

First Consultative meeting on enriching ESCWA's Digital Development Conceptual Framework and the standard template Pressing issues and emerging technologies

Digital Tools and Applications in Climate Change Modelling and Assessment and Linkages to the Digital Development Agenda

27 Nov 2023



UNITED NATIONS

الاسواق
ESCWA

Shared Prosperity **Dignified Life**



Presented by: Tarek Sadek – Hasan Awad

Climate Change and Natural Resources
Sustainability Cluster, ESCWA

WEATHER VS. CLIMATE

DEFINITION AND DIFFERENCES

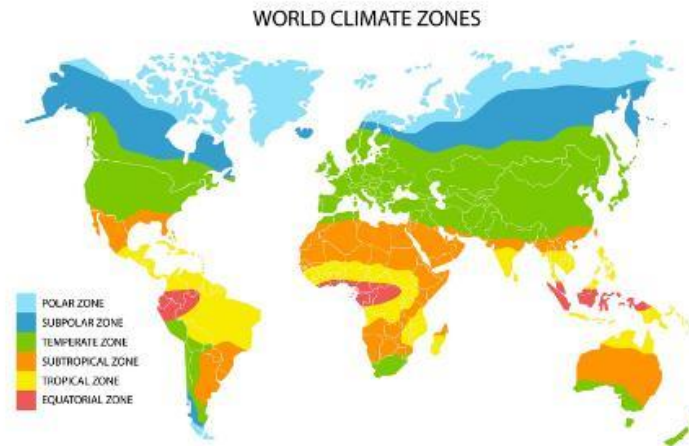
WEATHER

ATMOSPHERIC CONDITIONS
AT A GIVEN
SHORT MOMENT OF TIME

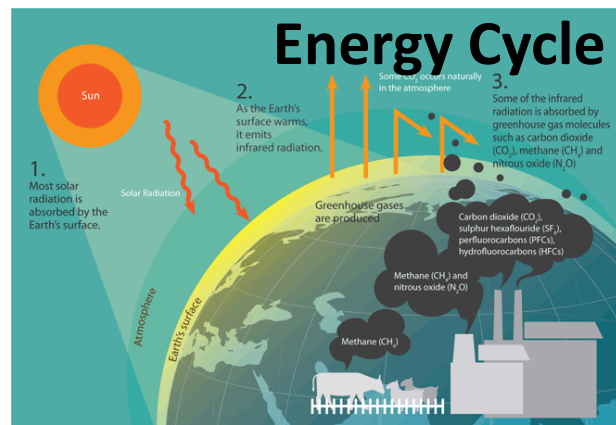
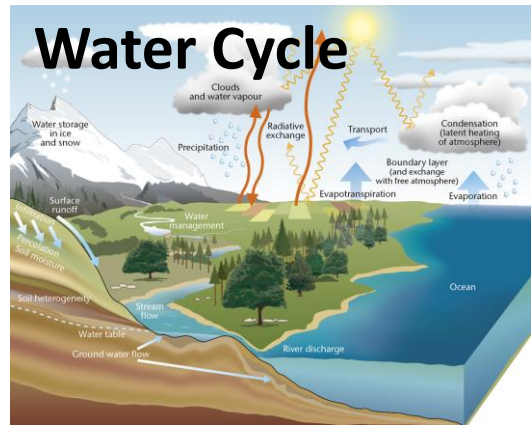
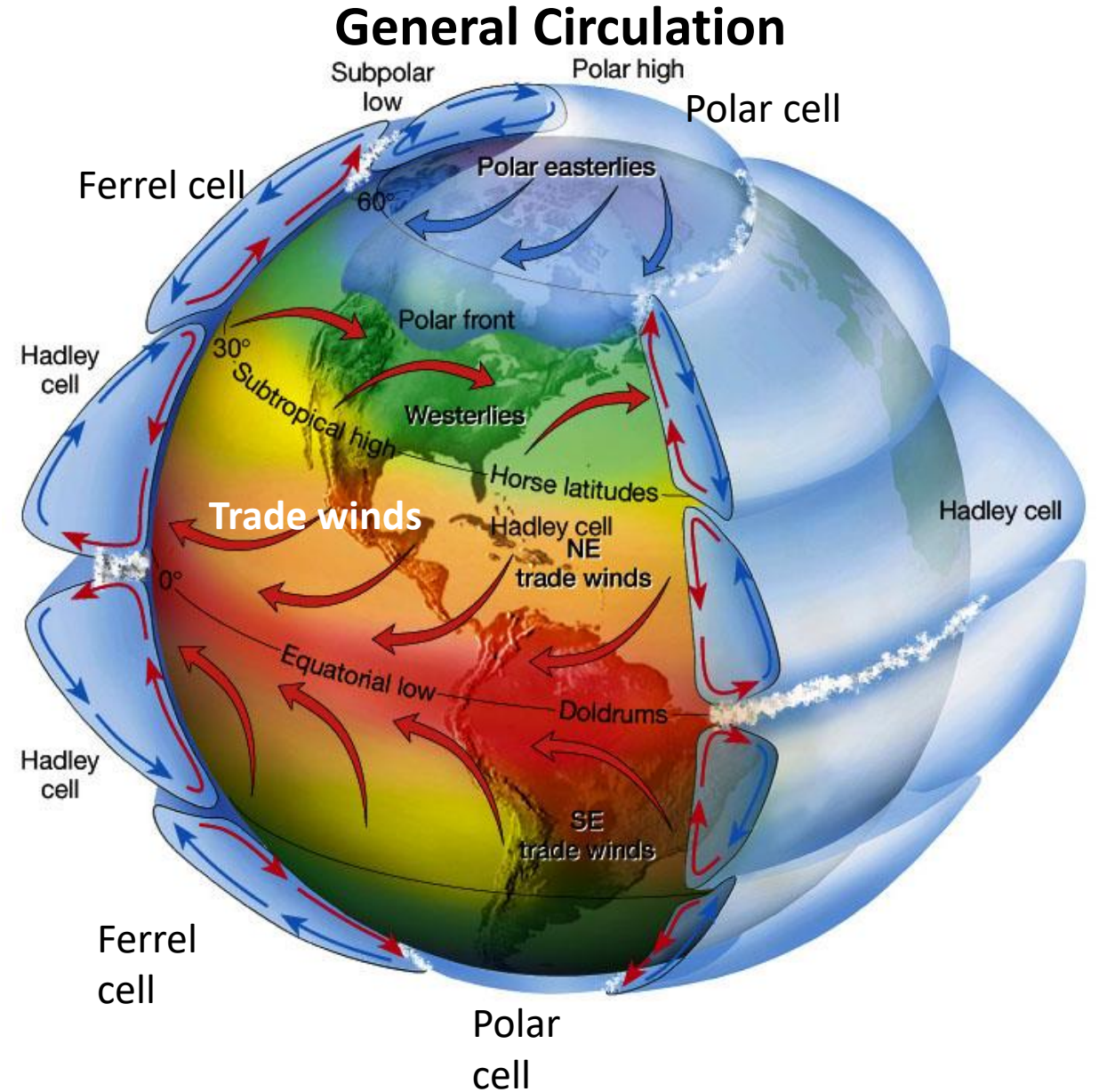
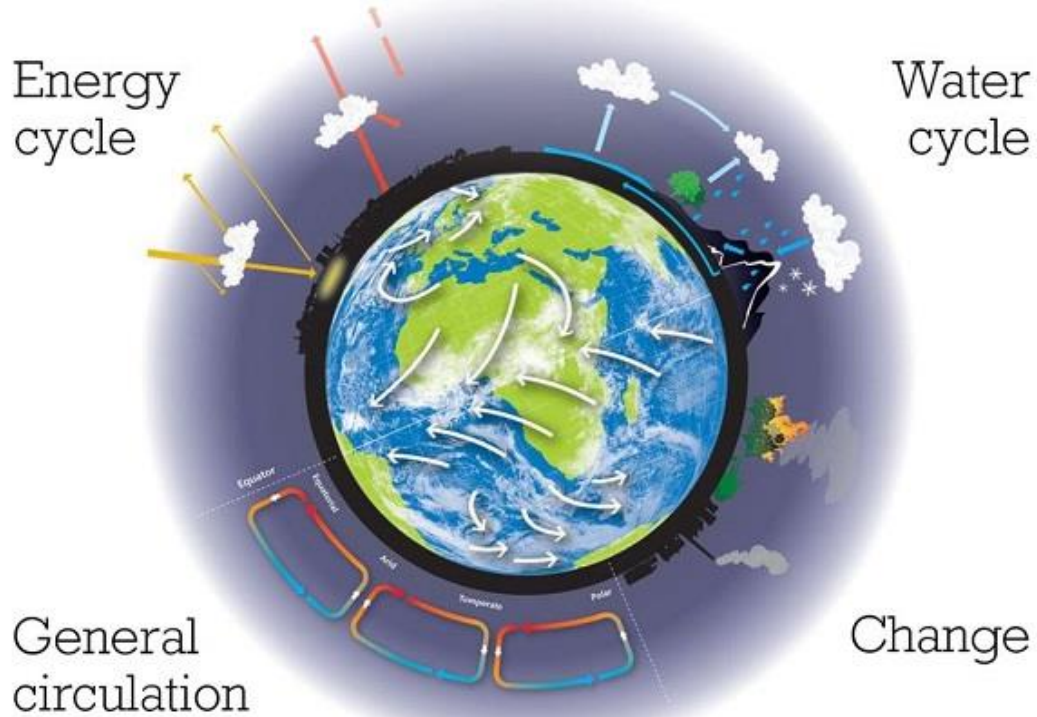


