

Una Rápida Introducción a los modelos CMIP6

Manejo de modelos climáticos usando Python

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Julio 2021

1910

1930

1950

1970

1990

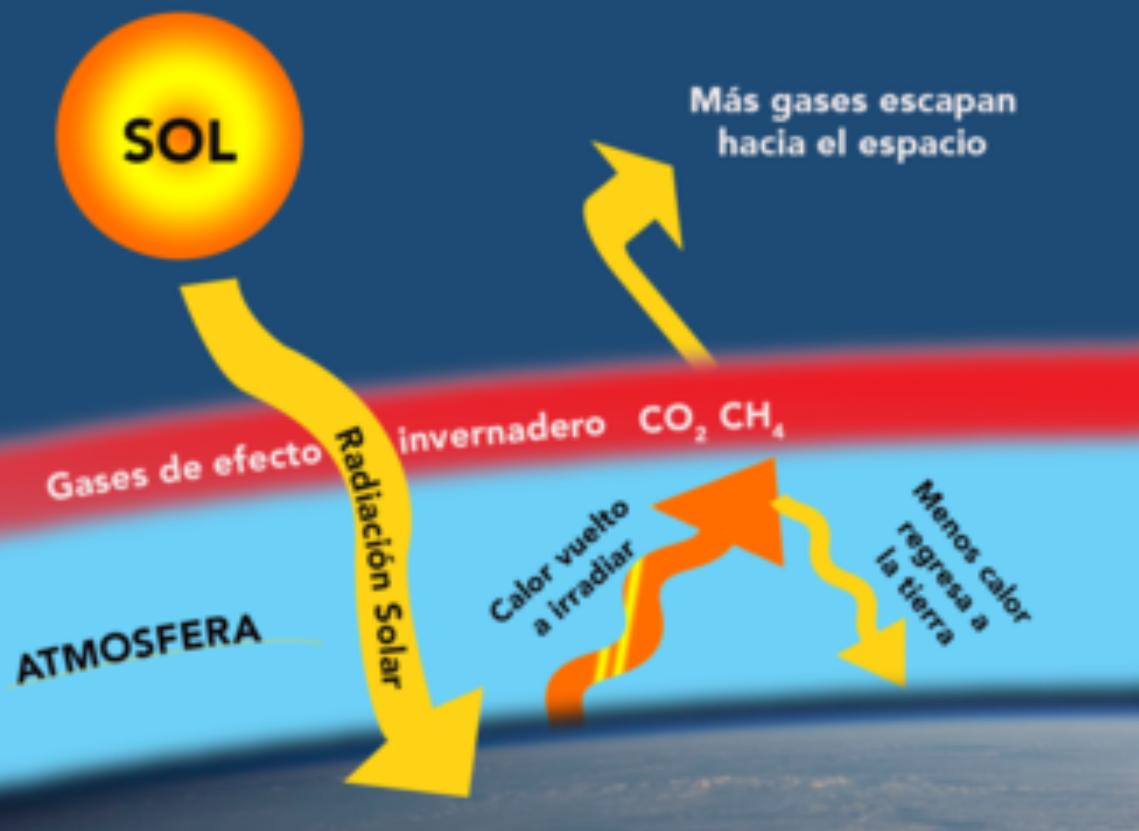
2010

¿QUÉ CONTROLA EL CLIMA DE LA TIERRA?



¿Qué son los gases de efecto invernadero?

