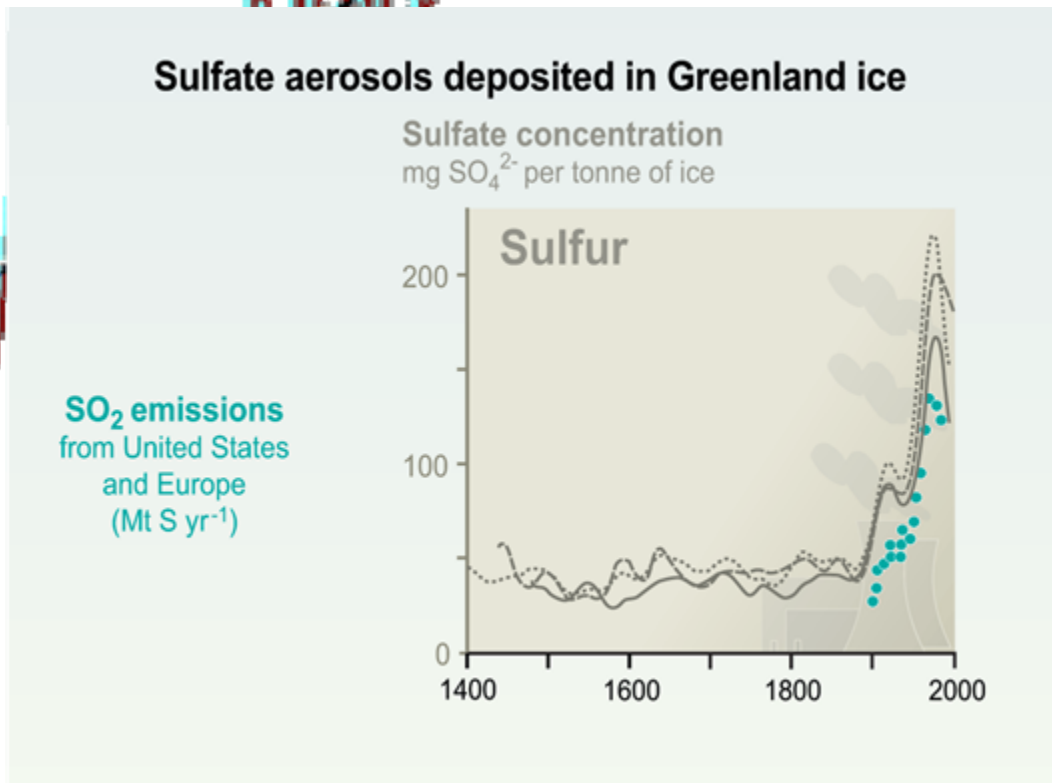
Valori massimi di anidride carbonica

Greenhouse Gases

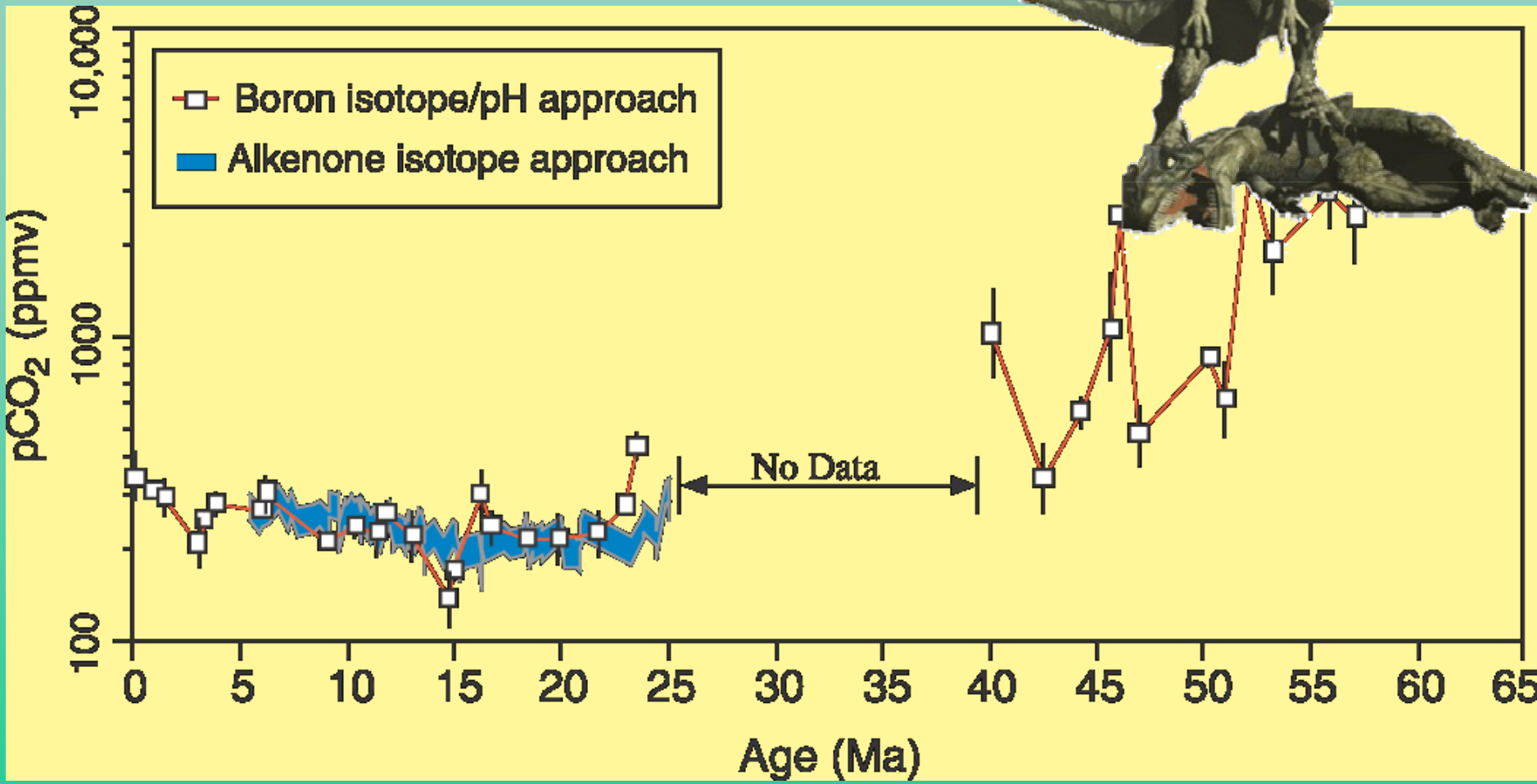








History of Carbon Dioxide



Global Temperature

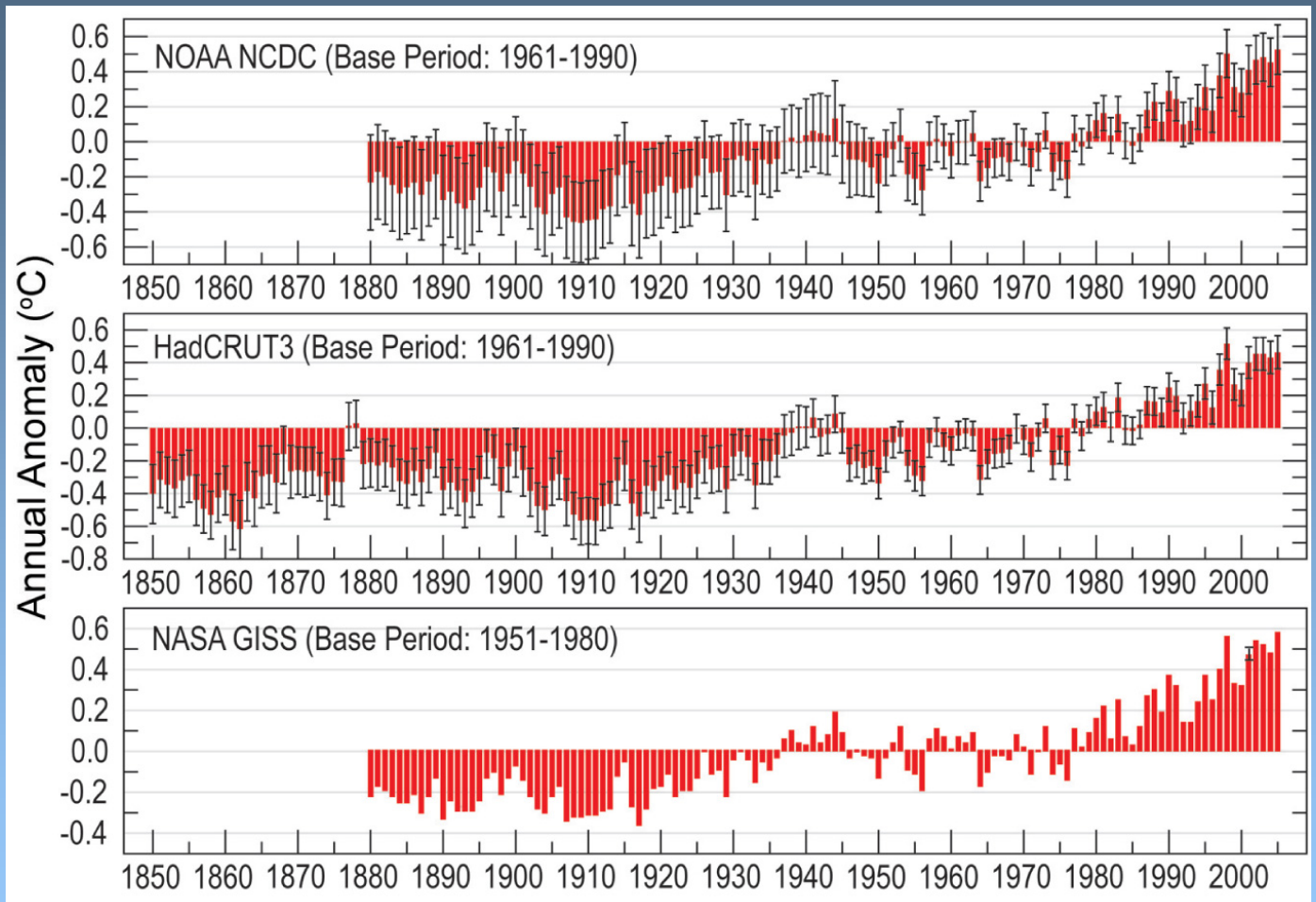
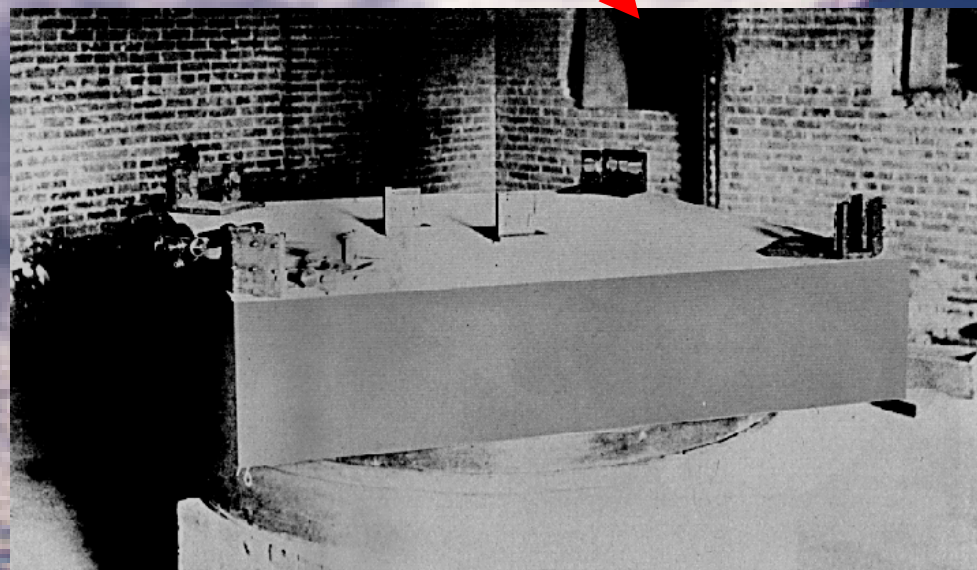


FIG. 2.1. Global annual surface temperature departures (°C) from the 1961 to 1990 average. The 95% confidence limits for the annual global estimates are shown (black error bars). [Sources: NOAA/NCDC; The Hadley Centre for Climate Prediction and Research and the Climate Research Unit of the University of East Anglia; and NASA GISS]

A scientific consideration of climate (I)

Crucial experiments like the famous experiment of Michelson e Morley are not possible in climate science

How is it possible a scientific investigation of climate ?