CLIMATE

AVERAGE WEATHER CONDITIONS
OF A GIVEN REGION
OVER A LONG PERIOD OF TIME

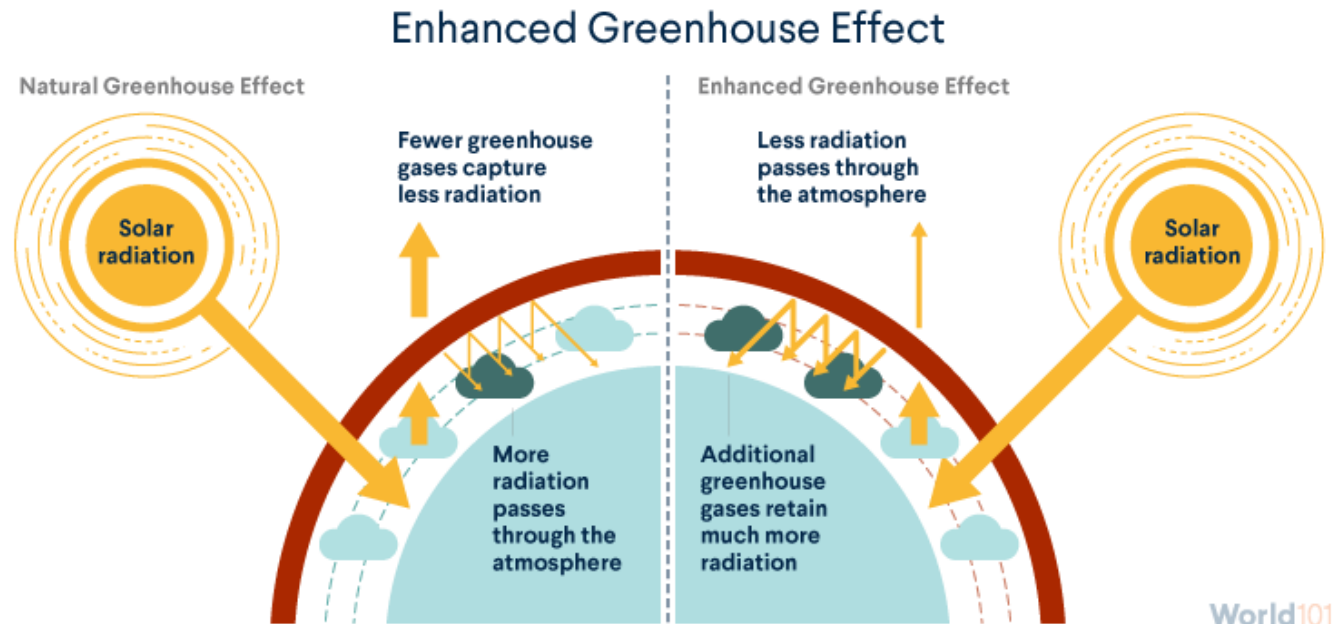
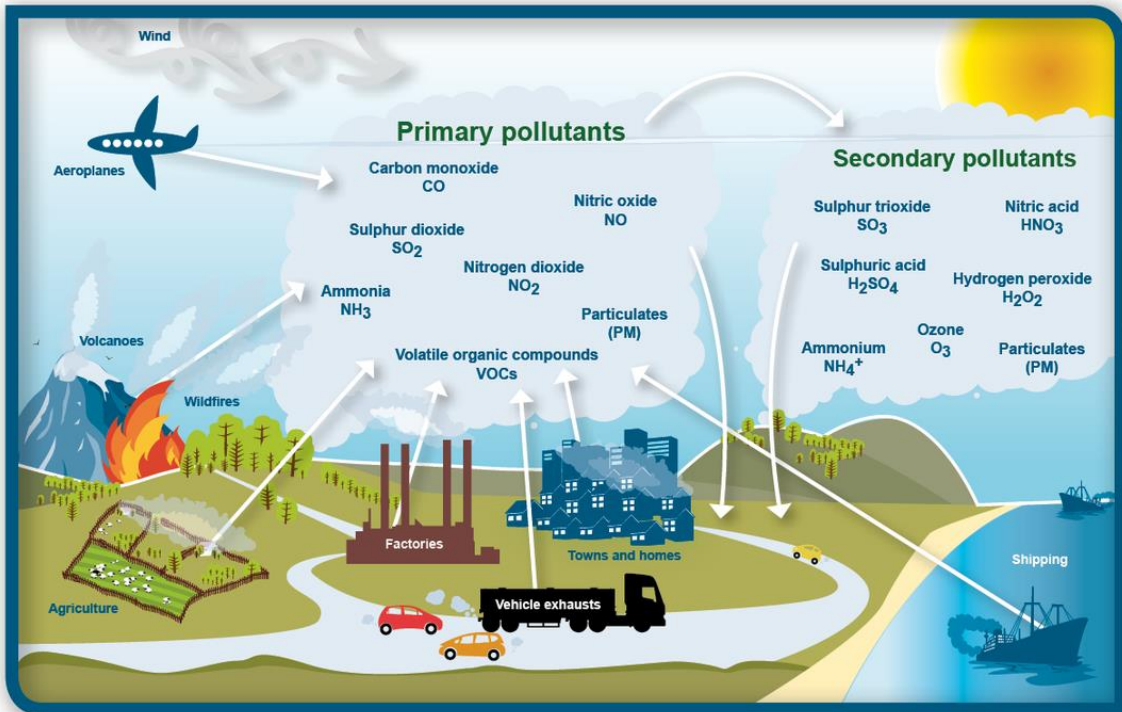


What is the Driving Force of the Climate system



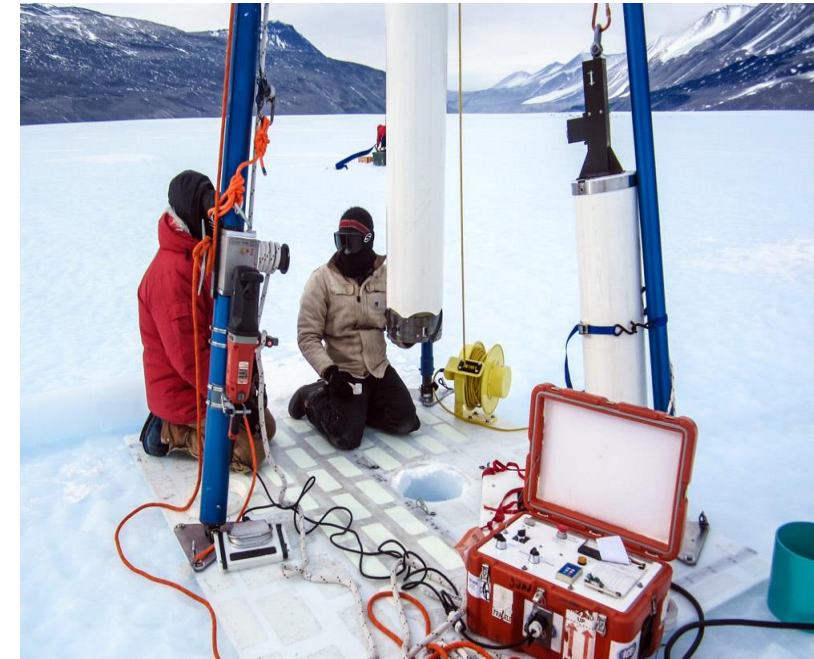
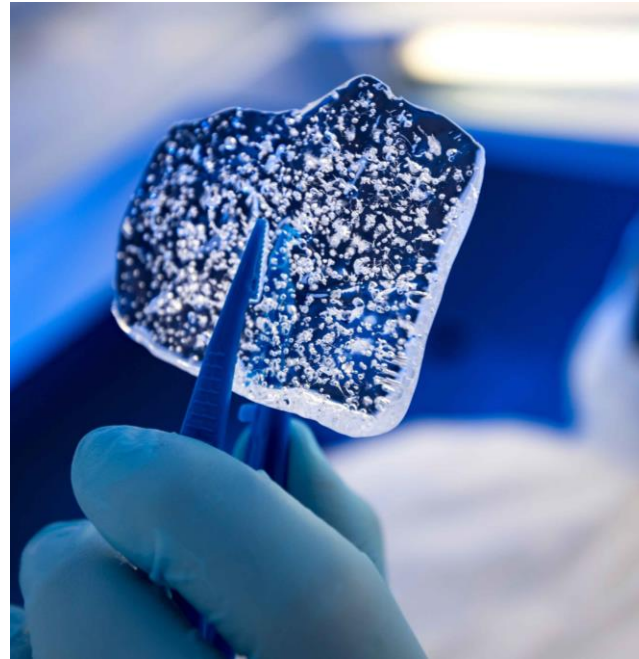
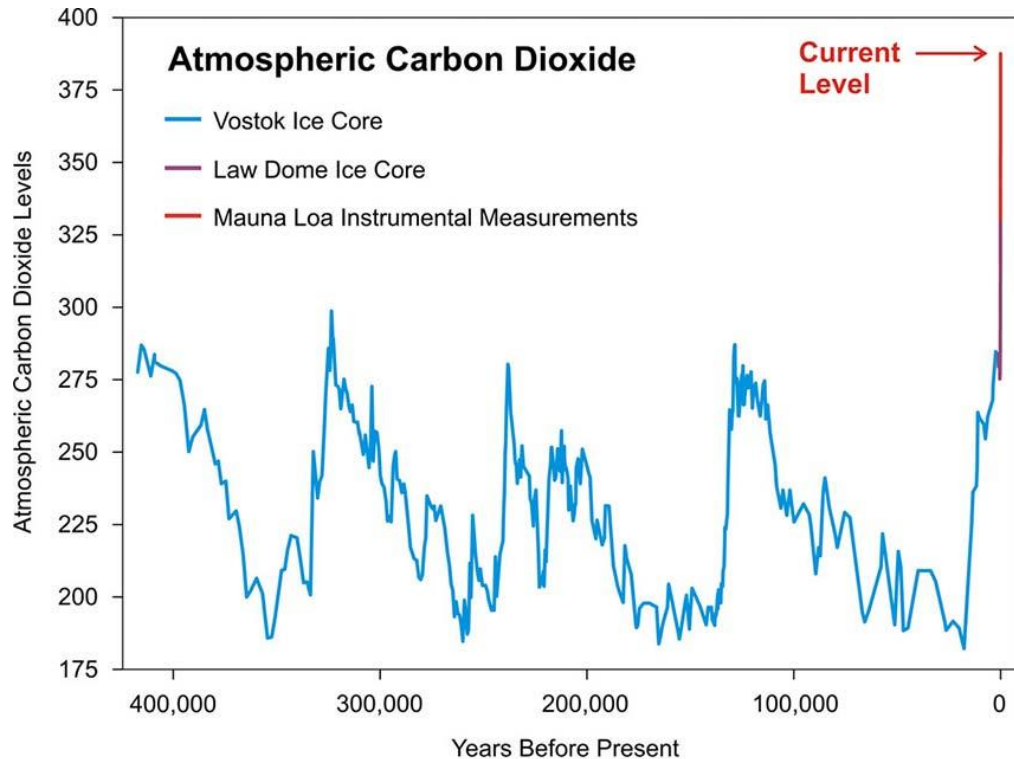
Source: Met Office from <http://www.metoffice.gov.uk/news/in-depth/weather-and-climate>, "Contains public sector information licensed under the Open Government Licence v1.0"

What is the Driving Force of the Climate system



Proxy Data – Historical CO₂ concentration

Over 400,000 years, and even longer, levels of carbon dioxide (CO₂) have risen and fallen from about **180 parts per million to 280**, varying from colder in the Ice Ages to warmer in interglacial periods.



Ice core records globally agree on these levels, and they match instrumented measurements from the 1950s onwards, confirming their reliability.