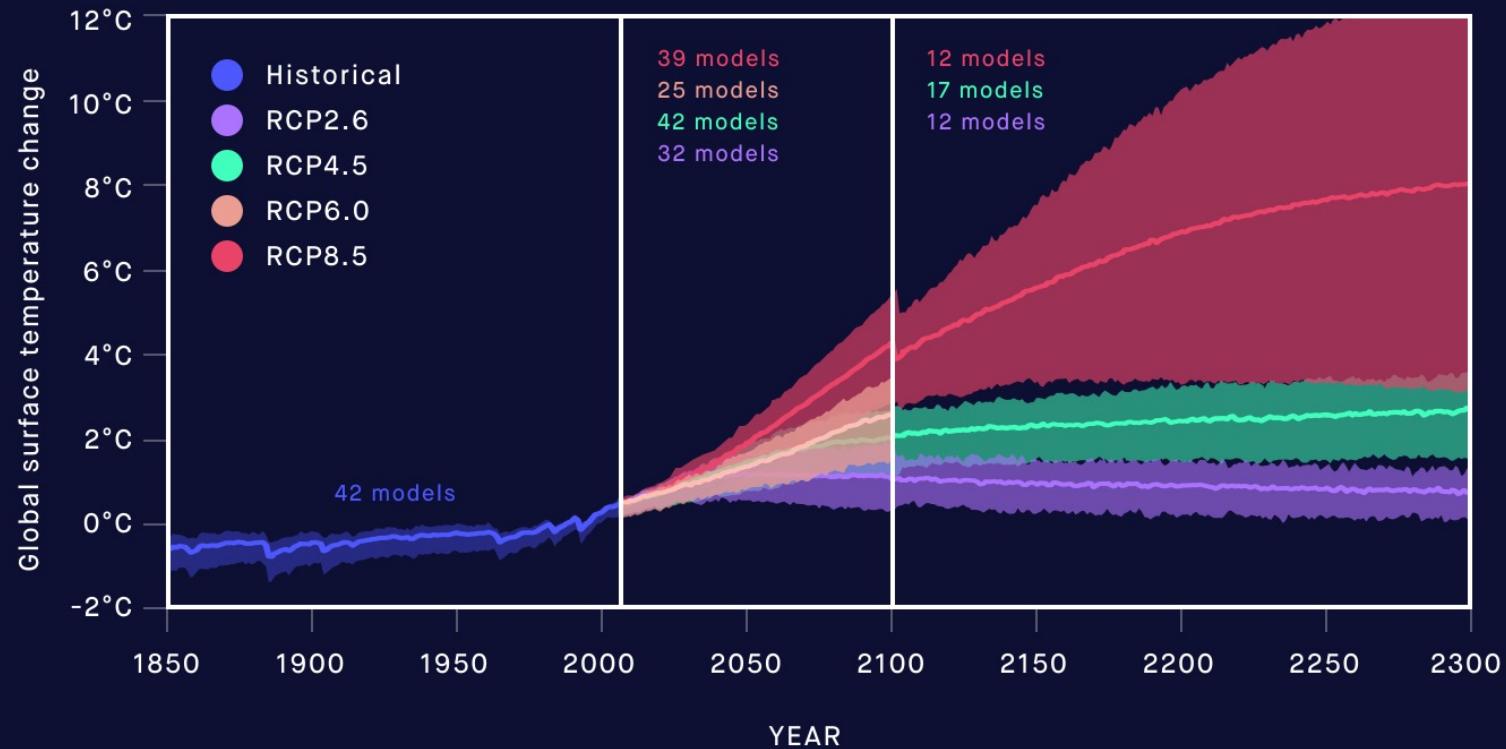
Efecto Natural de gases invernadero



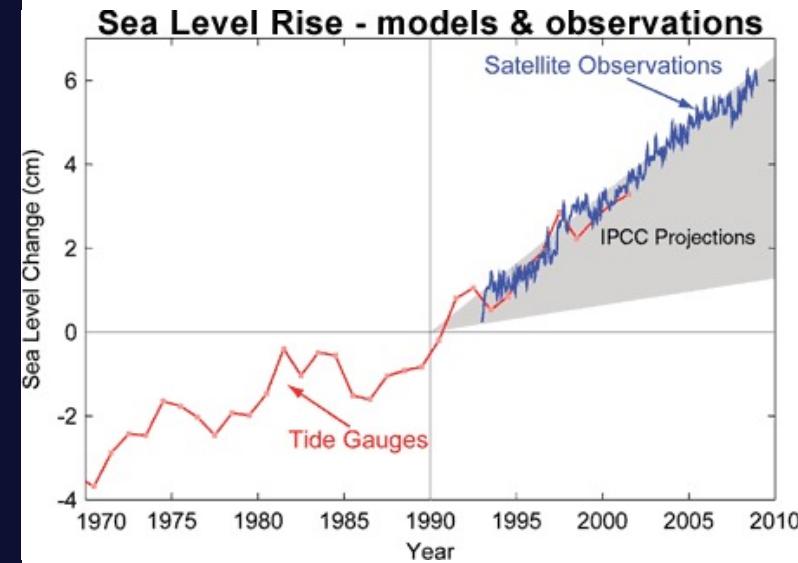
Efecto de gases invernadero aumentado por el hombre