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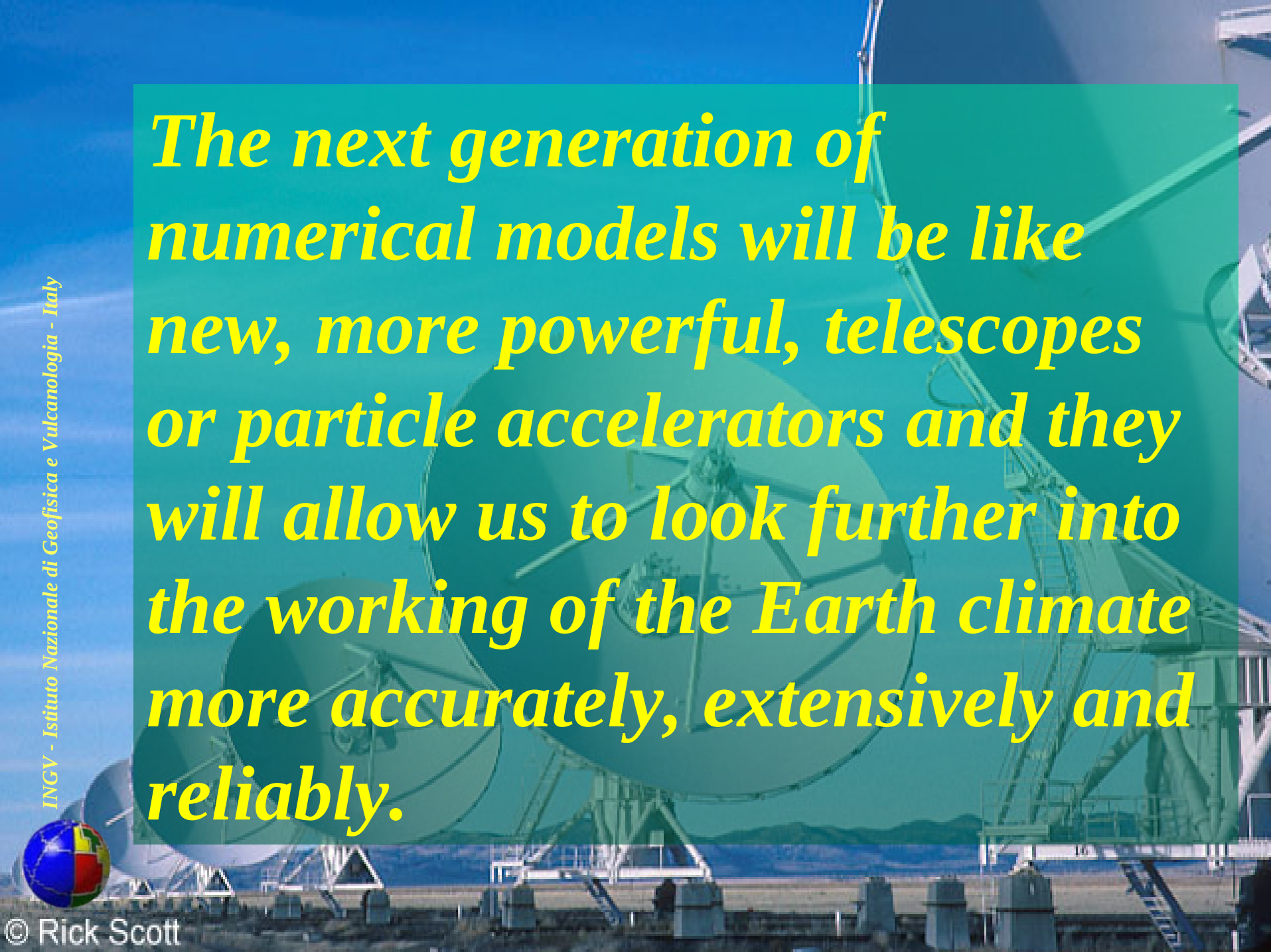
A scientific consideration of climate (II)

We can male experiments if we represent the climate system via a set of mathematical relations: the equation of climate.

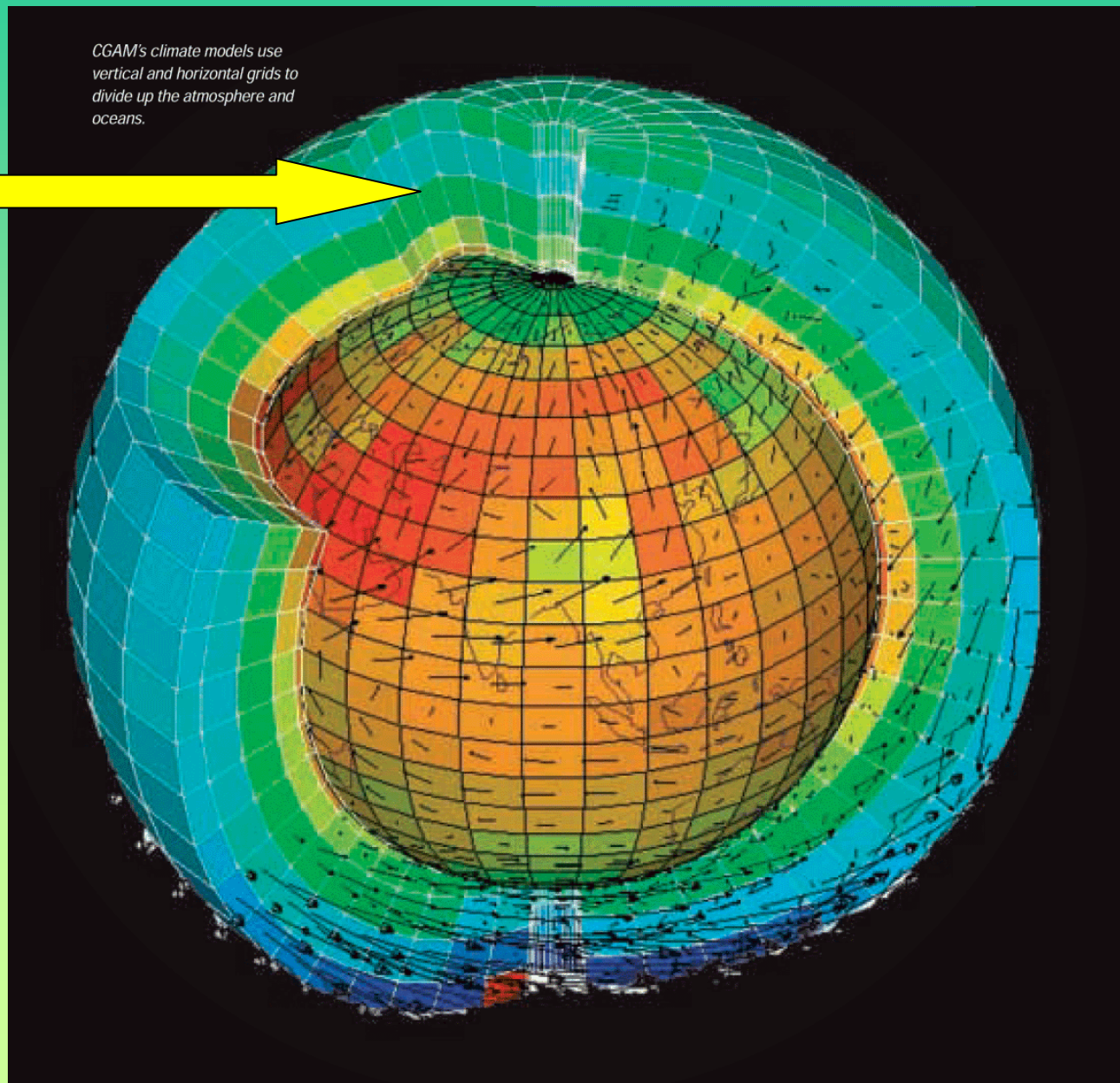
The equation of climate are very difficult, but they can be solved by numerical methods.

We can then treat very complex mathematical equations, paying the price of a enormous number of elementary operations.