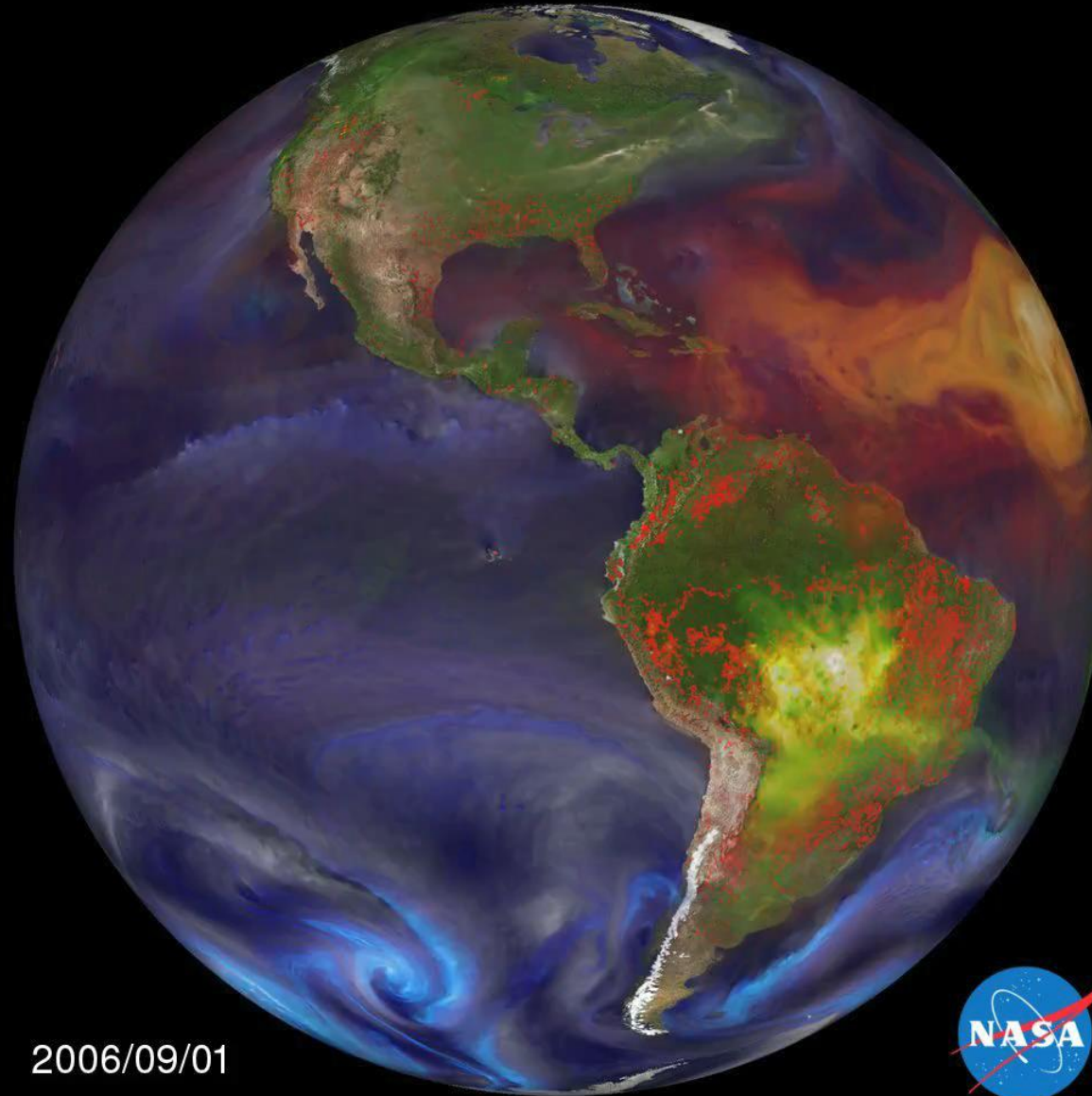
Estimated Global Daily CO₂



September 30, 2023

419.82 ppm

GMAO Animation Simulating the Transport of Aerosols with GEOS-5



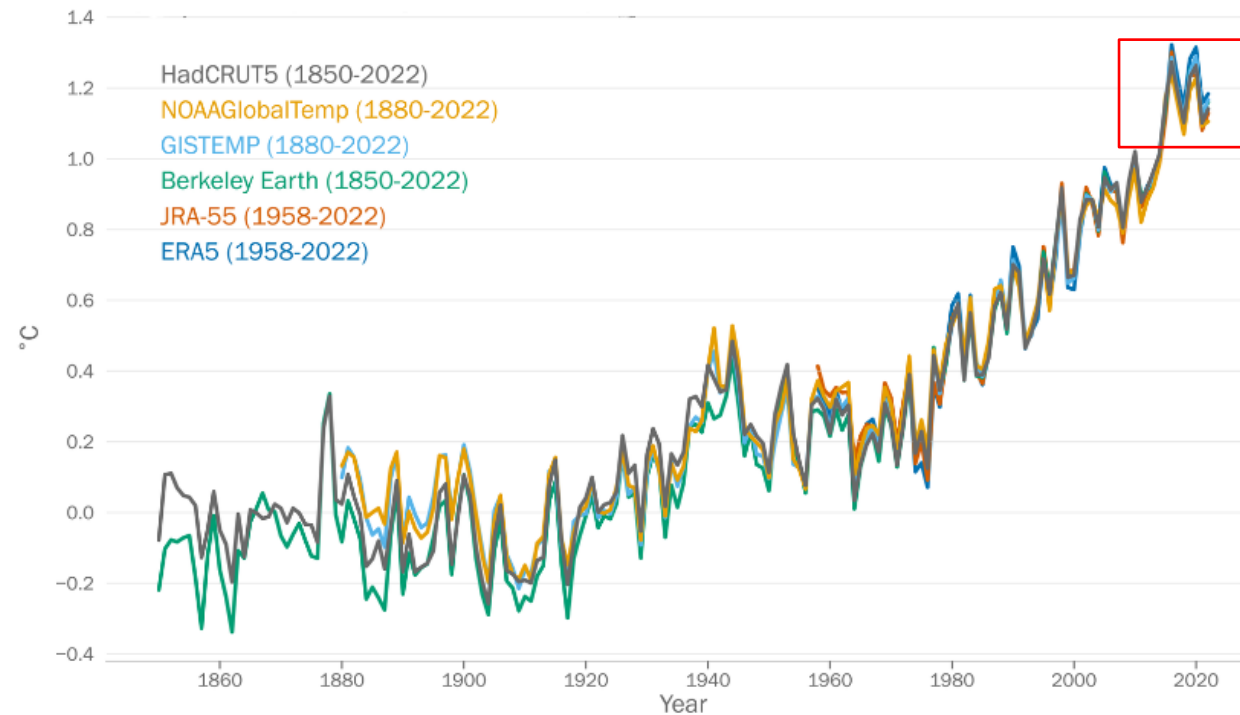
- Fires
- Sulfates
- Dust
- Organic aerosols
- Sea salt

2006/09/01



Is the climate changing?

Global mean temperature Compared to 1850-1900 average



Past 8 years are the warmest in records

- The Earth's average surface temperature has increased by more than 1.0°C since the late 1800s
- Human-caused greenhouse gas emissions are responsible for the observed warming.
- The last Ice Age was about 6°C colder than today.

Mendenhall Glacier, Alaska 1894



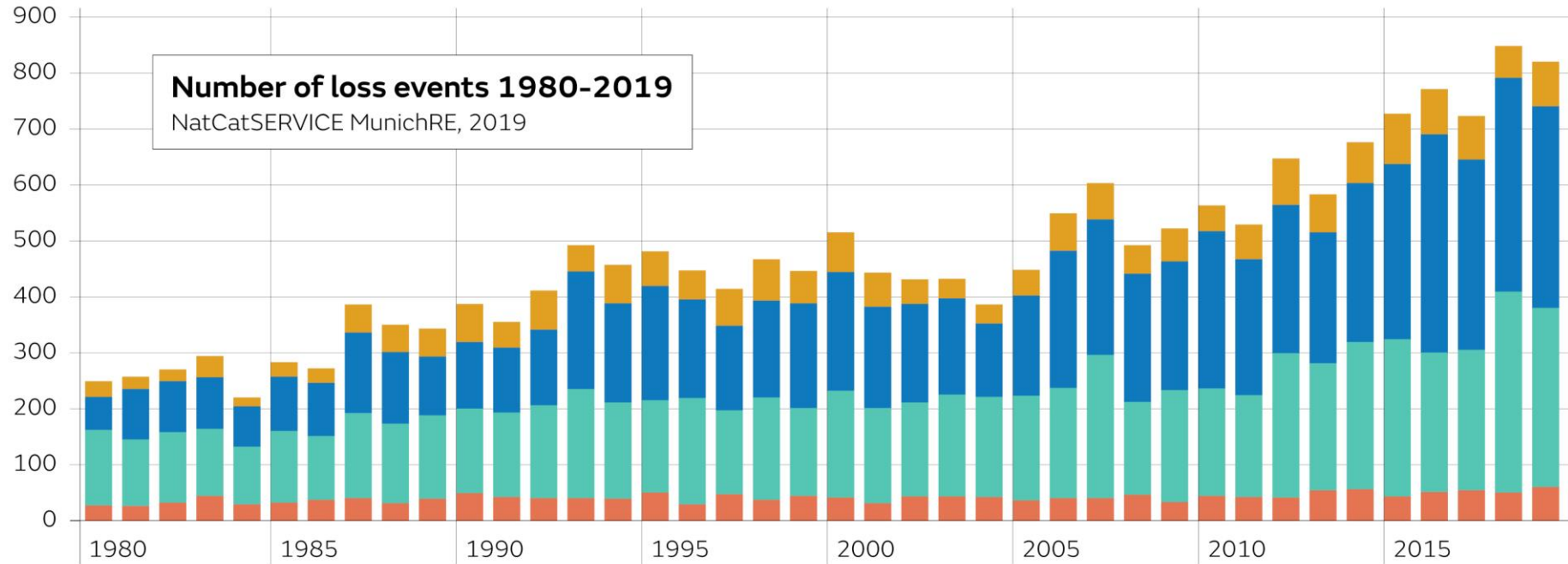
Source: NASA Climate Change, This image was presented by Gavin Schmidt during a seminar on Challenges and future prospects for climate modeling.



Source: Google Maps, This image was taken by Virginia Kelly in September 2020

Google

Met Office Are extremes becoming more frequent?



- Geophysical events**
Earthquakes, tsunami, volcanic activity
- Meteorological events**
Tropical storm, extratropical storm, convective storm, local storm.
- Hydrological events**
Flood, mass movement.
- Climatological events**
Extreme temperature, drought, wildfire.

Source: Met Office, How is climate linked to extreme weather?

Hotter temperatures

More severe storms

Increased Droughts

A warming, rising ocean

Loss of species

Not enough food

Poverty and displacement



General Circulations Models (GCMs)

General circulation models (GCMs) are mathematical models capable of representing physical processes of the atmosphere and ocean to simulate response of global climate to the increasing greenhouse gas emission (IPCC, 2013).

A simplified representation of part of the domain of a GCM illustrates some important components and processes