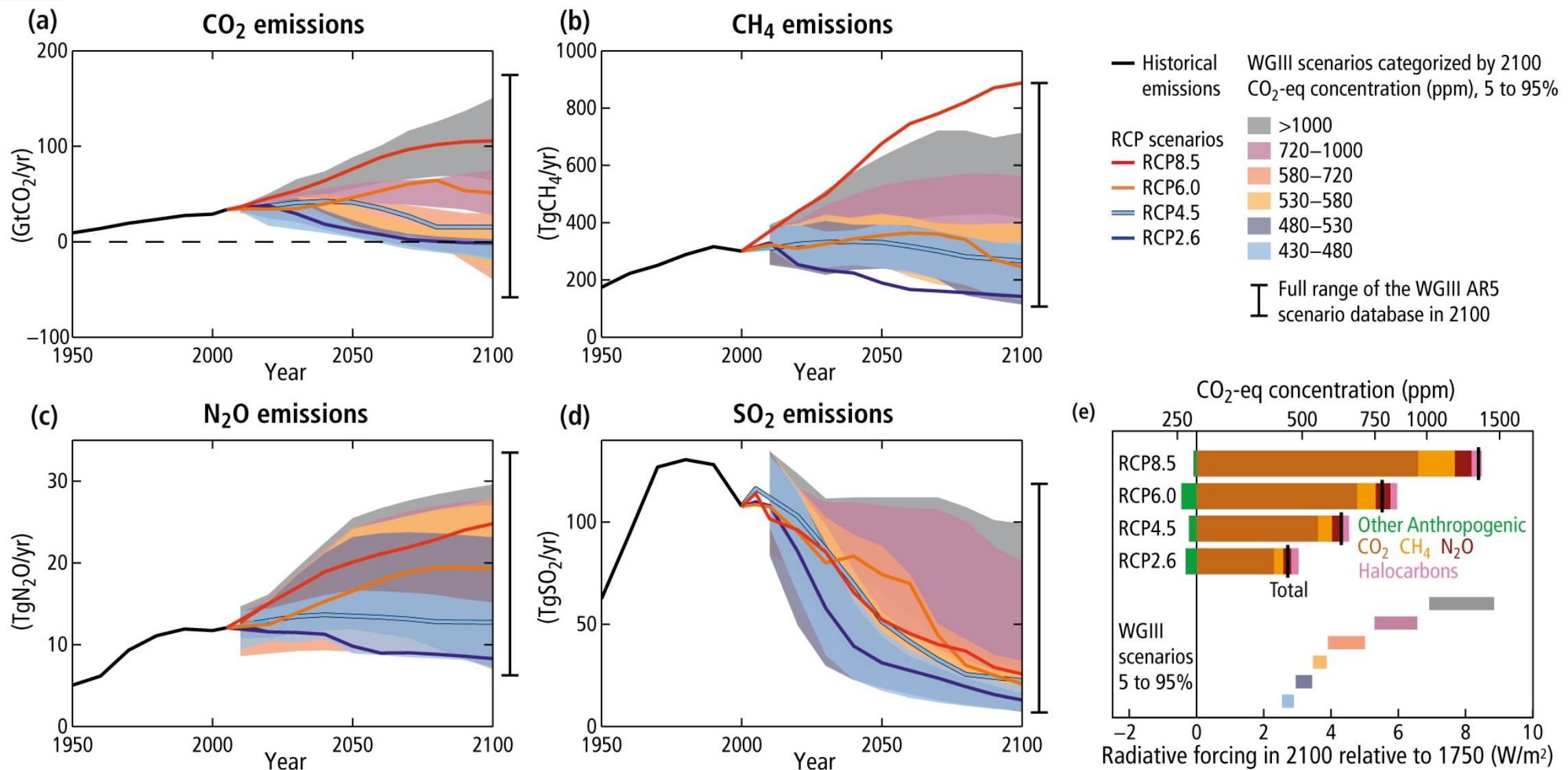
If nothing is done to curb
emissions global mean
temperature may rise by
between 4°C and 13°C by 2300.