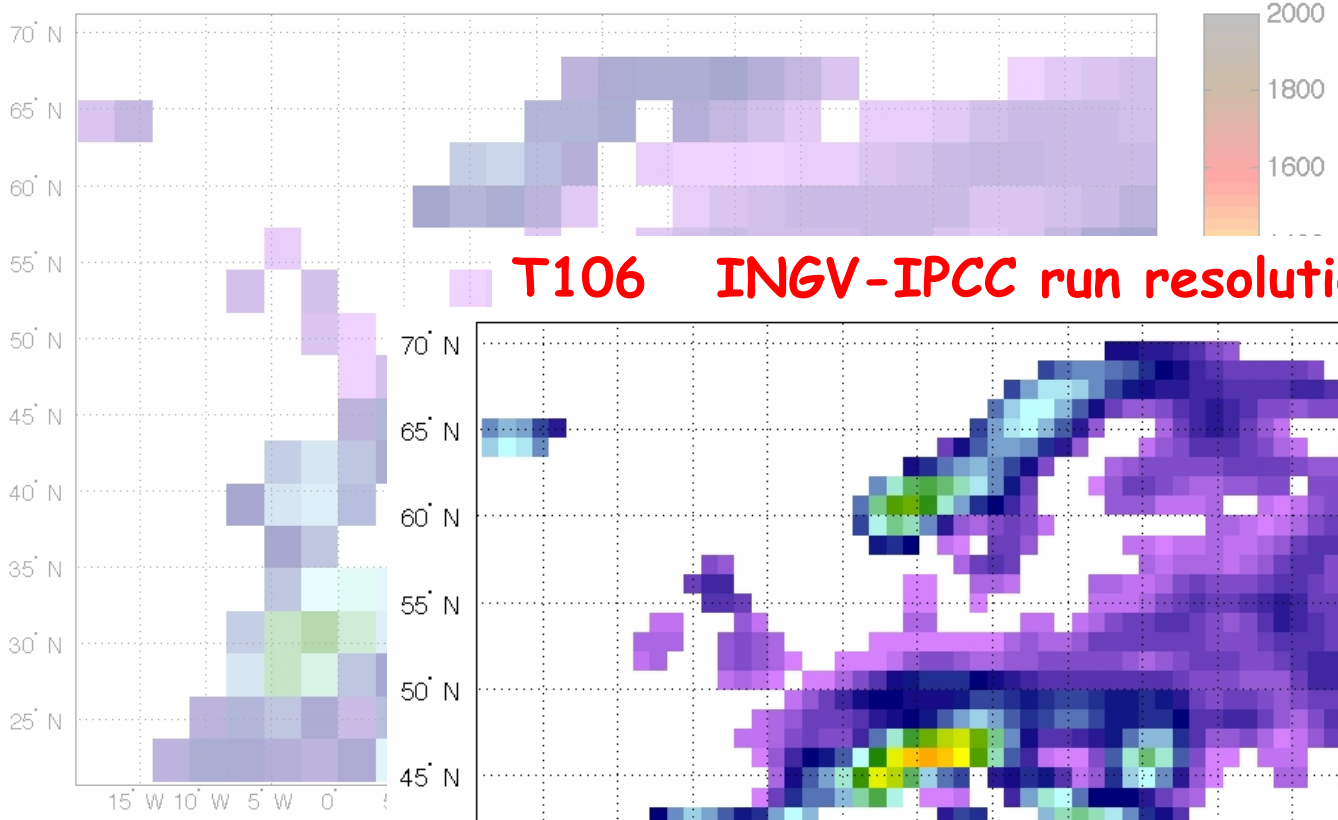


Grids for Earth

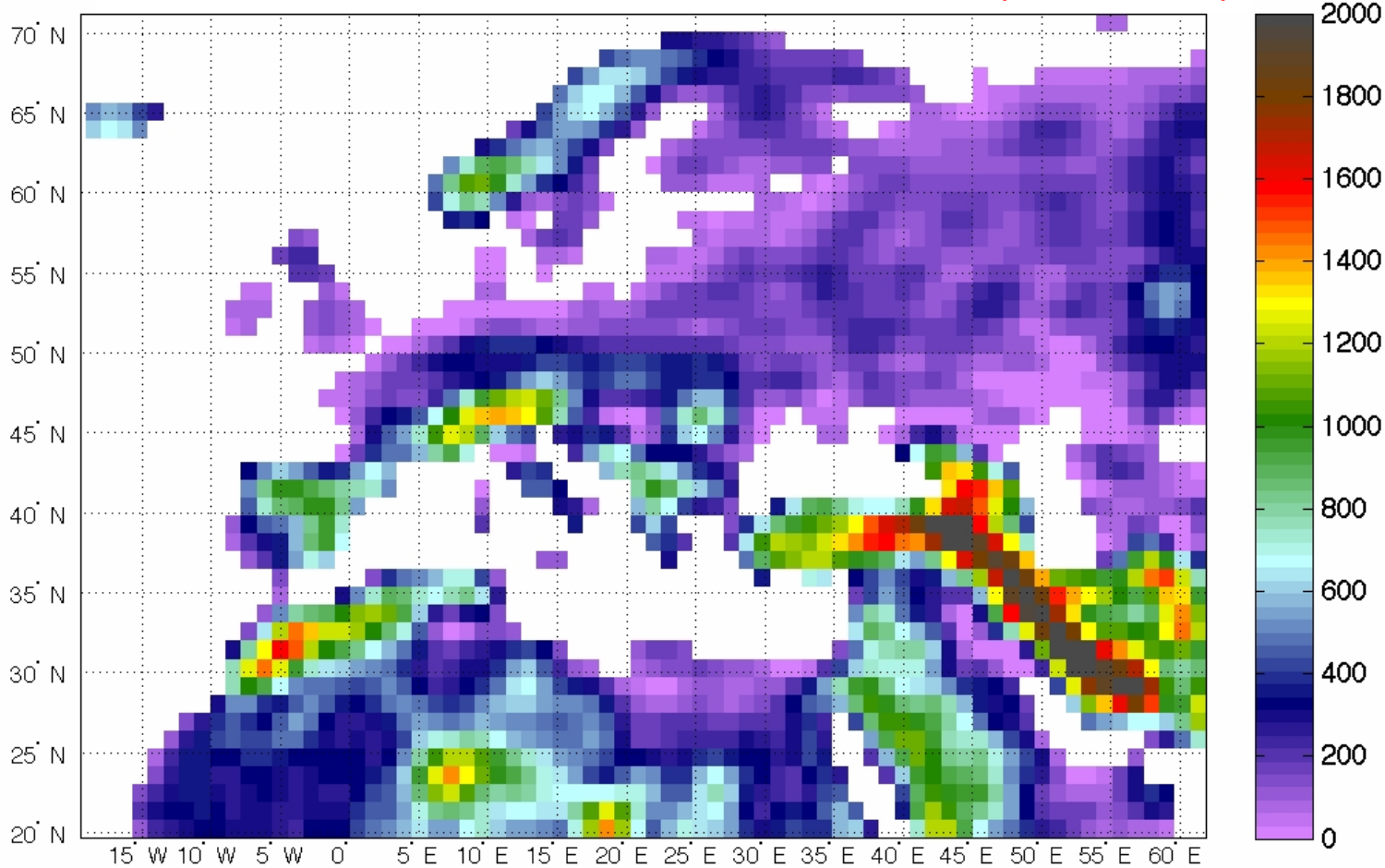
Sort of crowded at the pole



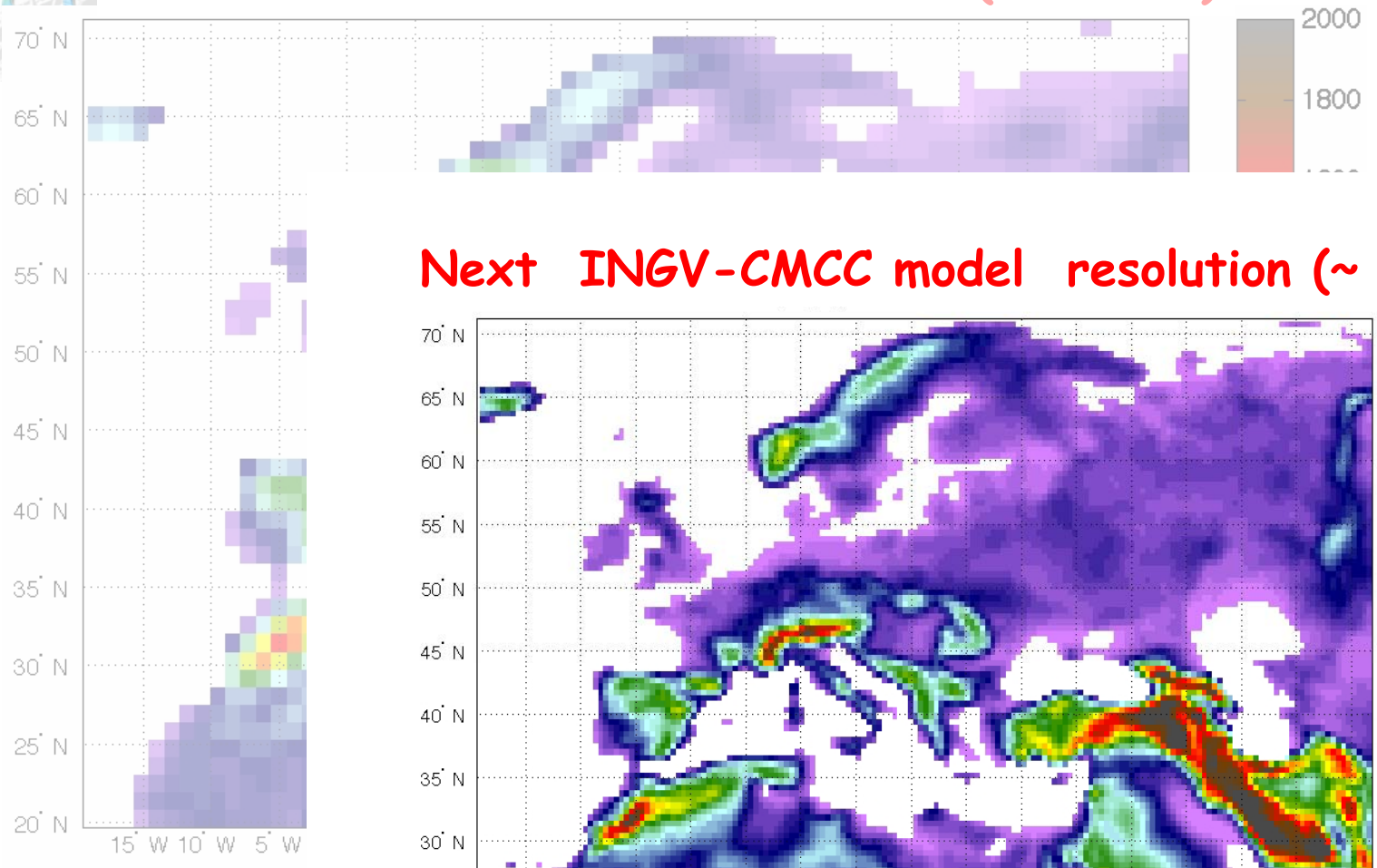
T42 IPCC standard resolution (~ 300Km)



T106 INGV-IPCC run resolution (~ 120Km)

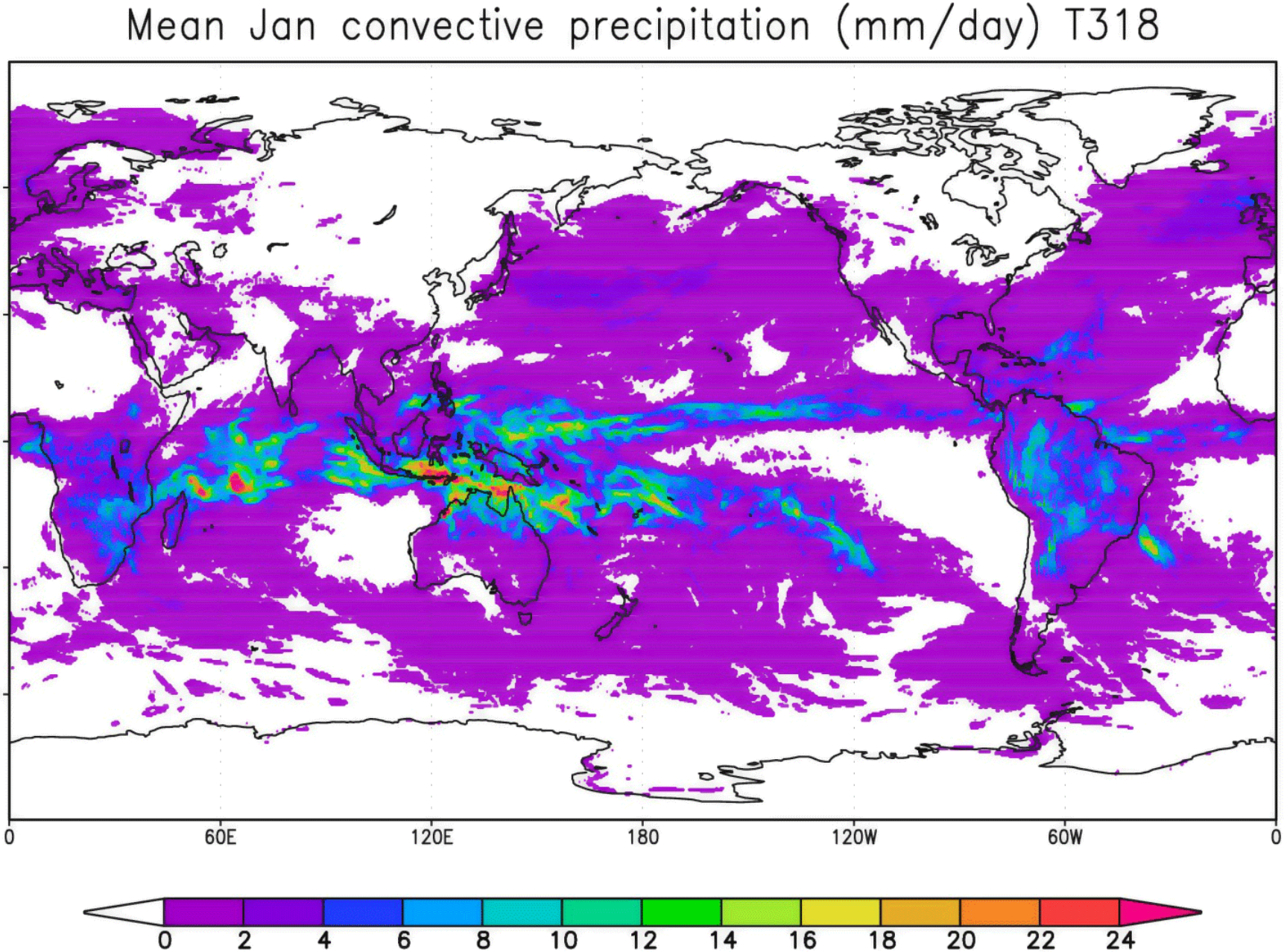


T106 INGV-IPCC run resolution (~ 120Km)



Next INGV-CMCC model resolution (~ 60Km)

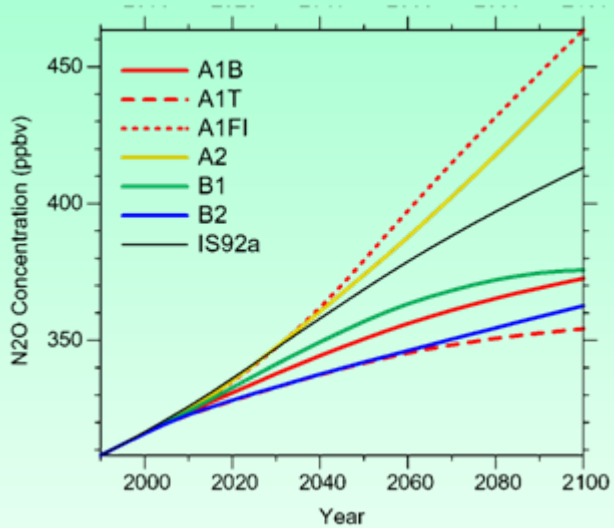
Mean JAN Precipitation Global 30km Resolution