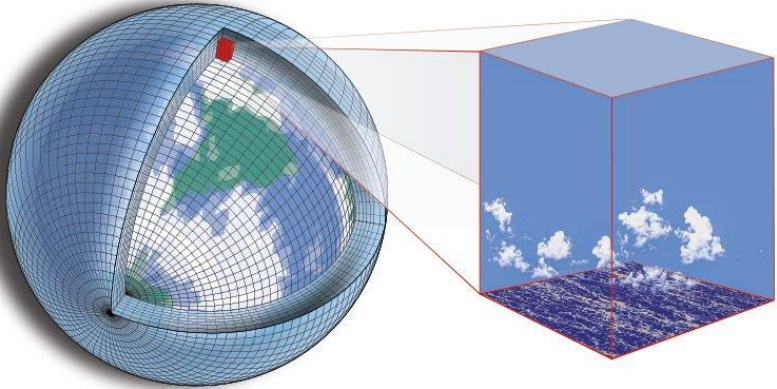


Image: Tapio Schneider/Kyle Pressel/Momme Hell/Caltech

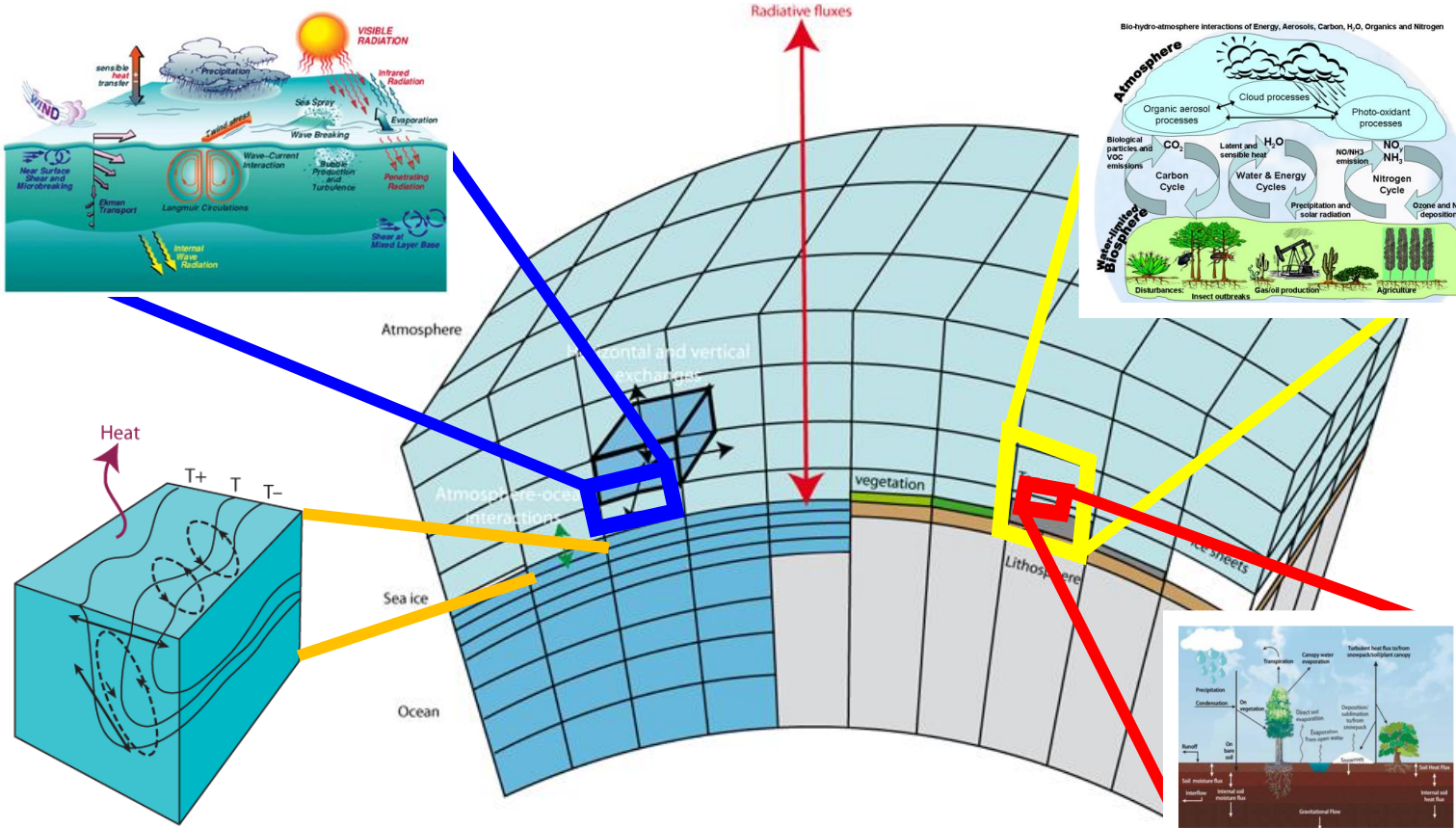


Image: H. Goose et al., réf., licence CC-BY-NC, the image is modified by escwa

Essential Climate Variables: Generated per Grid Box

Atmosphere

Surface

- [Precipitation](#)
- [Pressure](#)
- [Radiation budget](#)
- [Temperature](#)
- [Water vapour](#)
- [Wind speed and direction](#)

Upper-air

- [Earth radiation budget](#)
- [Lightning](#)
- [Temperature](#)
- [Water vapor](#)
- [Wind speed and direction](#)

Atmospheric Composition

- [Aerosols](#)
- [Carbon dioxide, methane and other greenhouse gases](#)
- [Clouds](#)
- [Ozone](#)
- [Precursors for aerosols and ozone](#)

Land

Hydrosphere

- [Groundwater](#)
- [Lakes](#)
- [River discharge](#)

Cryosphere

- [Glaciers](#)
- [Ice sheets and ice shelves](#)
- [Permafrost](#)
- [Snow](#)

Biosphere

- [Above-ground biomass](#)
- [Albedo](#)
- [Evaporation from land](#)
- [Fire](#)
- [Fraction of absorbed photosynthetically active radiation \(FAPAR\)](#)
- [Land cover](#)
- [Land surface temperature](#)
- [Leaf area index](#)
- [Soil carbon](#)
- [Soil moisture](#)

Anthroposphere

- [Anthropogenic Greenhouse gas fluxes](#)
- [Anthropogenic water use](#)

Ocean

Physical

- [Ocean surface heat flux](#)
- [Sea ice](#)
- [Sea level](#)
- [Sea state](#)
- [Sea surface currents](#)
- [Sea surface salinity](#)
- [Sea surface stress](#)
- [Sea surface temperature](#)
- [Subsurface currents](#)
- [Subsurface salinity](#)
- [Subsurface temperature](#)

Biogeochemical

- [Inorganic carbon](#)
- [Nitrous oxide](#)
- [Nutrients](#)
- [Ocean colour](#)
- [Oxygen](#)
- [Transient tracers](#)

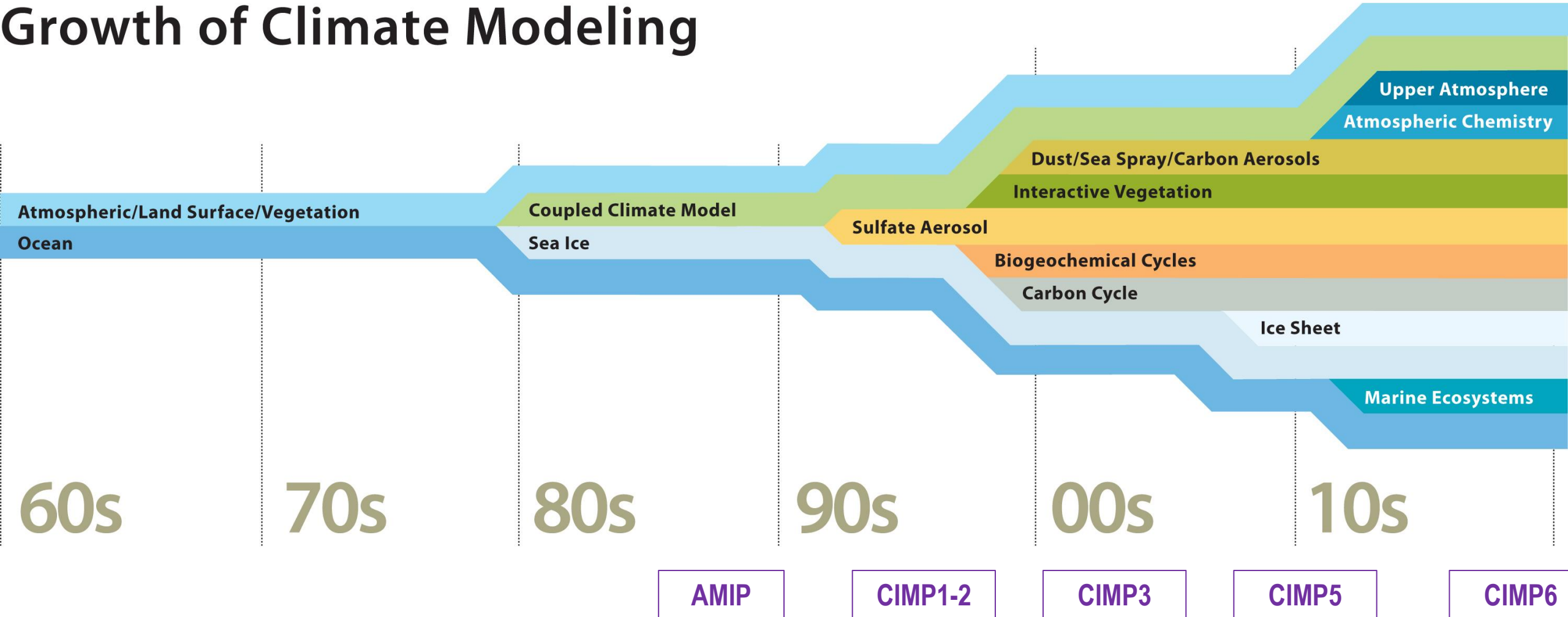
Biological/ecosystems

- [Marine habitats](#)
- [Plankton](#)

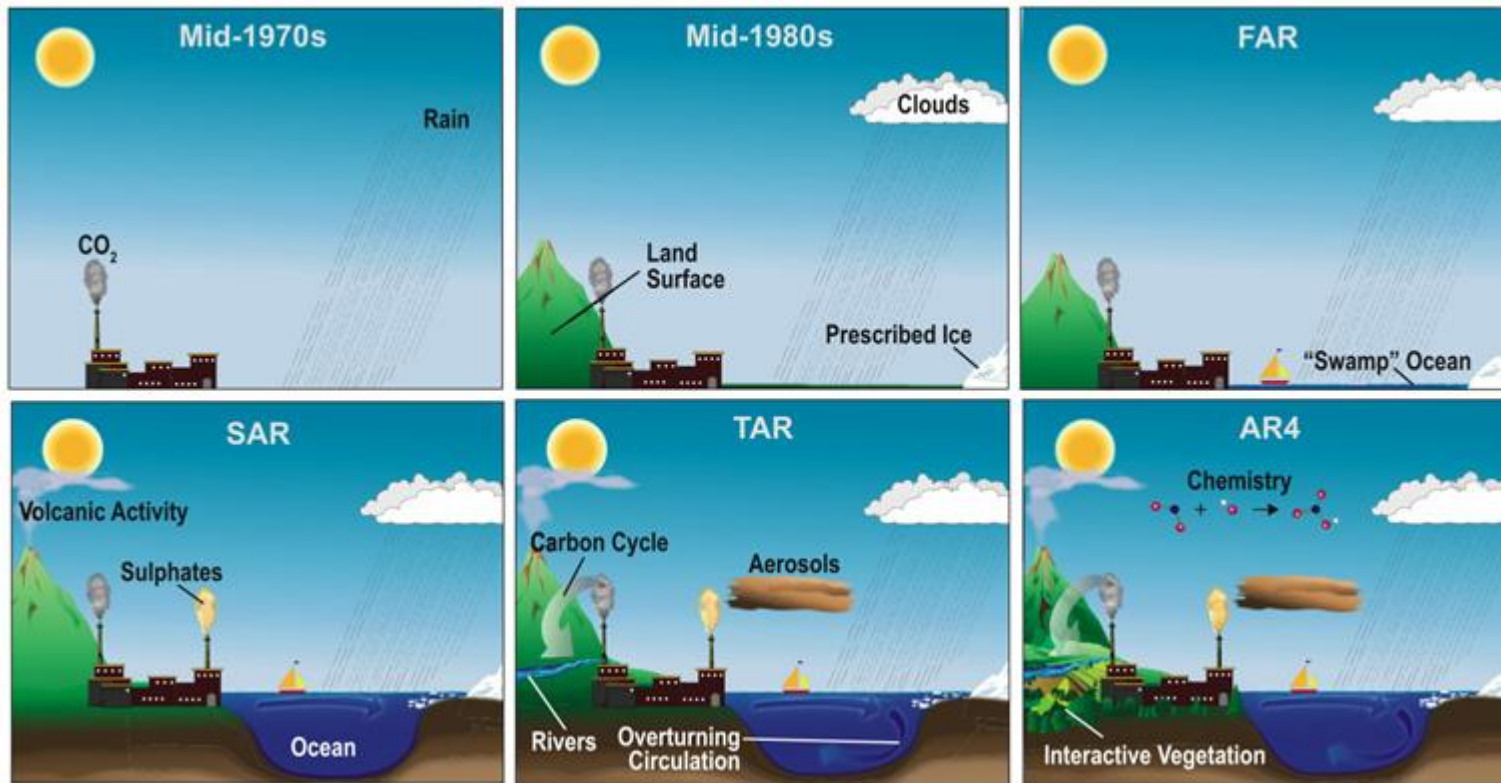
Essential Climate Variables (ECV) datasets provide the empirical evidence needed to understand and predict the evolution of climate

Essential Climate Variables by GCOS, available through <https://gcos.wmo.int/en/essential-climate-variables/table>