Representative Concentration Pathway
RCP

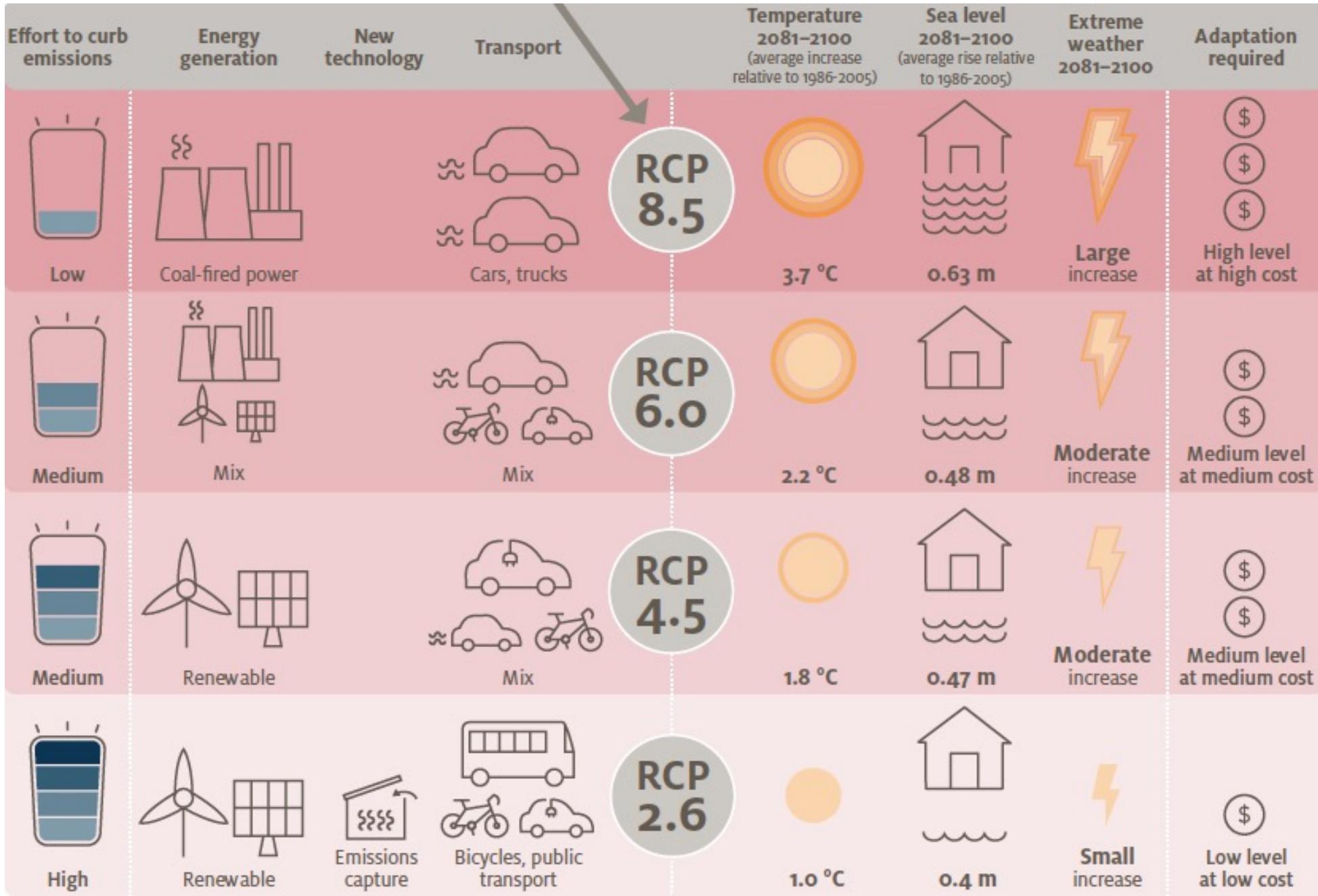


Representative Concentration Pathway (RCP)



The Representative Concentration Pathways (RCPs): Describen cuatro vías diferentes para el siglo XXI en cuanto a emisiones de gases de efecto invernadero (GEI) : concentraciones atmosféricas, emisiones de contaminantes atmosféricos y uso del suelo.

Representative Concentration Pathway (RCP)



World Climate Research Programme
Coupled Model Intercomparison Project

CMIP



WCRP 40
World Climate Research Programme #WCRP40



Proyectos de Intercomparación Modelos Acoplados (CMIP)

Proyectos de Intercomparación
Modelo Acoplado (CMIP). El quinto informe de evaluación (IE5) del IPCC de 2013 presentó modelos climáticos del CMIP5, mientras que el próximo sexto informe de evaluación (IE6) del IPCC de 2021 presentará nuevos modelos CMIP6.

El CMIP6 consistirá en las "corridas" de alrededor de 100 modelos climáticos distintos que se producen en 49 grupos de modelización diferentes.

Grupos de modelización del CMIP6

The figure is a world map illustrating the global distribution of CMIP6/ESGF contributors. The map shows the locations of various research institutions across the globe, represented by their national flags placed on the map. Major oceanic regions are labeled: Pacifico Norte, Atlántico Norte, Pacífico Sur, Atlántico Sur, Océano Índico, and Océano Antártico. A legend on the left side lists 28 contributing institutions, each with its name and a small logo.