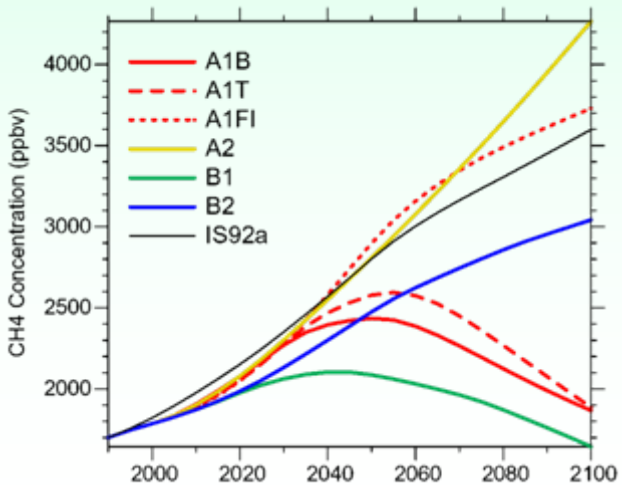
Scenarios

CO2

N2O

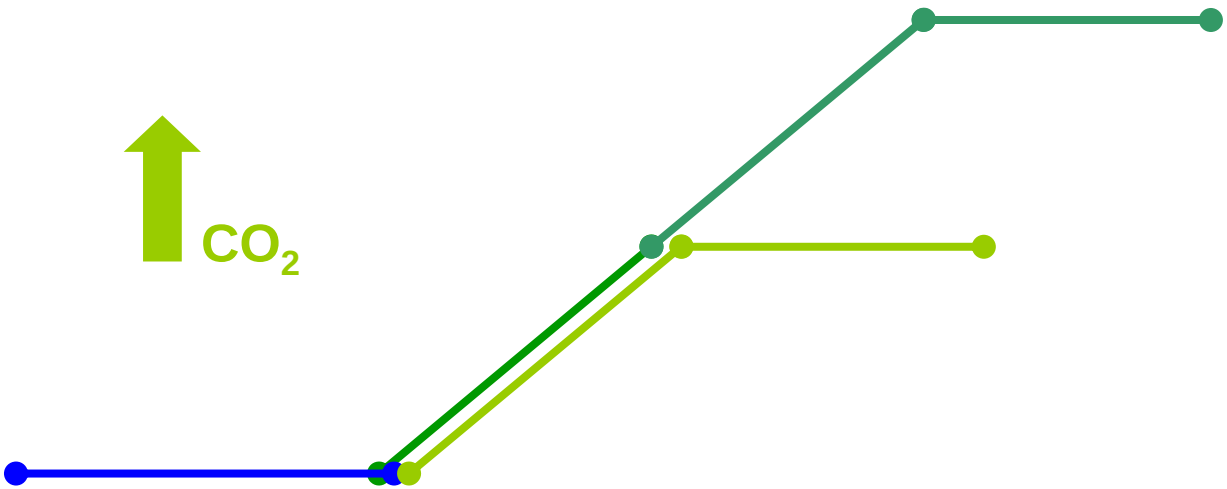


CH4



THE SCENARIO SIMULATIONS

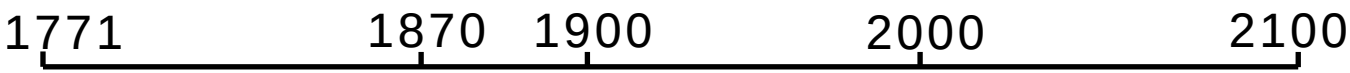
INGV(CMCC) SXG IPCC Experiments:



1pccto4x [150y]

1pccto2x [150y]

picntrl [100y]



20c3m [130y]

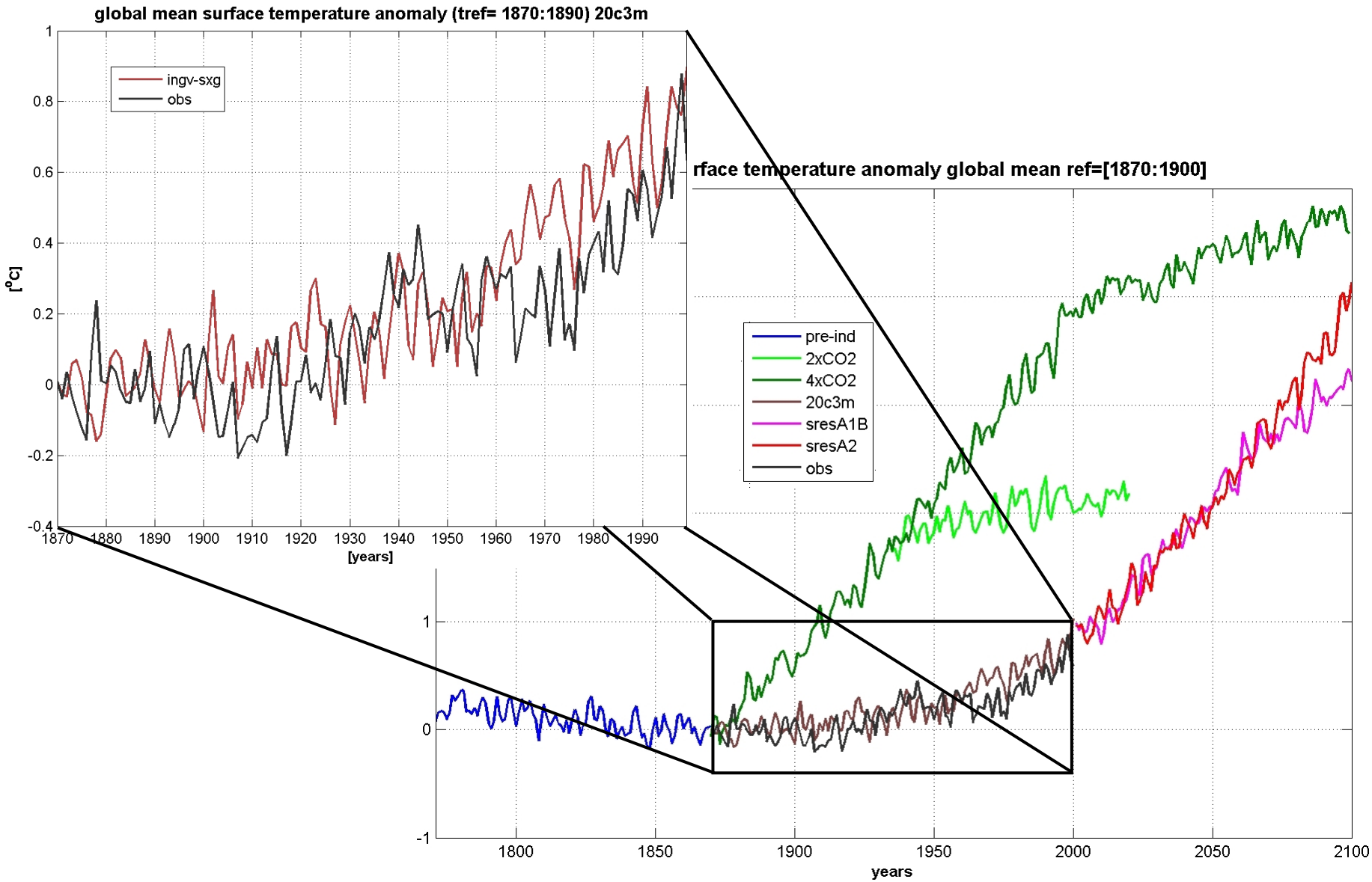
sres a1b [100y]

sres a2 [100y]

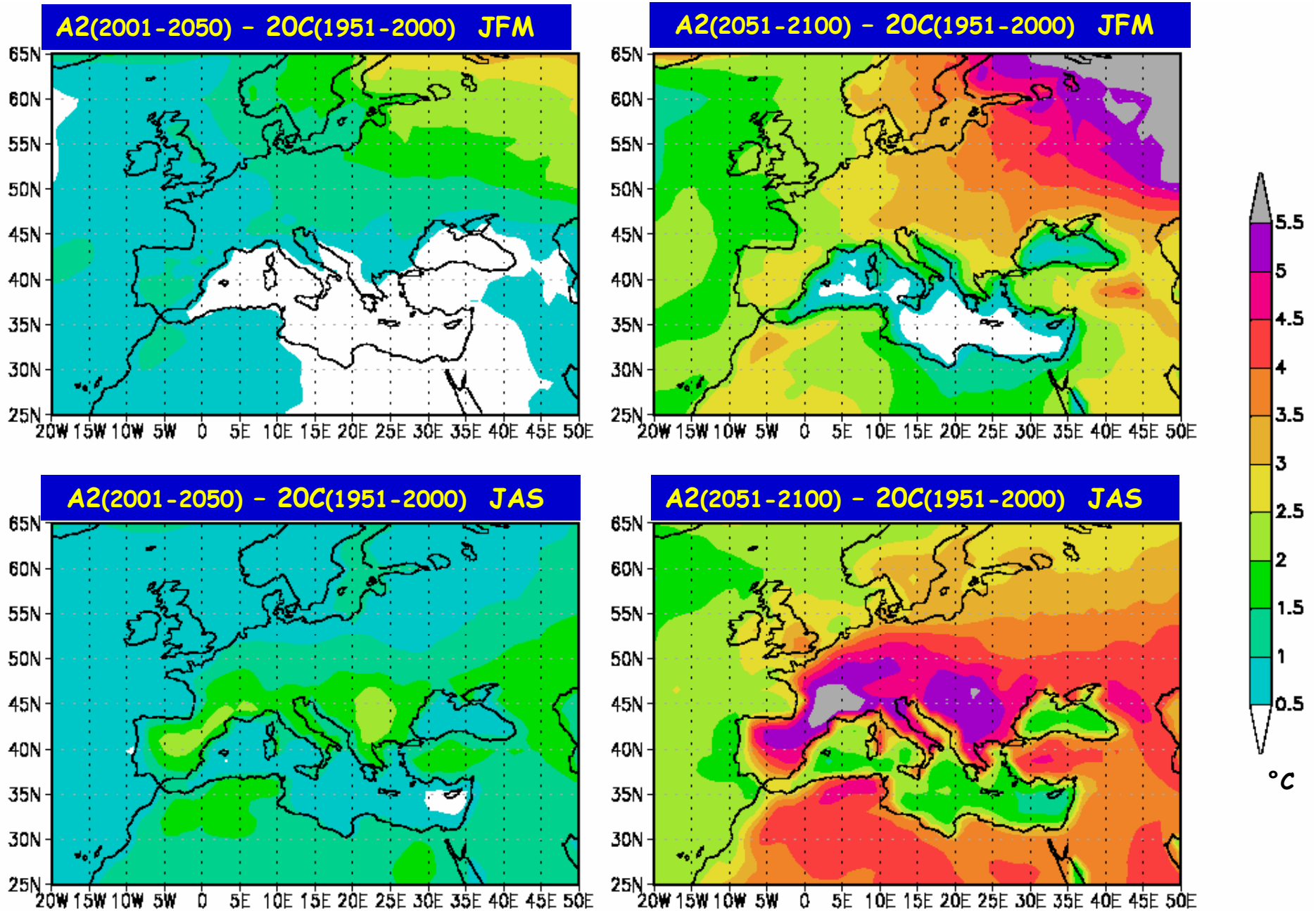
TOT: [730y]