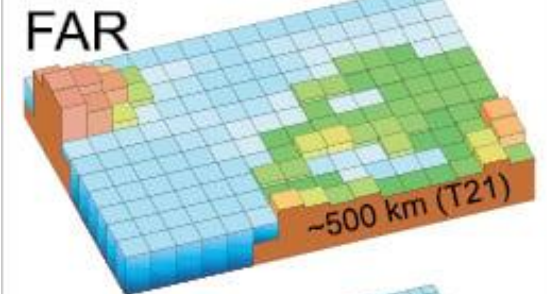
Growth of Climate Modeling



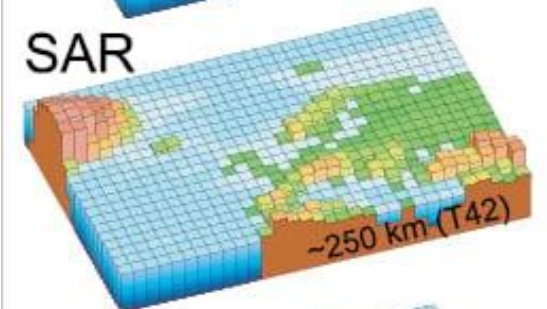
The Evolution of Climate Models



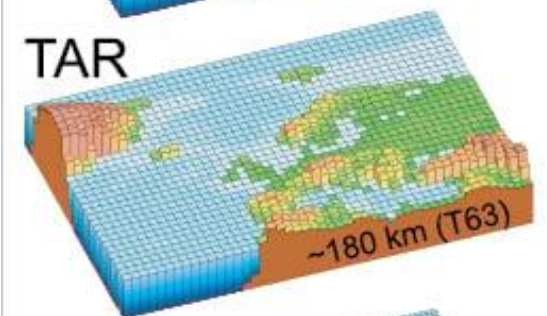
1990



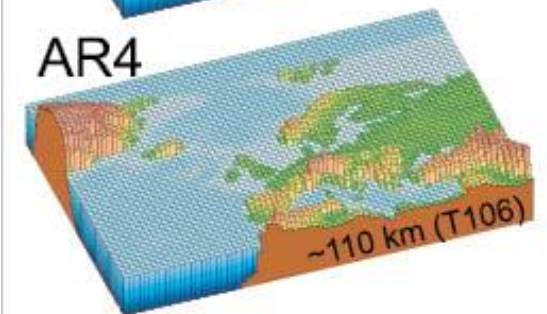
1995



2001



2007



Geographic resolution characteristic of the generations of climate models used in the IPCC Assessment Reports

Image: FAR (IPCC, 1990), SAR (IPCC, 1996), TAR (IPCC, 2001a), and AR4 (2007).

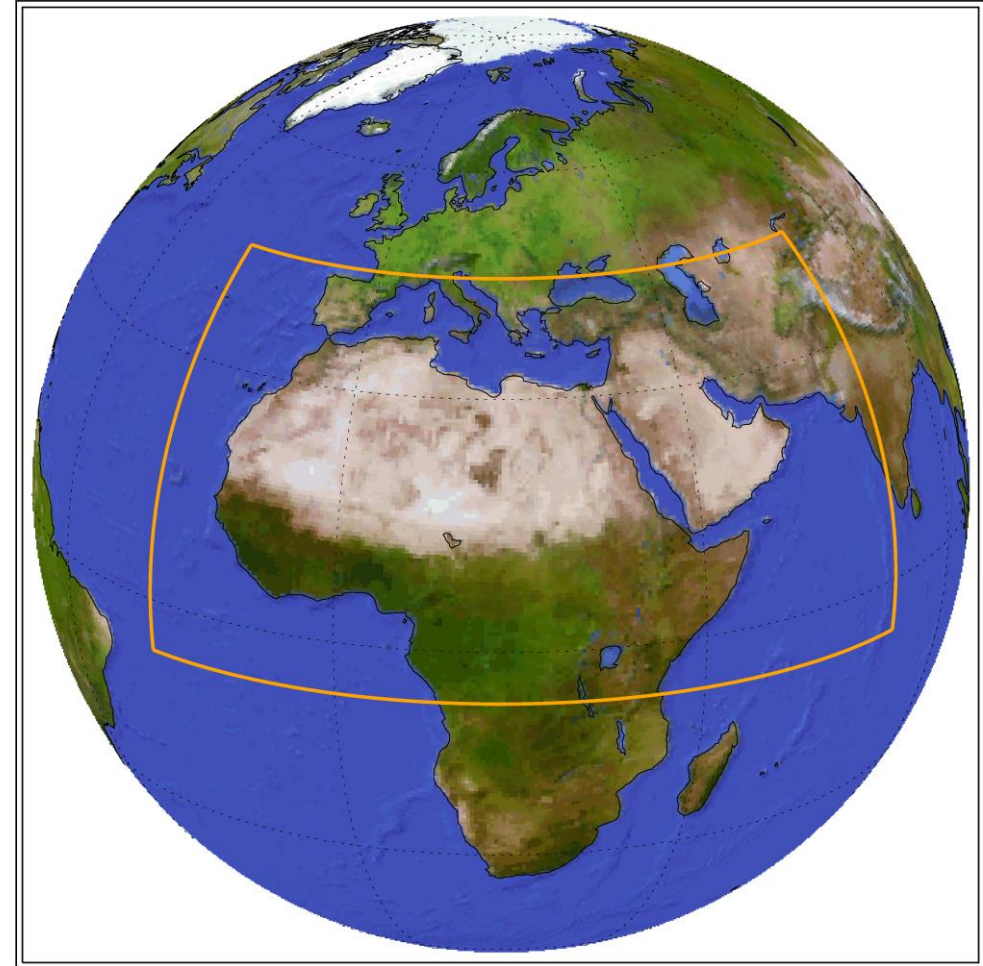
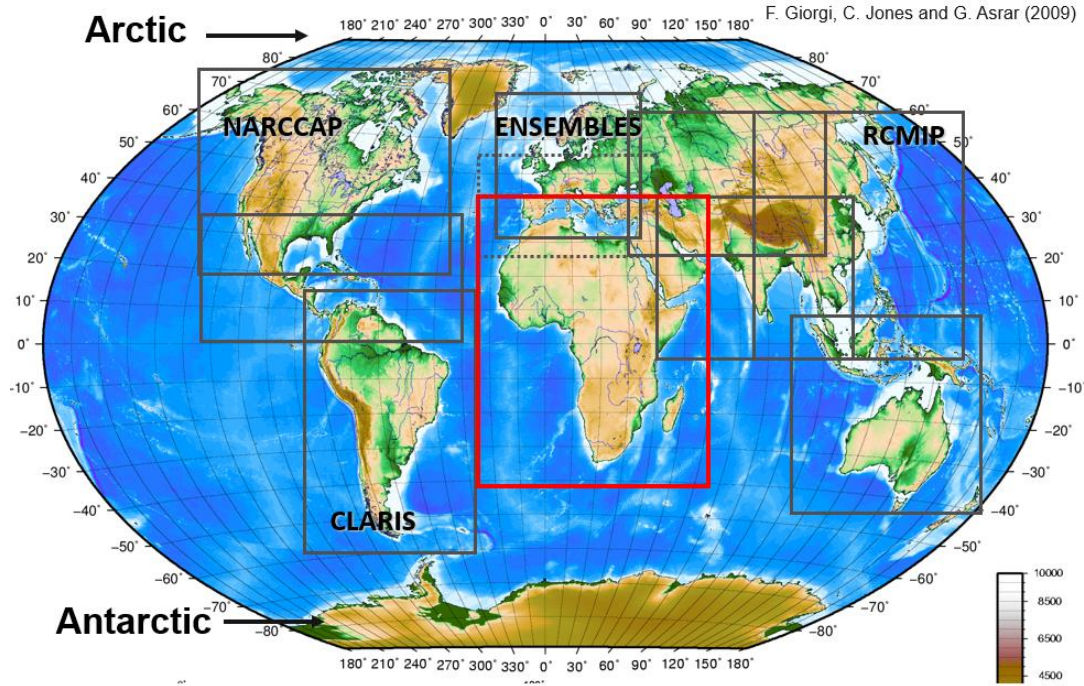
CORDEX Domain Region 13

Middle East/ North Africa

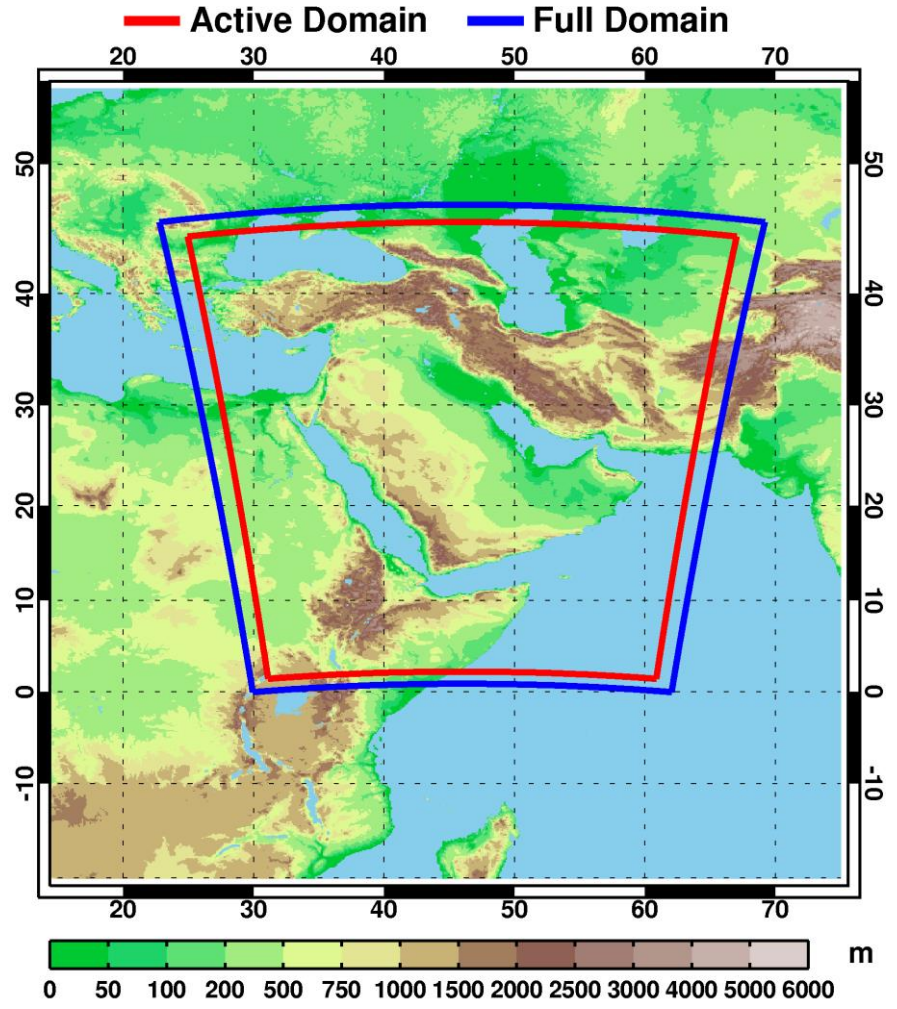
Initial CORDEX Domains

Coordinated Regional Climate Downscaling Experiment

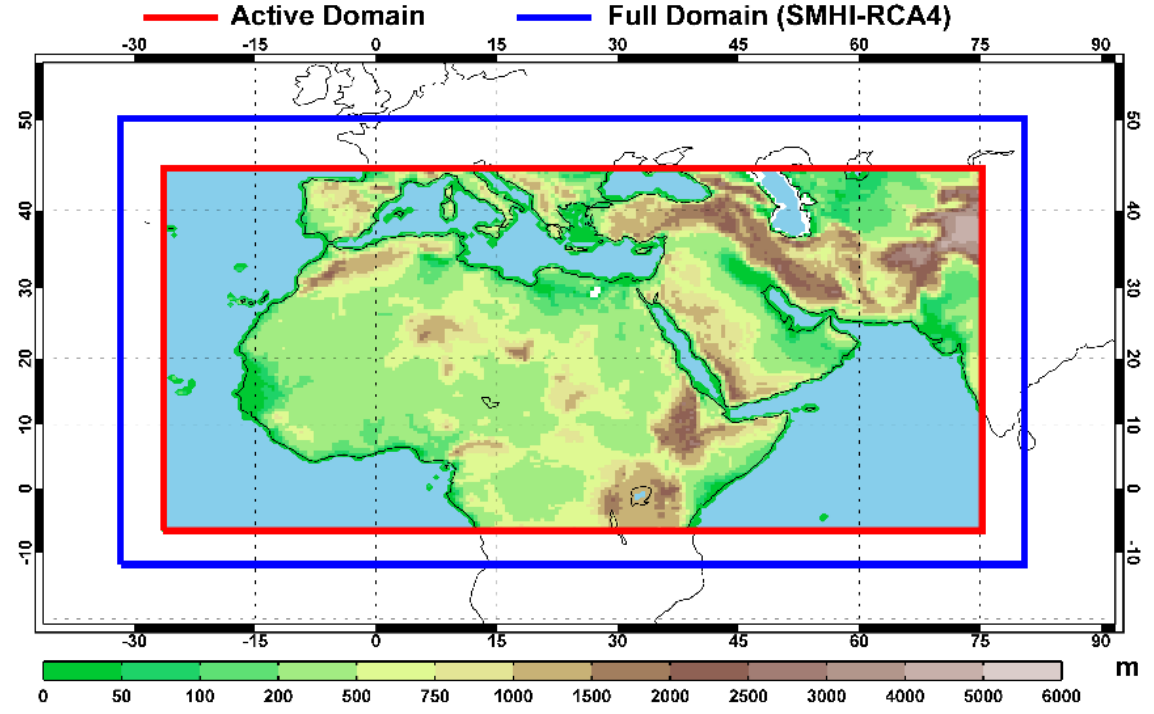
F. Giorgi, C. Jones and G. Asrar (2009)



**RICCAR Mashreq Domain | 10km | MSH-10
HCLIM-ALADIN (SMHI)**

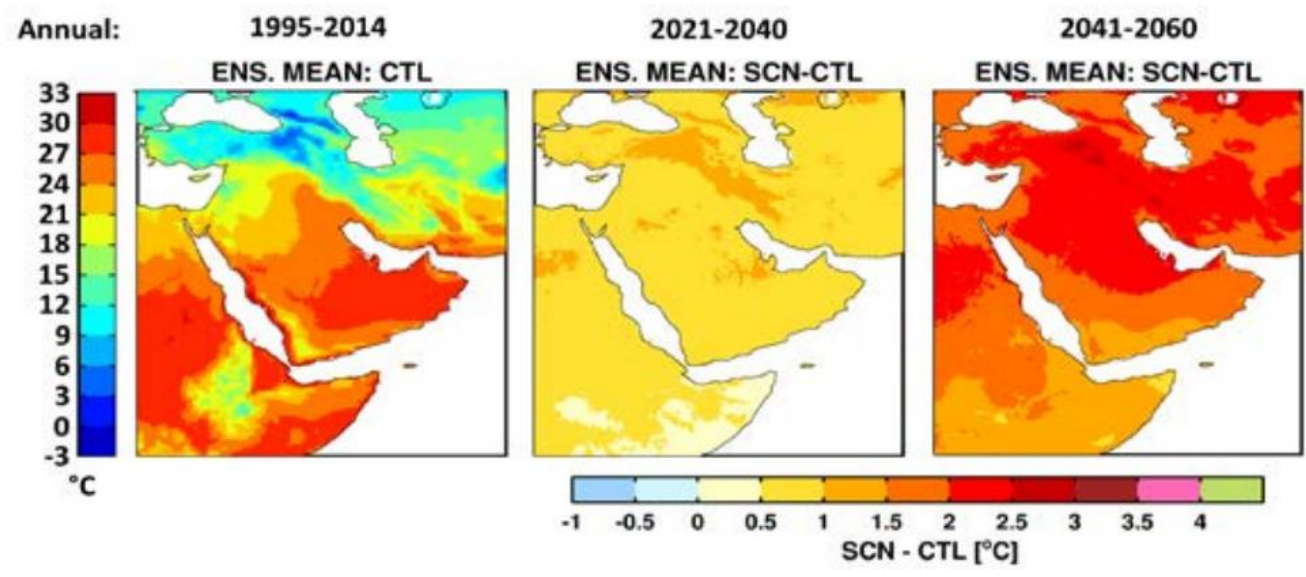


CORDEX-MENA/Arab Domain | 0.44° (50 km)

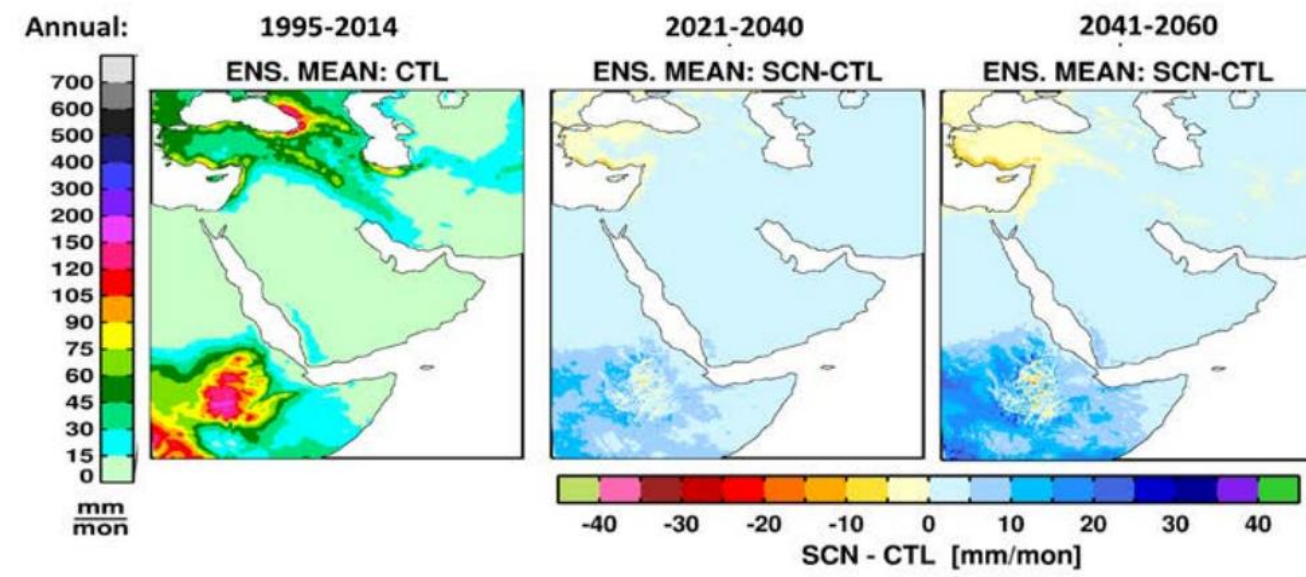


Mashreq Domain	Arab Domain
10 km ²	50 km
SSP-8.5	RCP 4.5 – 8.5

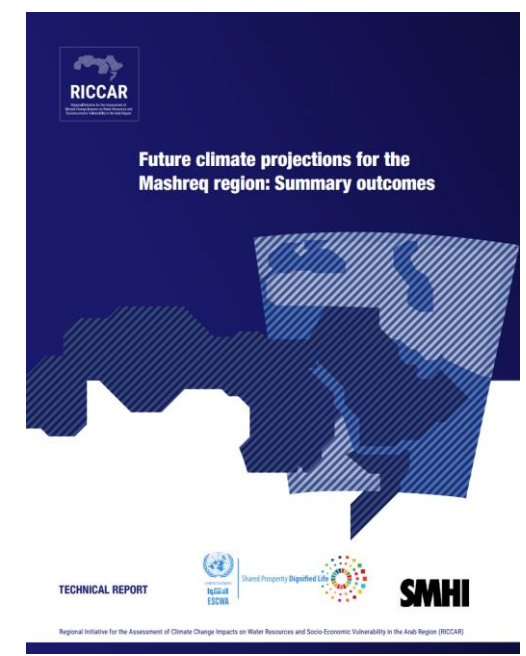
Mean temperature change (°C)



Mean precipitation change (mm/month)



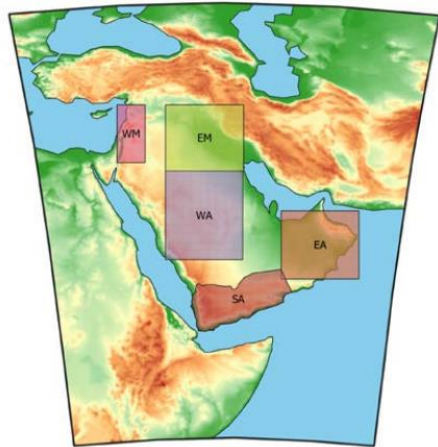
Source
riccar.org



متوفر بالعربية
Available in Arabic

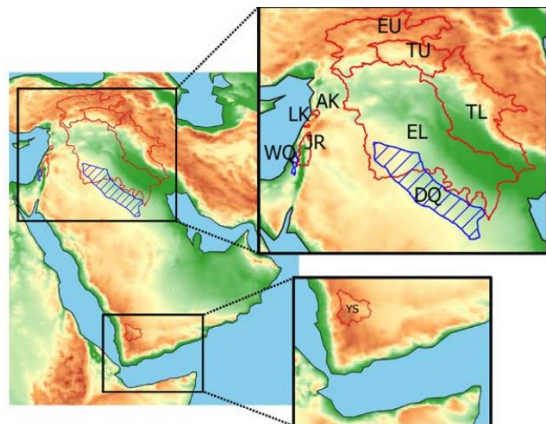
Summary of projection results for the Euphrates river headwaters

Location map showing sub-region areas identified for highlighted analysis



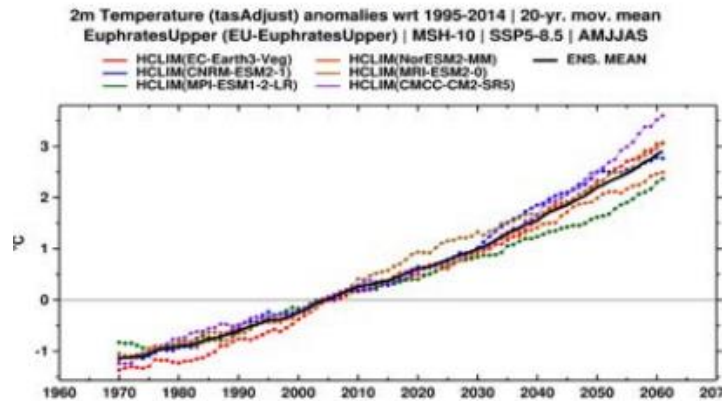
- WM - WEST MASHREQ
- EM - EAST MASHREQ
- WA - WEST ARABIAN PENINSULA
- EA - EAST ARABIAN PENINSULA
- SA - SOUTH ARABIAN PENINSULA

Location map showing river basins and recharge areas identified for highlighted analysis

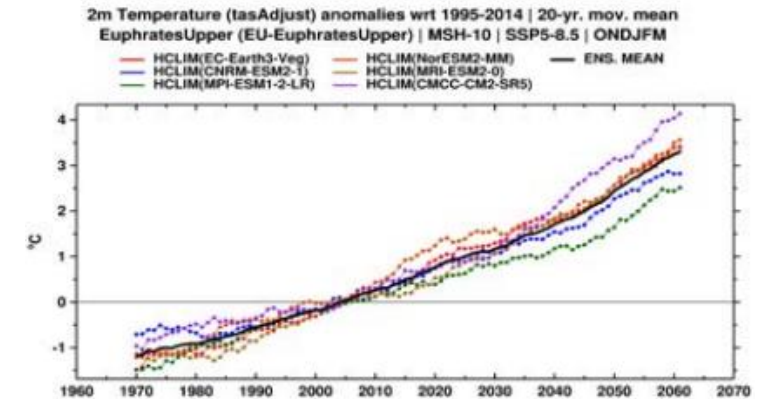


- EU - EUFRATES HEADWATERS
- EL - EUFRATES LOWER
- TU - TIGRIS HEADWATERS
- TL - TIGRIS LOWER
- AK - NAHR AL-KABIR
- LK - NAHR AL-KALB
- JR - JORDAN RIVER WEST
- WQ - WESTERN AQUIFER
- DQ - DAMMAN AQUIFER NORTH
- YS - SANAA BASIN