THE SCENARIO SIMULATIONS

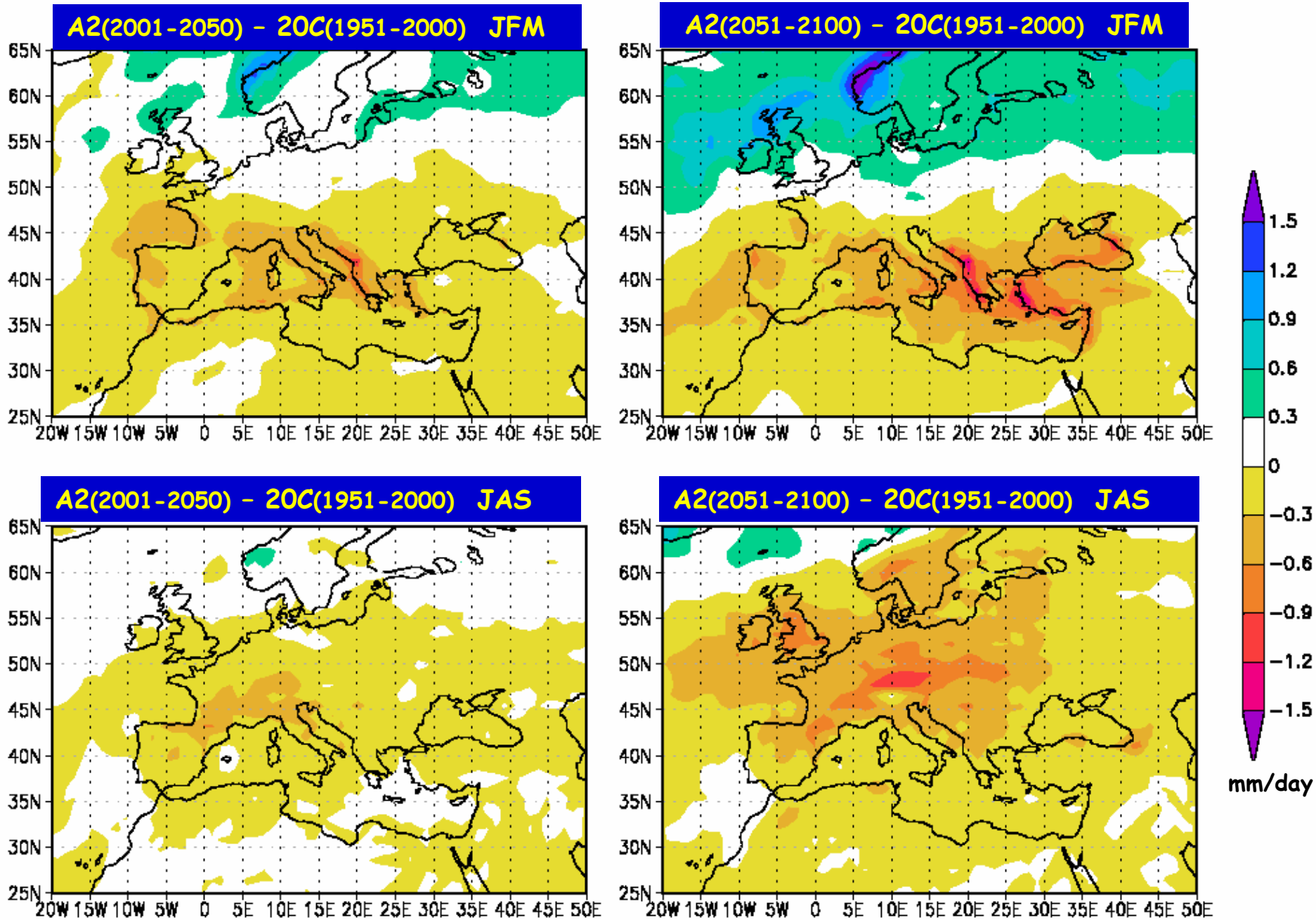
global mean surface temperature anomaly



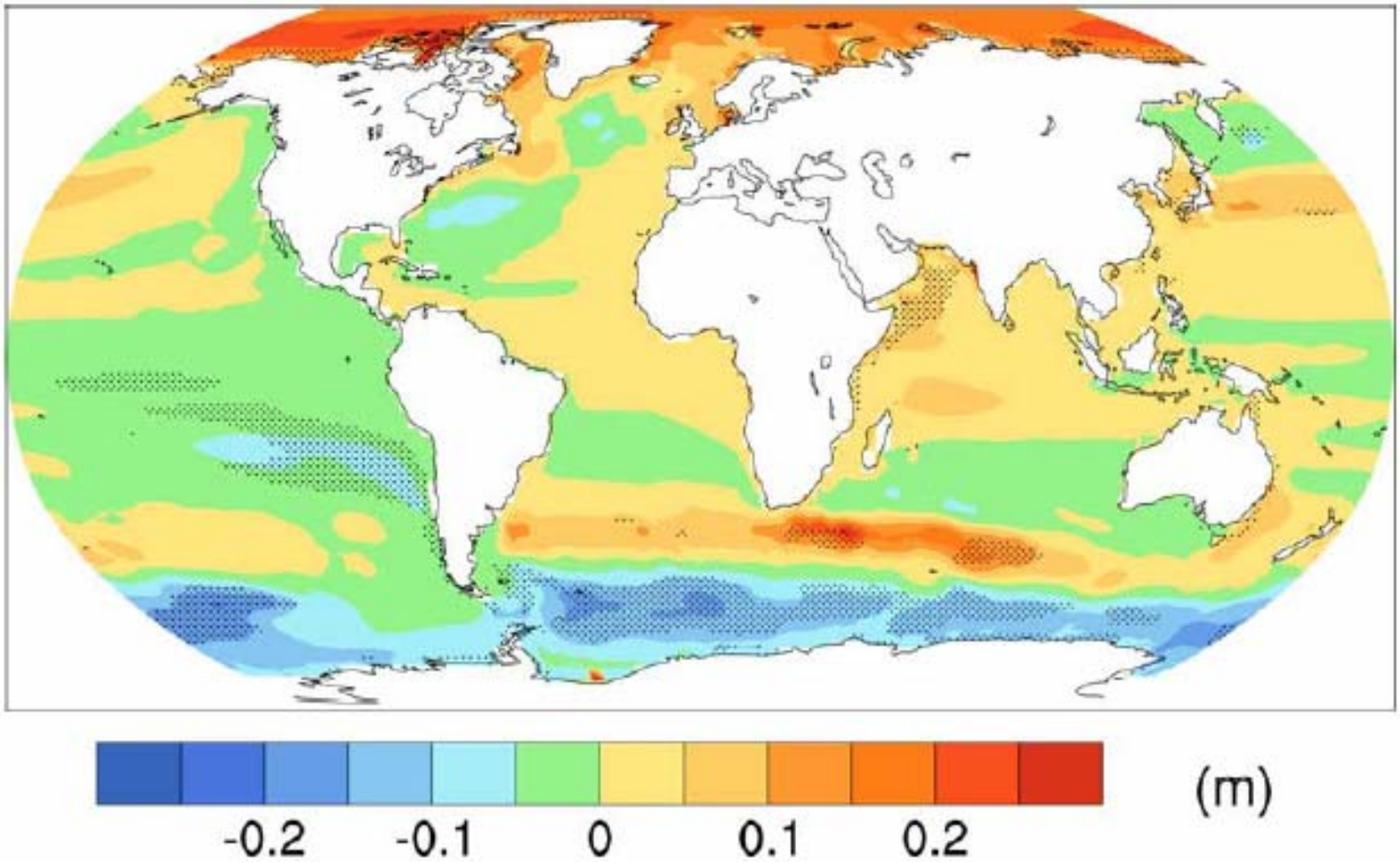
SCENARIO: A2 - 20C 2m-Temperature



SCENARIO: A2 – 20C precipitation



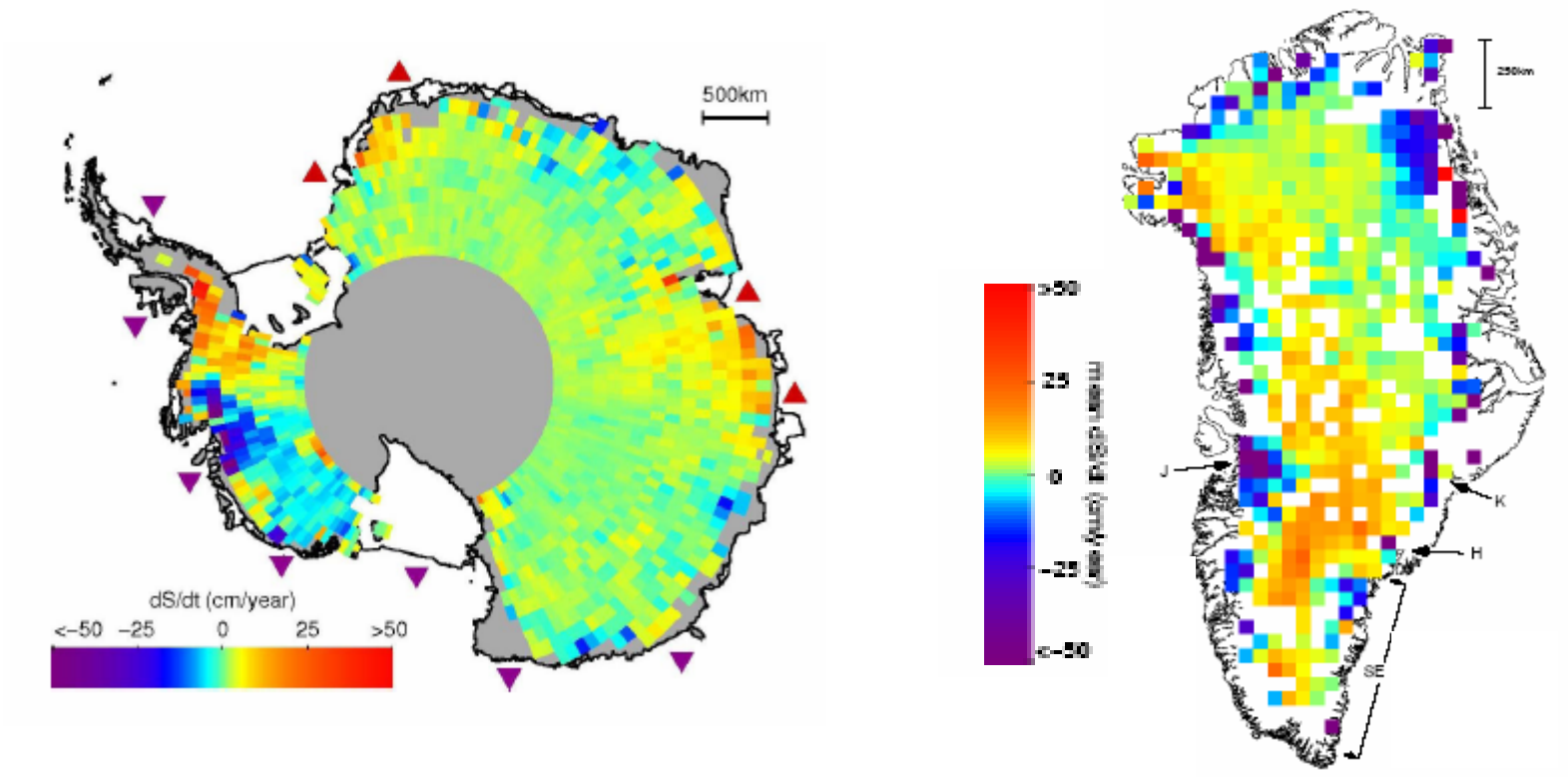
Projected sea level change is not globally uniform



Sea level change due to ocean density and circulation change during 21st century (2080-2099 relative to 1980-1999) under A1B, average of 16 AOGCMs, shown relative to global mean. Spatial variation is about 25% of global mean.

IPCC AR4

Observed ice-sheet changes and rapid ice-sheet dynamics



Flow accelerations of some near-coastal areas of the Greenland and Antarctic ice sheets, estimated as 0.32 mm yr^{-1} sea-level rise (the central value for Antarctic imbalance 1993-2003 plus half of Greenland imbalance, with other half from accelerated surface melting).

Local warming (air or ocean) is implicated, although changes in ocean circulation also may have contributed.

IPCC AR4

The climate in 2005:the Arctic

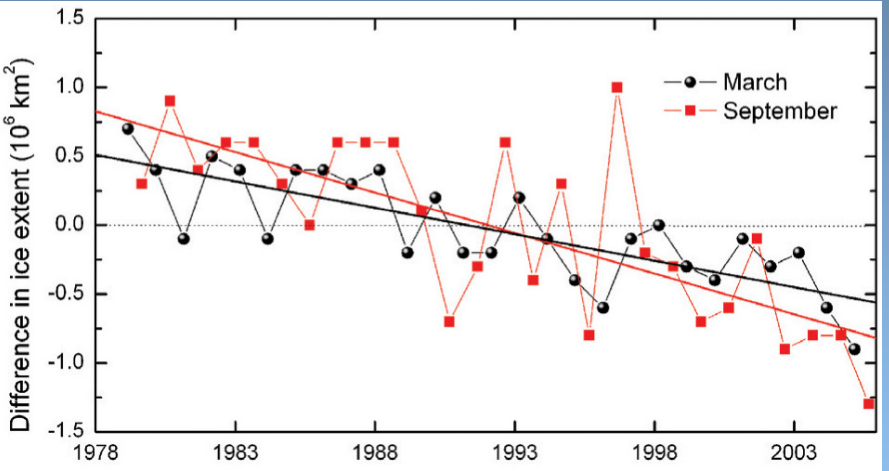


FIG. 5.7. Time series of the variability of ice extent in March (maximum) and September (minimum) for the period 1979–2005, normalized by the respective monthly mean ice extent for the period 1979–2005. Based on a least-squares linear regression, the rate of decrease in March and September was 2% decade^{-1} and 7% decade^{-1}, respectively.