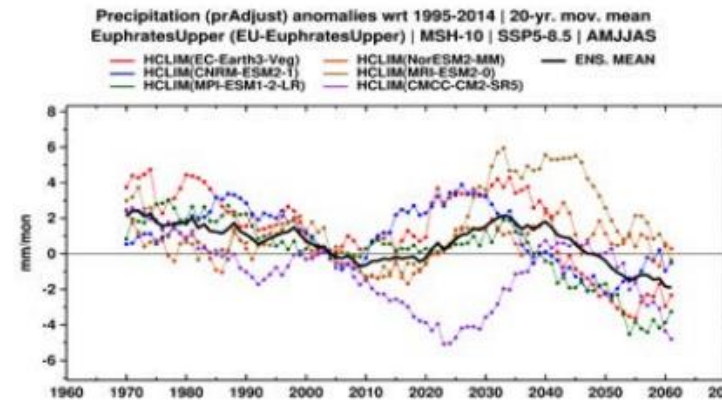
Temperature change (April-September)



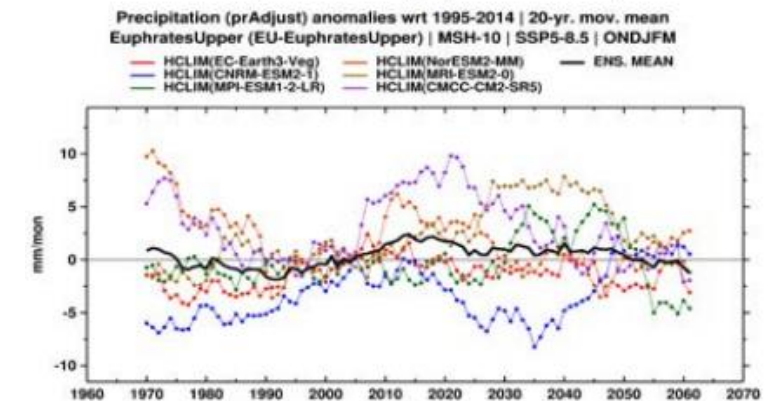
Temperature change (October-March)



Precipitation change (April-September)



Precipitation change (October-March)



Note: The background colours on the map indicate topography where brown shows higher elevations and green designates lower elevations.

Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region

KNOWLEDGE RESOURCES

The central aim of this Regional Knowledge Hub is to provide access to information that can facilitate cooperation, coordination, dialogue and exchange among Arab States, organizations

DATA PORTAL

The data portal allows interactive visualization of RICCAR maps and provides access to RICCAR data repository.



KNOWLEDGE NODES

Innovation of National, Regional and International Nodes for the Transfer and Sharing of Knowledge

PARTNERSHIPS

Strategic partnerships for supporting strategic objectives to implement climate change adaptation and mitigation programs at the national and regional levels

Request Data

<https://riccar.org/>



Mashreq Domain

Bias-adjusted ensemble mean

Reference period (1995-2014)

Near-term (2021-2040)

Mid-term (2041-2060)

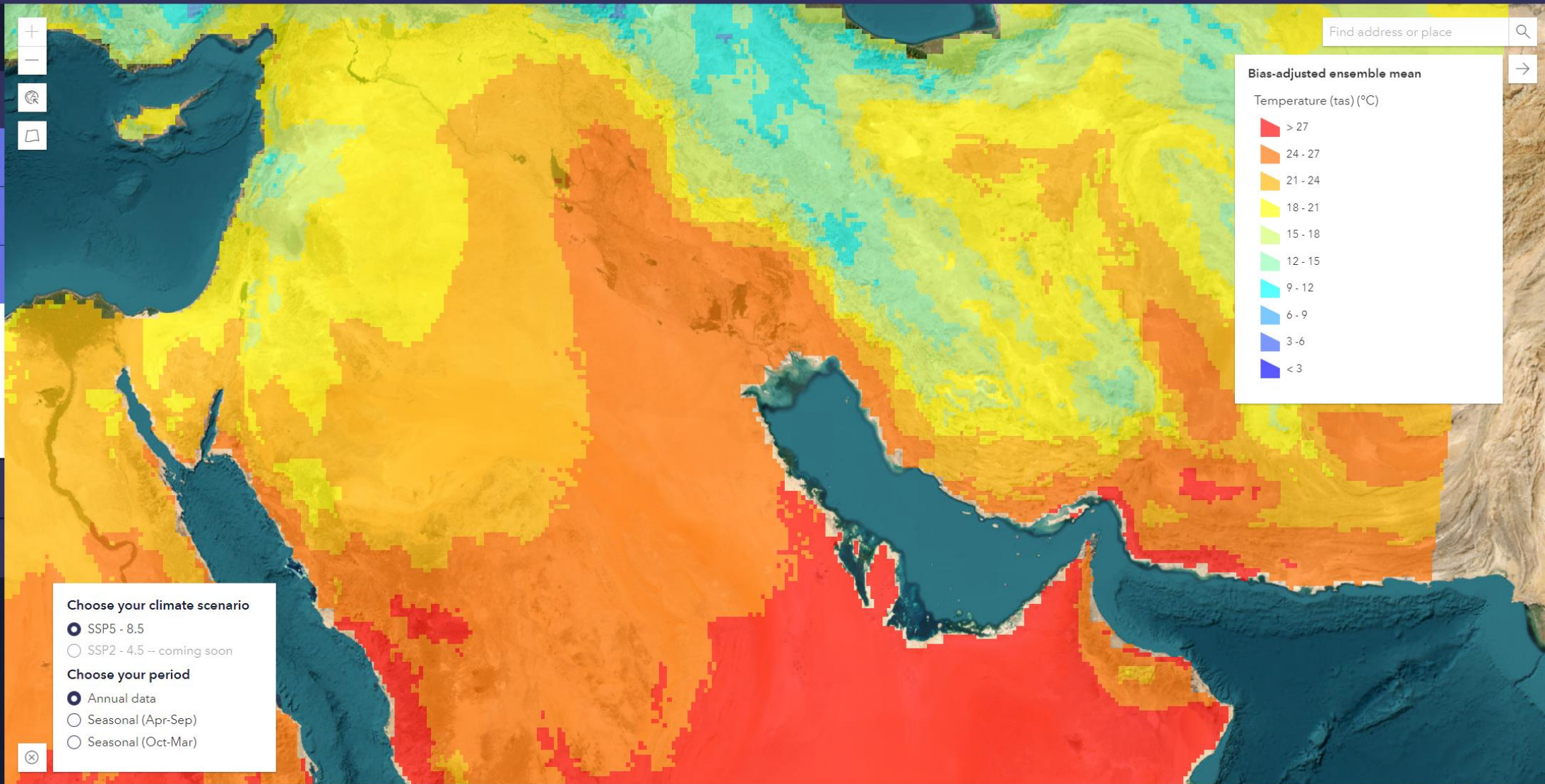
Change in temperature (tas)

Change in minimum temperature (tmin)

Change in maximum temperature (tmax)

RAW RCM ensemble mean

Upload your shapefile



Bias-adjusted ensemble mean

Temperature (tas) (°C)

- > 27
- 24 - 27
- 21 - 24
- 18 - 21
- 15 - 18
- 12 - 15
- 9 - 12
- 6 - 9
- 3 - 6
- < 3

Choose your climate scenario

SSP5 - 8.5

SSP2 - 4.5 -- coming soon

Choose your period

Annual data

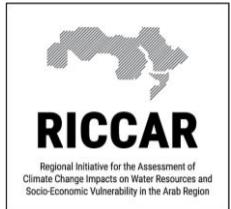
Seasonal (Apr-Sep)

Seasonal (Oct-Mar)

Earthstar Geographics

Powered by Esri

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RICCAR Knowledge Resources



About Data Portals Knowledge Resources Meetings & Events Knowledge Nodes Partners



- All
- Main Reports
- Technical Reports
- Technical Notes
- Training Materials
- Booklets
- Request Data

Vulnerability assessment of the water sector to climate change in Jordan

TECHNICAL REPORT

Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region (RICCAR)

Climate-proof Watershed Management Design and Resilience Synthesis Report

TECHNICAL REPORT

Sweden Sverige

Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region (RICCAR)

Directives de gestion des bassins versants et de leur résilience à l'épreuve du climat : bassins versants algériens

RAPPORT TECHNIQUE

Sweden Sverige

Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region (RICCAR)

Impact of climate change on groundwater resources in the Dibdibba aquifer system, Iraq

TECHNICAL REPORT

Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region (RICCAR)

Regional climate modelling outputs for Saudi Arabia: Key findings

TECHNICAL REPORT

Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region (RICCAR)

A training manual for agricultural extension agents:

The use of RICCAR climate data in a crop model (APSIM) to identify context-based climate adaptation and mitigation options.

TECHNICAL REPORT

ICARDA Sida

Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region (RICCAR)

Impact of climate change on shared water resources in the Nahr el Kabir el Janoubi basin

TECHNICAL REPORT

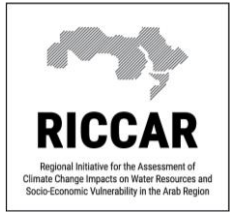
Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region (RICCAR)

Guidelines on the use of climate data for improving agricultural productivity

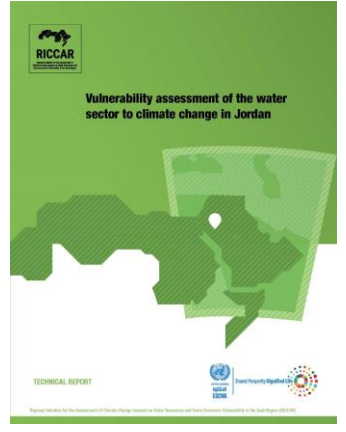
TECHNICAL NOTE

Sweden Sverige

Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region (RICCAR)



Vulnerability Assessments of the water and agriculture sectors to Climate Change in the Arab region

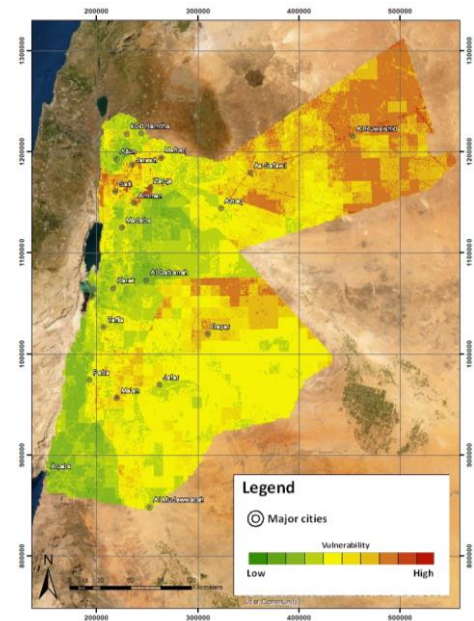


Vulnerability assessment of the water sector to climate change in Jordan

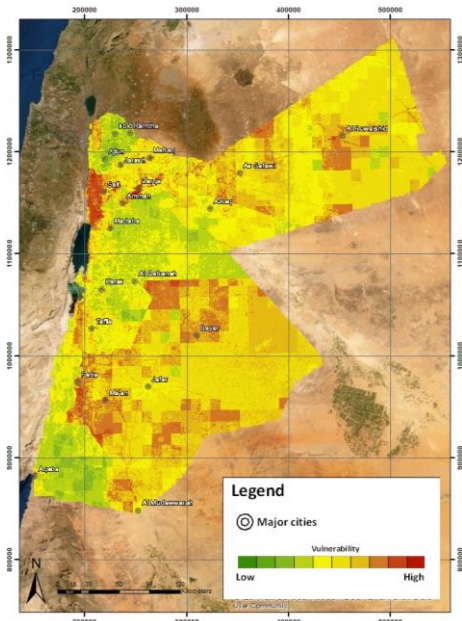
E/ESCWA/CL1.CCS/2022/RICCAR/TECHNICAL REPORT.16

<https://www.unescwa.org/publications/vulnerability-assessment-water-sector-climate-change-jordan>

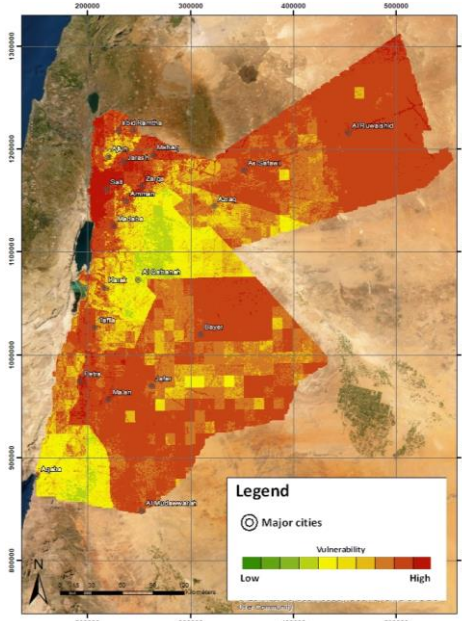
Jordan



Reference period (1995-2014)



Near term (2021-2040)



Mid term (2041-2060)

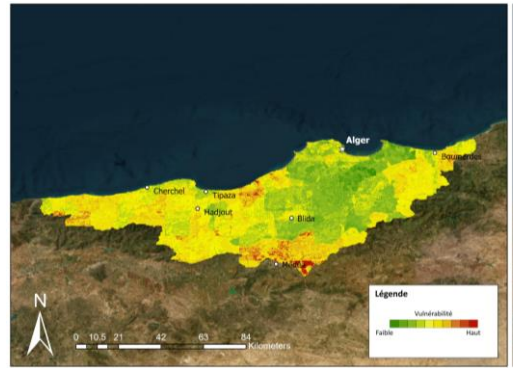


Directives de gestion des bassins versants et de leur résilience à l'épreuve du climat : bassins versants algérois

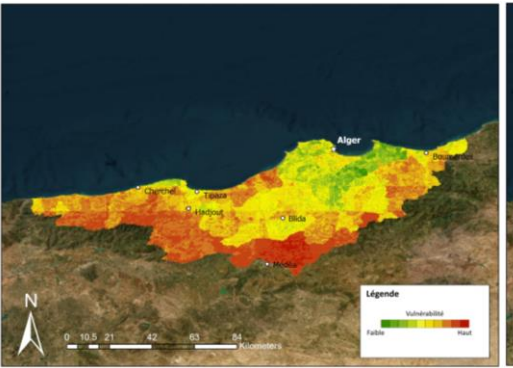
E/ESCWA/CL1.CCS/2022/RICCAR/Technical Report.13

<https://www.unescwa.org/publications/directives-de-gestion-des-bassins-versants-et-de-leur-resilience-a-l-epreuve-du-climat>

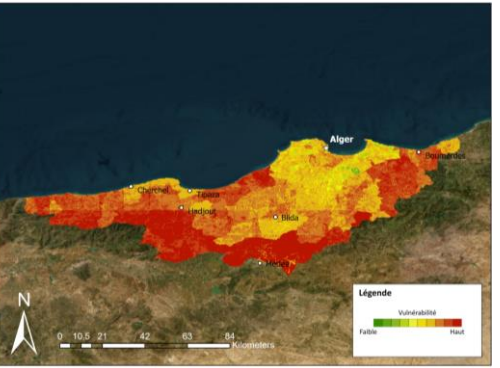
Algerois watershed, Algeria



Reference period (1986-2005)



Near term (2021-2040)



Mid term (2041-2060)

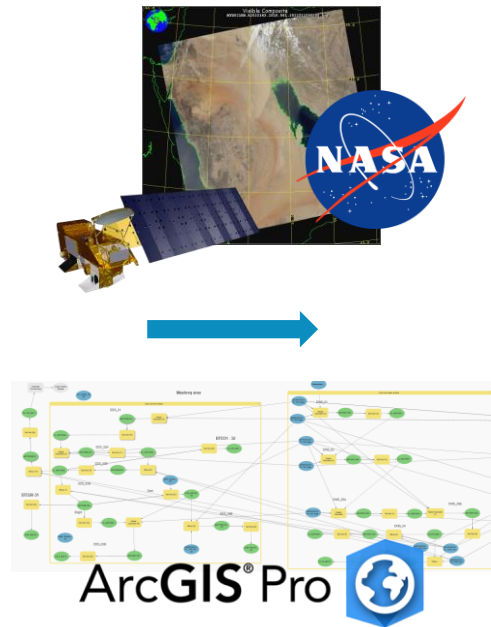
Major Sand and Dust Storms Events Over the Arabian Peninsula

SDS Mapping using MODIS MYD021KM Products

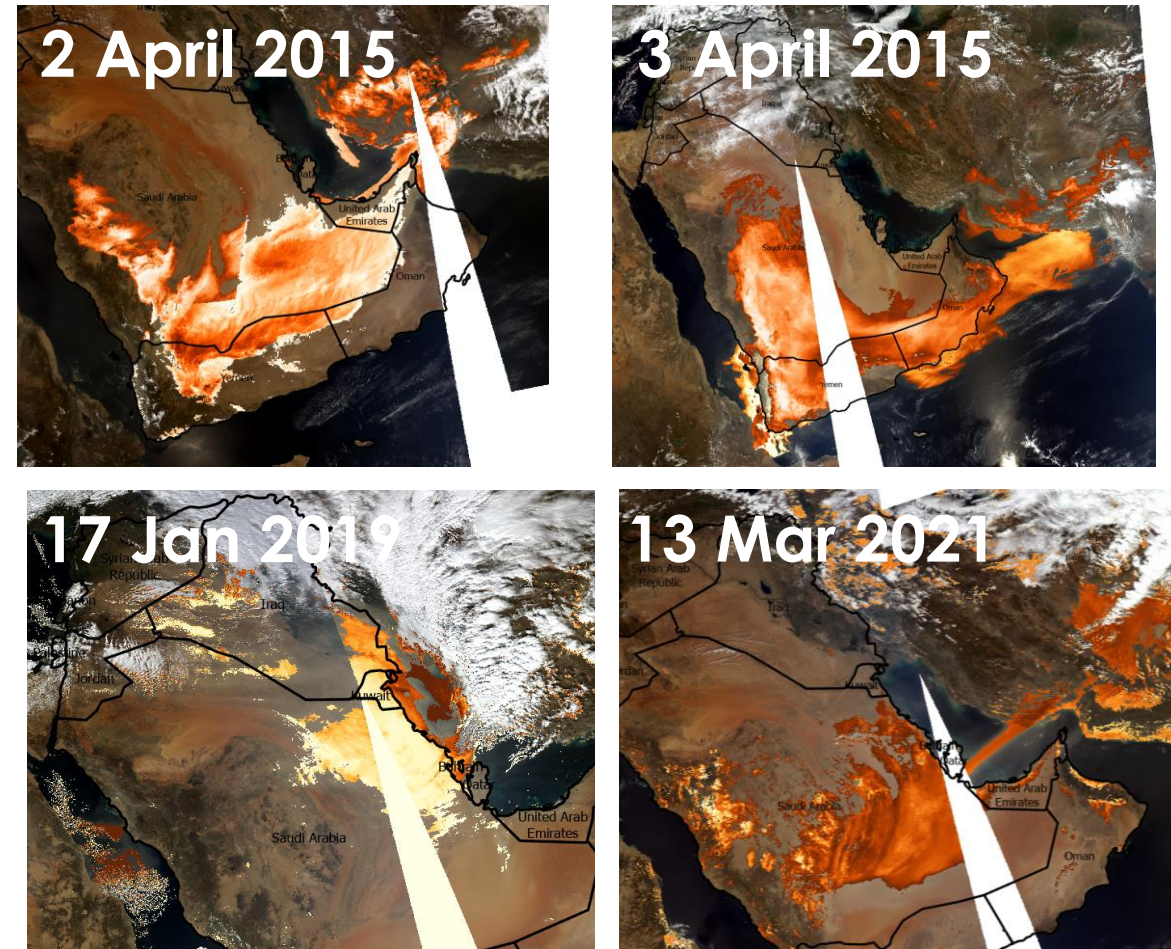
RGB Truecolor images



Analytical Framework



Storm Extent



Dust coverage



RICCAR

Regional Initiative for the Assessment of
Climate Change Impacts on Water Resources and
Socio-Economic Vulnerability in the Arab Region

ESCWA at COP 28

Sunday 3 December 9:00 - 10:00 RCREEE Pavilion	Sustainable Energy Solutions in Conflict Areas to Increase Resilience for the Most Vulnerable	
Sunday 3 December 11:30 - 13:00 SE Room 9	Arab Cooperation for Climate Action in Water, Energy and Food Systems	
Sunday 3 December 14:30 - 15:30 SDG Pavilion	Cross-Sectoral Rural Development through Renewable Energy Access	
Monday 4 December 9:00 - 10:30 LAS Pavilion	Carbon Markets for Sustainable Energy Transitions: Insights and Pathways for the Arab Region	
Monday 4 December 12:00 - 13:00 LAS Pavilion	Climate Resilience and Finance in the Arab Region	
Monday 4 December 16:00 - 17:30 Action Room 2	Regional Platforms for Climate Finance: Unlocking Climate Finance Flows through Project Acceleration	
Tuesday 5 December 9:00 - 11:00 UNFCCC Pavilion	Global Energy Interconnection: Advancing Just and Inclusive Energy Transition	
Tuesday 5 December 11:00 - 12:30 LAS Pavilion	Unlocking Clean Hydrogen as Decarbonization Pathway for the Arab Region	
Tuesday 5 December 13:00 - 14:30 LAS Pavilion	Powering the Arab Future: The Pan-Arab Electricity Market Progress and Vision	



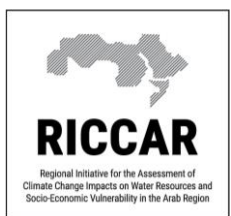
Shared Prosperity Dignified Life



ACCPC
ARAB CENTRE FOR CLIMATE CHANGE POLICIES
المركز العربي لسياسات تغير المناخ



**COP28
UAE**



Tuesday 5 December 15:00 - 15:45 Arena 3	Liquefied Petroleum Gas (LPG) for Clean Cooking	
Wednesday 6 December 11:00 - 12:30 RCREEE Pavilion	Accelerating the Adoption and Integration of Electric Vehicles in the Arab Region's Transport Sectors	
Wednesday 6 December 11:30 - 13:00 Room 4	Responsible and Inclusive Management of Critical Energy Transition Minerals	
Wednesday 6 December 13:00 - 14:30 LAS Pavilion	Innovation for Sustainable Energy Transition in the Arab Region: Smart Buildings, AI, and Blockchain Applications	
Wednesday 6 December 16:00 - 17:00 Iraq Pavilion	Regional Dialogue on Transboundary Sand and Dust Storms in the Arab Region	
Sunday 10 December 12:00 - 13:00 LAS Pavilion	Enhancing the Resilience of Arab Food Systems in light of Environmental and Climate Challenges: The Role of Rainfed Agriculture	
Sunday 10 December 13:00 - 14:00 Saudi Green Building Forum Pavilion	Discussion Panel on Water Scarcity in the MENA Region	
Sunday 10 December 15:00 - 16:30 RCREEE Pavilion	Water Desalination with Renewable Energies: Challenges and Opportunities in the Arab Region	





Shared Prosperity Dignified Life



Thank you

Presented by: Tarek Sadek – Hasan Awad

Climate Change and Natural Resources
Sustainability Cluster, ESCWA