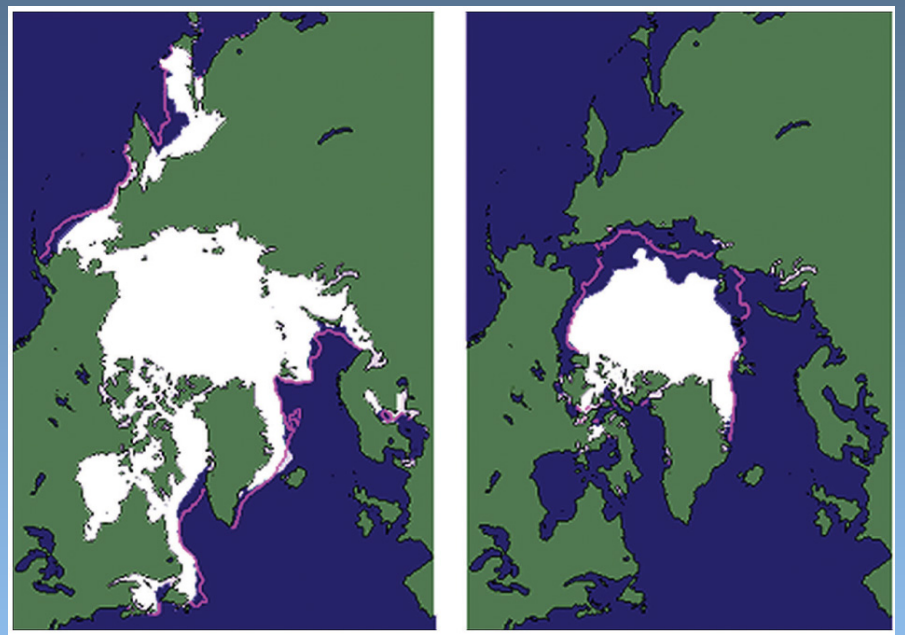


FIG. 5.6. Sea ice extent in (left) March and (right) September 2005, when the ice cover was at or near its maximum and minimum extent, respectively. The magenta line indicates the median maximum and minimum extent of the ice cover, for the period 1979–2000. [Source: NOAA/National Snow and Ice Data Center (NSIDC)]

The climate in 2005: hurricanes

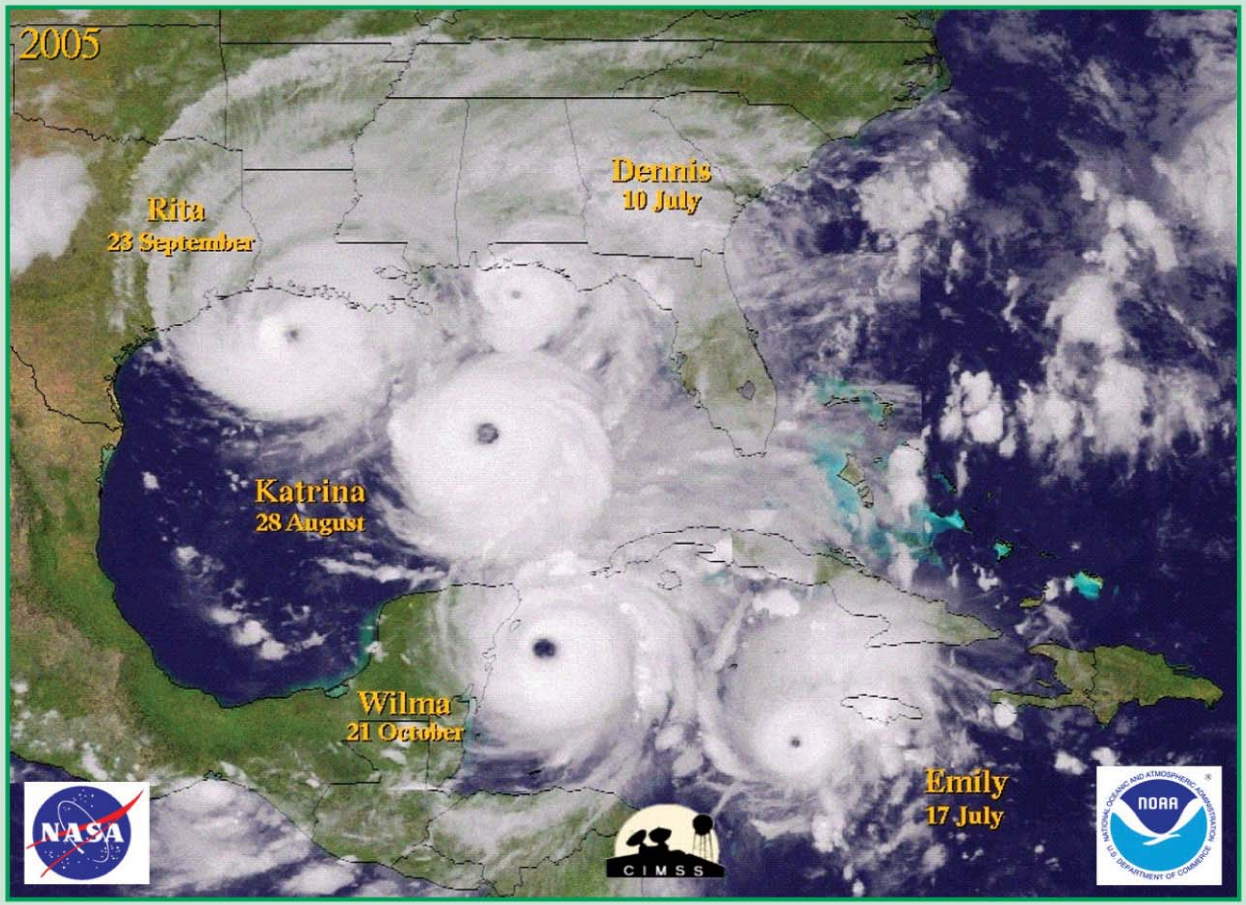


FIG. 4.23. Satellite montage of U.S. landfalling hurricanes. [Courtesy: C. Velden, University of Wisconsin—Madison, Cooperative Institute for Mesoscale Meteorological Studies (CIMMS)]

The climate in 2005: Africa

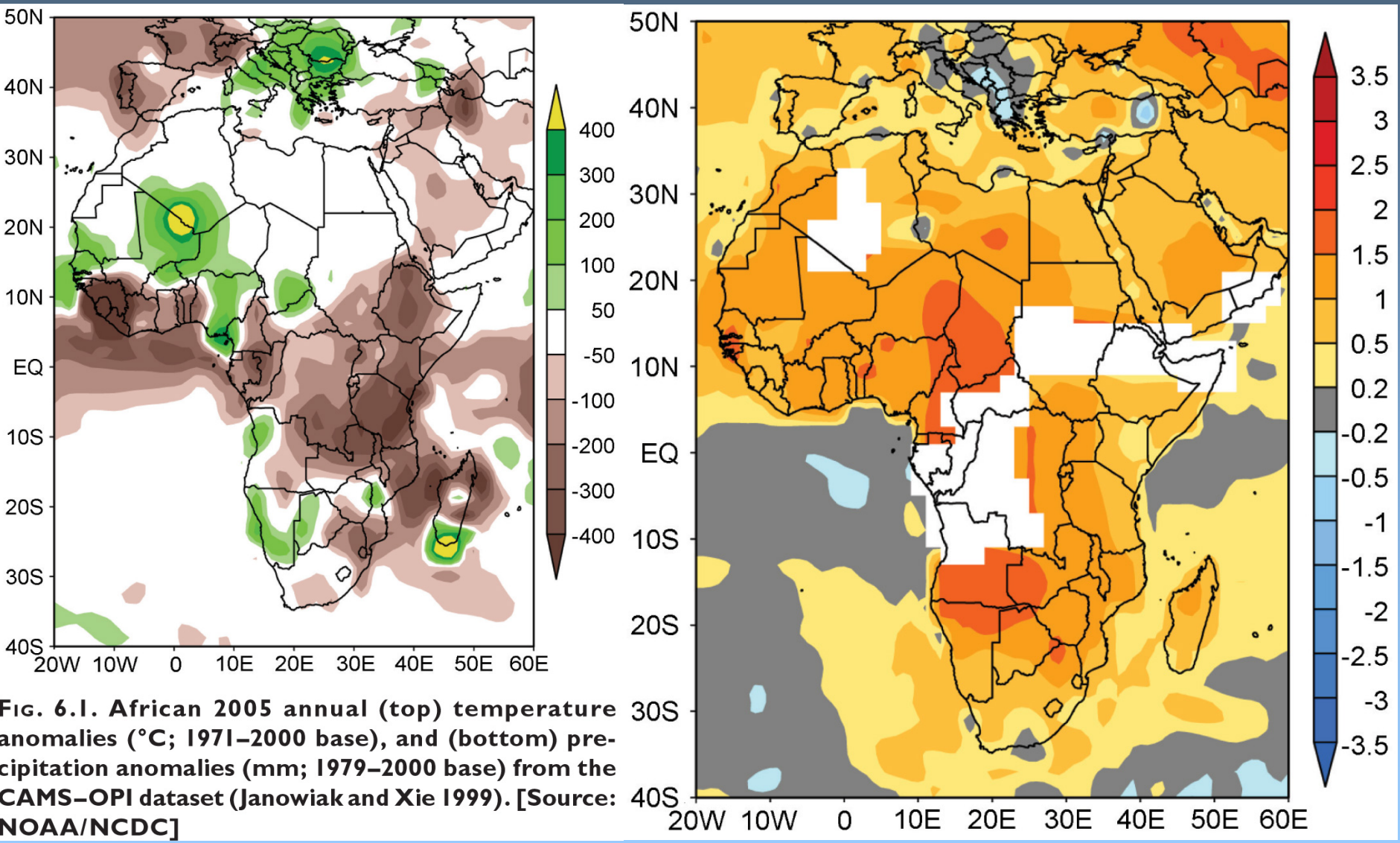


Fig. 6.1. African 2005 annual (top) temperature anomalies (°C; 1971–2000 base), and (bottom) precipitation anomalies (mm; 1979–2000 base) from the CAMS–OPI dataset (Janowiak and Xie 1999). [Source: NOAA/NCDC]

The climate in 2005: Amazon River

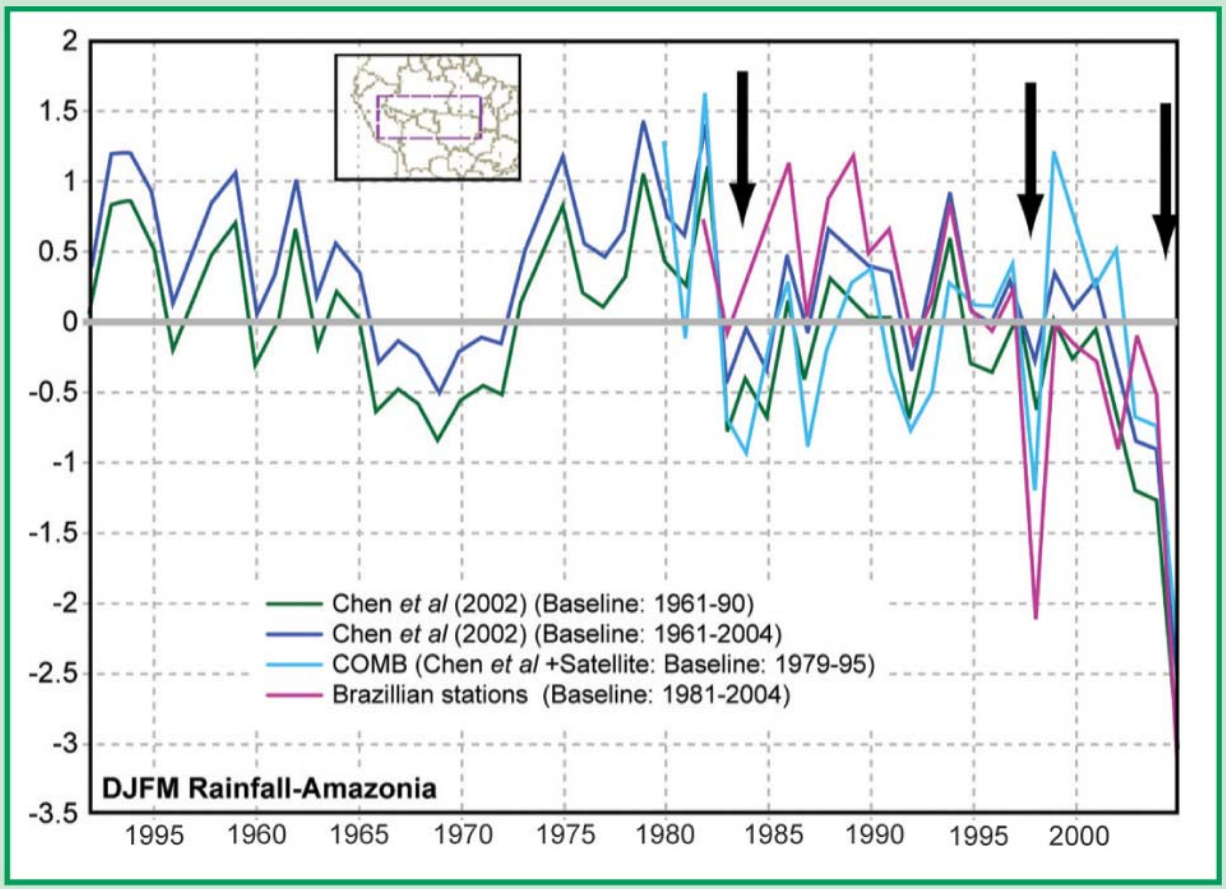
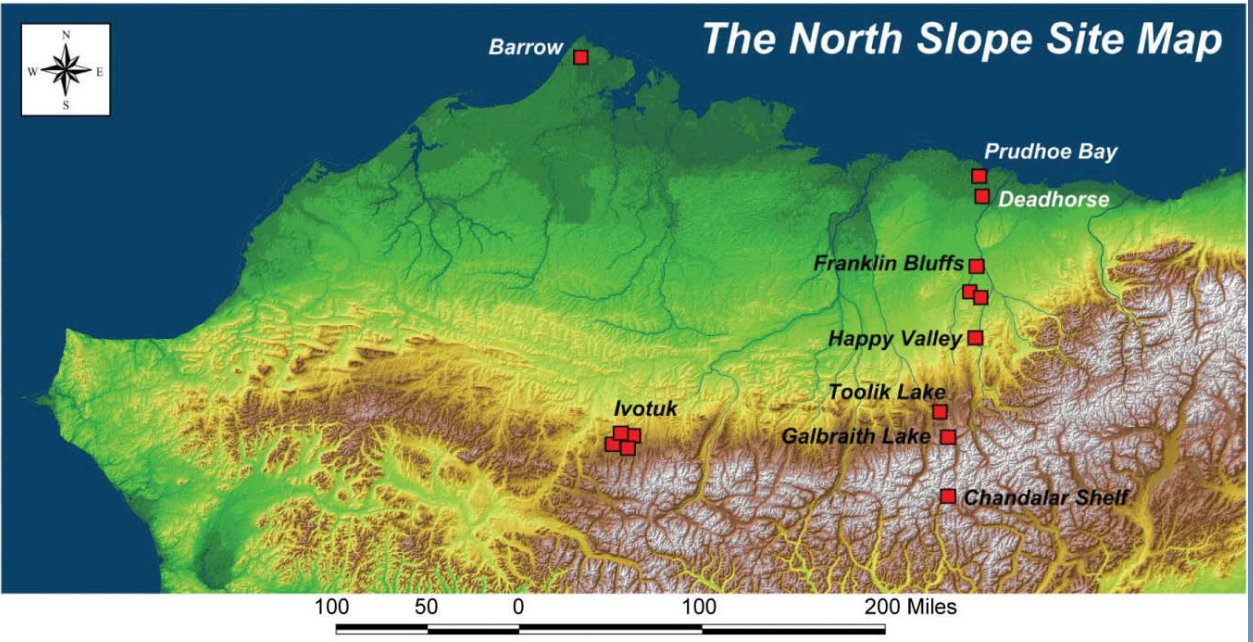


FIG. 6.18. Rainfall anomalies (mm day^{-1}) in central Amazonia during the peak season (December–May) 1951–2005. Black arrows represent drought years 1983, 1998, and 2005.

The Permafrost in 2005



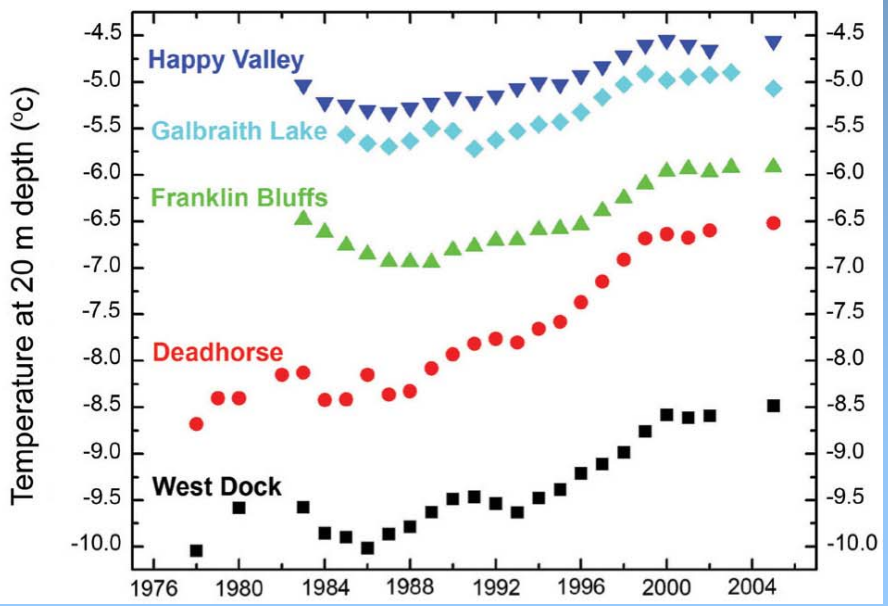


Fig. 5.11. (top) Location of the long-term University of Alaska permafrost observatories in northern Alaska 1978–2005. (right) Changes in permafrost temperatures (°C) at 20-m depth during the last 20–25 years (updated from Osterkamp 2003).

Euro Mediterranean Center for Climate Change

Euro Mediterranean Center for Climate Change

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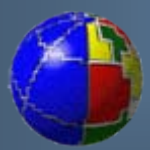
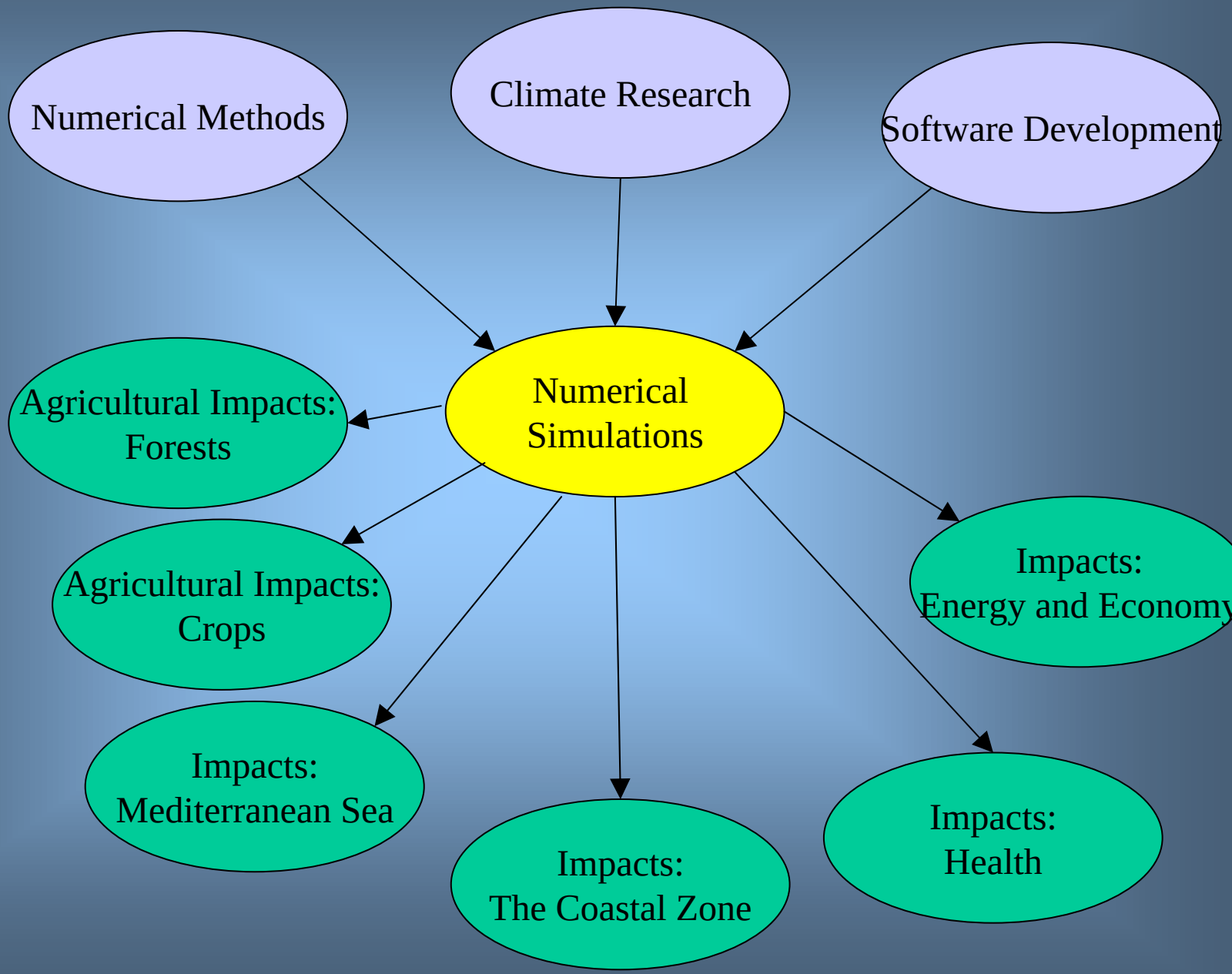


The Structure of the CMCC



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CIRCE

Climate Change and Impact ResearCh: the Mediterranean Environment

An FP6 Project of the European Union

INGV - Istituto Nazionale di Geofisica e Vulcanologia - Italy

Chair: Antonio Navarra and Laurence Tubiana

The project will investigate how global and Mediterranean climates interact, how the radiative properties of the atmosphere and the radiative fluxes vary, the interaction between cloudiness and aerosol, the modifications in the water cycle.

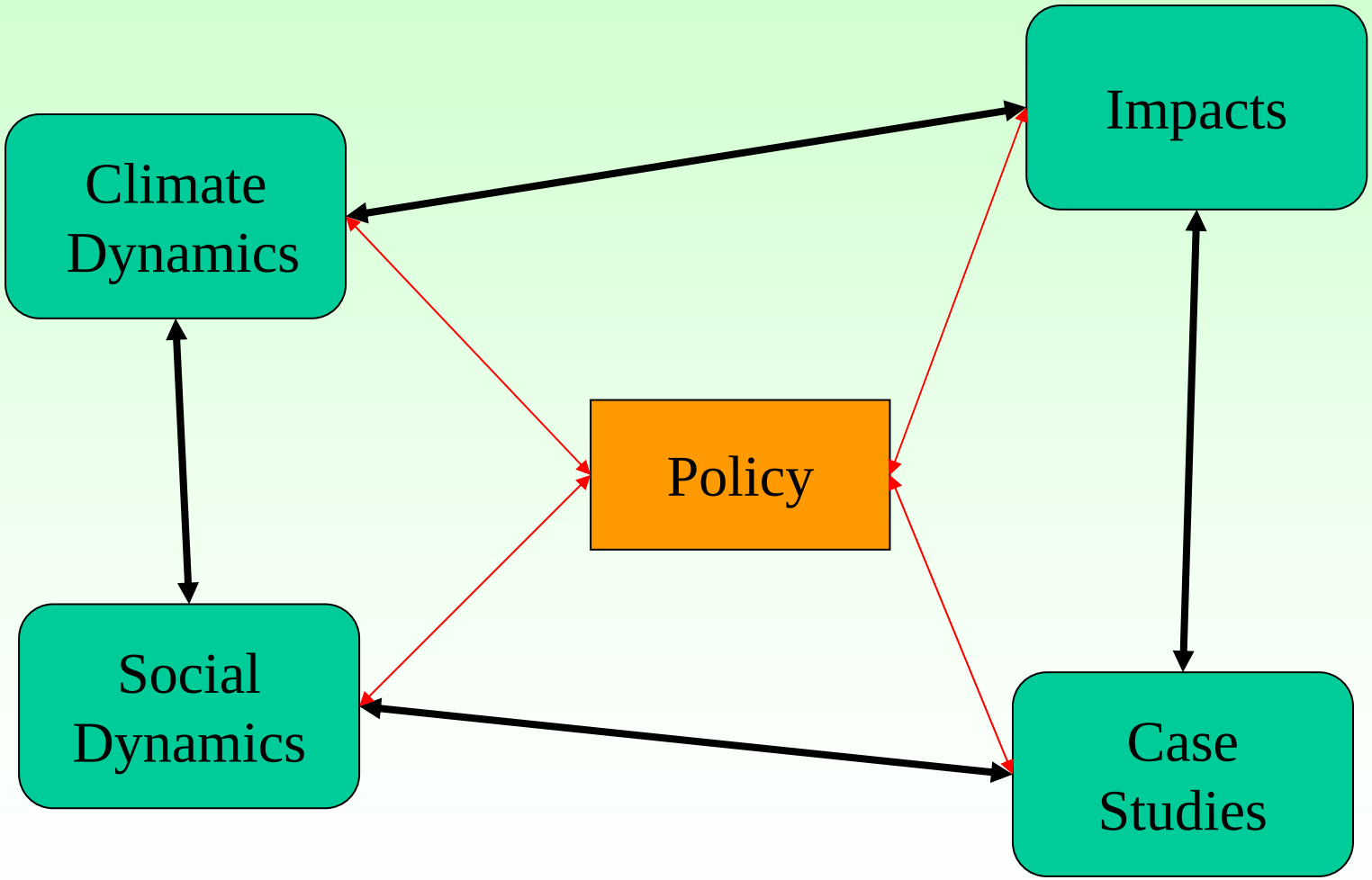
The economic and social consequences of climate change shall be evaluated by analyzing direct impacts on migration, tourism and energy markets together with indirect impacts on the economic system. CIRCE will moreover investigate the consequences on agriculture, forests and ecosystems, human health and air quality. The variability of extreme events in the future scenario and their impacts will be assessed.

The integrated results discussed by the project CIRCE will be presented in the first Regional Assessment of Climate Change in the Mediterranean area.

CIRCE partners

1 Istituto Nazionale di Geofisica e Vulcanologia INGV
2 Consejo Superior de Investigaciones Científicas, Instituto de Ciencias de la Tierra “Jaume Almera” CSIC
3 Fundación Centro de Estudios Ambientales del Mediterráneo CEAM
4 CLU Ltd CLU
5 Danish Meteorological Institute DMI
6 University of Crete, Environmental Chemical Processes Laboratory UOC
7 Ente per le Nuove Tecnologie, l'Energia e l'Ambiente ENEA
8 Fondazione Eni Enrico Mattei FEEM
9 Universidad Complutense de Madrid UCM
10 Institute for Coastal Research GKSS GKSS
11 Water, Environment, Sustainable Solutions WESS
12 Institute of Accelerating Systems and Applications IASA
13 Consiglio Nazionale delle Ricerche CNR
14 Potsdam Institut für Klimafolgenforschung PIK
15 Centre de Coopération Internationale en Recherche Agronomique pour le Développement CIRAD
16 Centre National de la Recherche Scientifique CNRS
17 Universidad Politecnica de Madrid UPM
18 World Health Organization, Regional Office for Europe WHO
19 Institut du Développement Durable et des Relations Internationales IDDRI
20 Natural Environment Research Council NOCS
21 Max-Planck-Society for the Advancement of Science MPI
22 National Observatory of Athens NOA
23 National Institute of Marine Sciences and Technologies INSTM
24 University of Haifa UNIHAIFA
25 University of Natural Resources and Applied Life Sciences BOKU
26 European Commission DG Joint Research Centre JRC
27 Parc Cientific de Barcelona LRC-PCB
28 ASL RME, Department of Epidemiology ASL Rome
29 Meteo-France METEO-FRANCE
30 Met Office METOFFICE
31 Università degli Studi della Tuscia UNITUSCIA
32 Stochkolm Environment Institute SEI
33 University of Birmingham U Birmingham
34 Universidad del Pais Vasco UPV
35 Universitat Politècnica de Catalunya UPC
36 National and Kapodistrian University of Athens UAT
37 Tel-Aviv University TAU
38 Univerdidad de Alcala UAH
39 Zadigroma srl ZADIGROMA
40 University of East Anglia UEA
41 Universitat de les Illes Balears UIB
42 Instituto de Ciência Aplicada e Tecnologia da Faculdade de Ciências da Universidade de Lisboa ICAT-UL
43 Universität Hamburg UNI-HAMBURG
44 University of the Aegean UNIAEGEAN
45 Centre For Environment and Development For Arab Region and Europe CEDARE
46 University of Bern UNIBERN
47 Università degli Studi - L'Aquila CETEMPS
48 Freie Universität Berlin FU Berlin
49 University of Lecce UNILE
50 European Climate Forum ECF
51 Vrije Univeristeit Amsterdam VU
52 The Hebrew University of Jerusalem HUJI
53 Università di Santiago di Compostela USC
54 Istituto Superiore della Sanità ISS
55 Institute Pasteur de Tunis PASTEUR
56 Association pour la Recherche sur le Climat et l'Environnement ARCE
57 International Center for Agricultural Research in the Dry Areas ICARDA
58 Hellenic Center for Marine Research HCMR
59 University of Southampton UNI-SOTON
60 Centro Euromediterraneo per i cambiamenti climatici CMCC

CIRCE Strategy



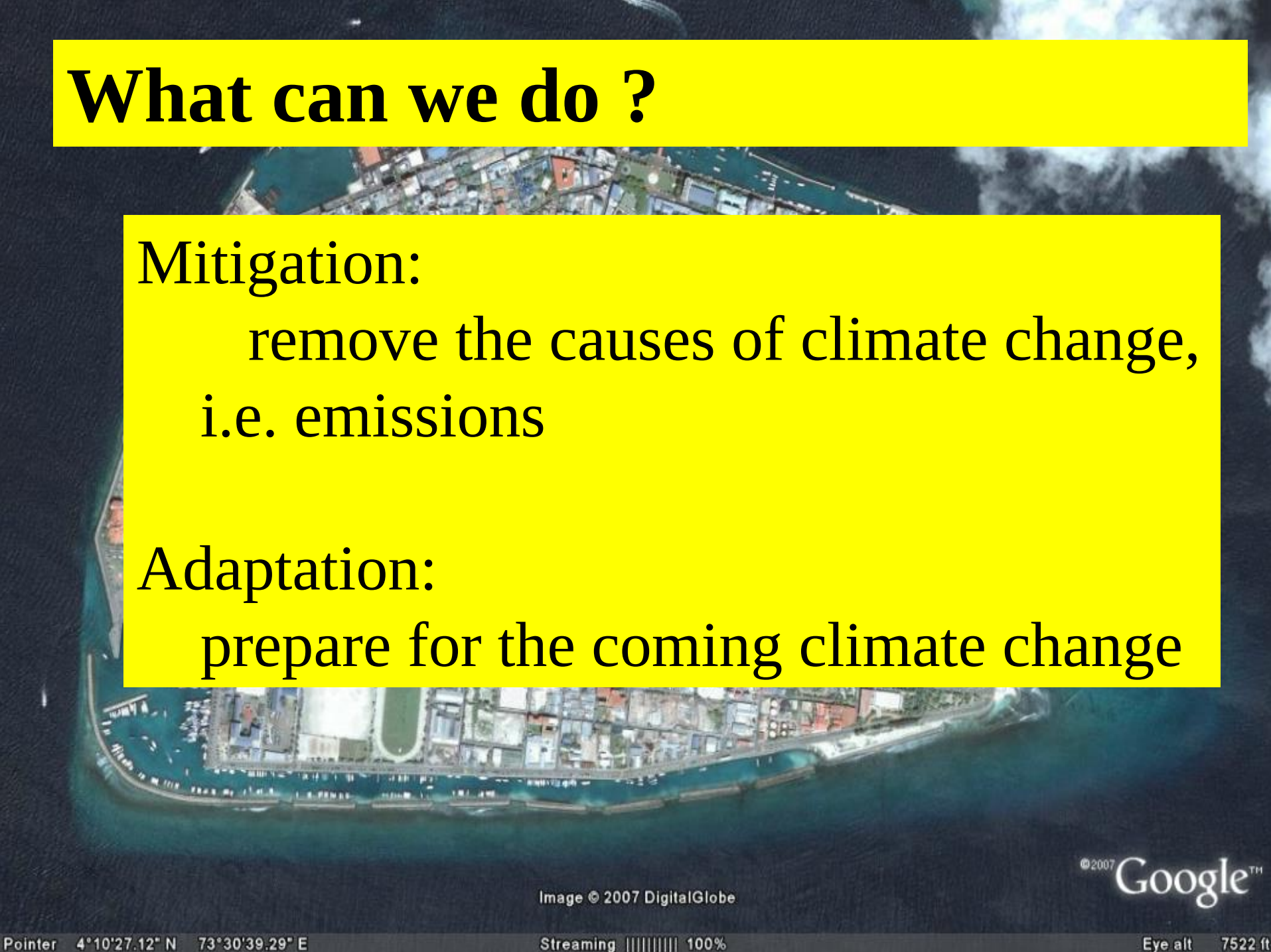
What can we do ?

Mitigation:

remove the causes of climate change, i.e. emissions

Adaptation:

prepare for the coming climate change



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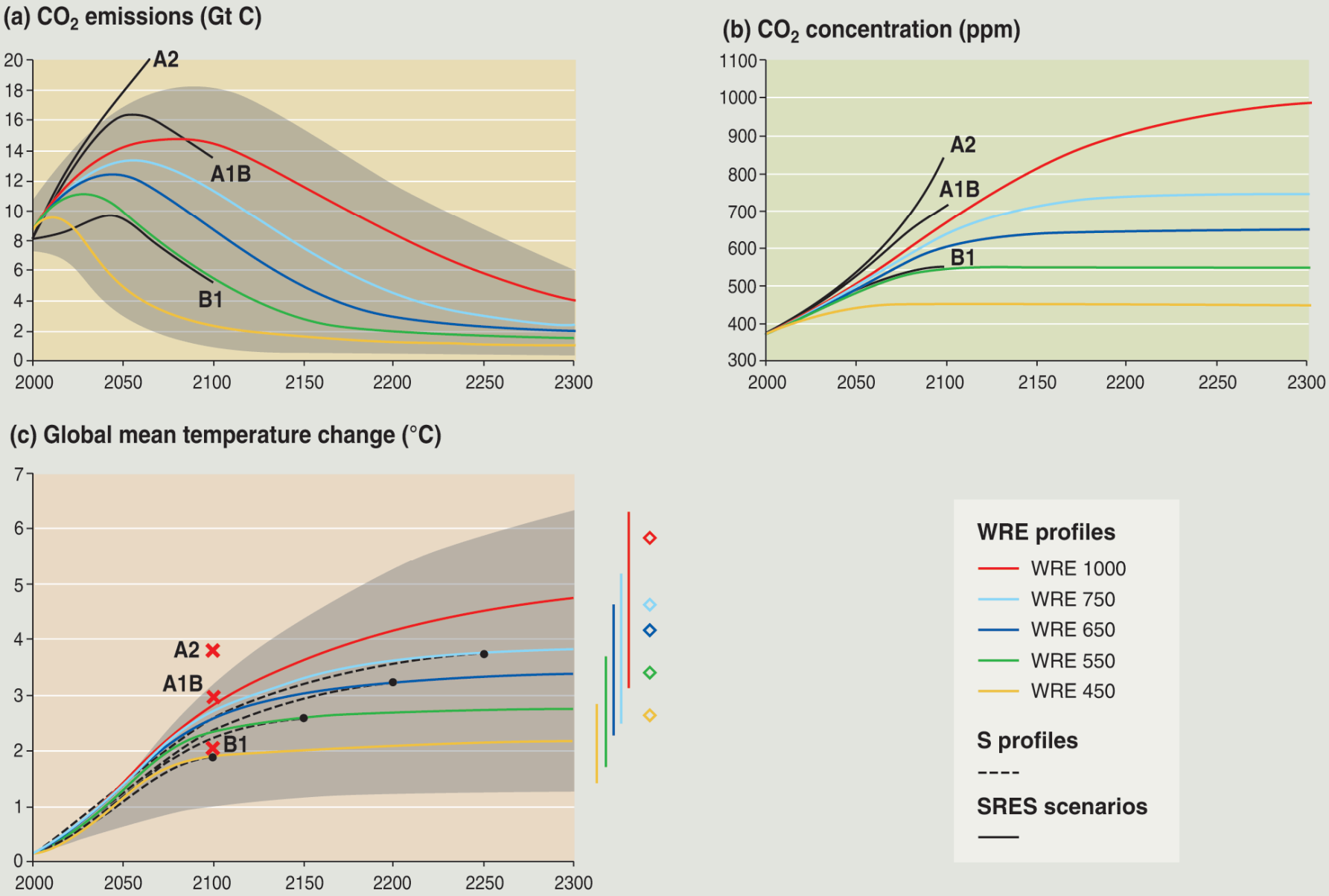
Dutch Cows, after adaptation

Emissions, concentrations, and temperature changes corresponding to different stabilization levels for CO_2 concentrations



Optimists

But Concerned