Legend of Contributors:

- CCCR-IITM
- CCCma
- CEDA
- CERFACS
- CICERO
- CMA
- CMCC
- CNR-ISAC
- CNRM
- CSIR
- CSIRO
- DKRZ
- DLR
- DMI
- DWD
- ECMWF
- ENEA
- ETH
- FIO
- FMI

Grupos de modelización del CMIP6

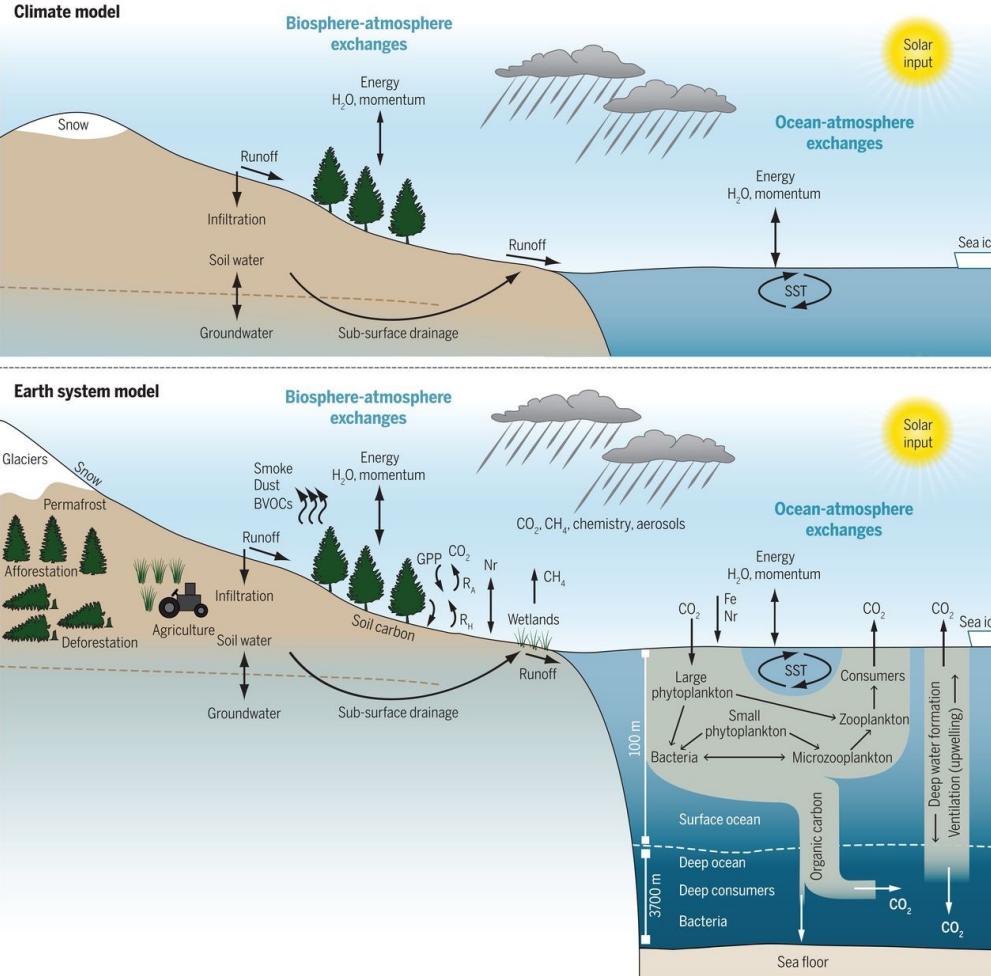
	Institution	Country		Institution	Country		Institution	Country
1	AWI	Germany	12	DOE	USA	23	MRI	Japan
2	BCC	China	13	EC-Earth-Cons	Europe	24	NASA-GISS	USA
3	BNU	China	14	FGOALS	China	25	NCAR	USA
4	CAMS	China	15	FIO-RONM	China	26	NCC	Norway
5	CasESM	China	16	INM	Russia	27	NERC	UK
6	CCCma	Canada	17	INPE	Brazil	28	NIMS-KMA	Republic of Korea
7	CCCR-IITM	India	18	IPSL	France	29	NOAA-GFDL	USA
8	CMCC	Italy	19	MESSY-Cons	Germany	30	NUIST	China
9	CNRM	France	20	MIROC	Japan	31	TaiESM	Taiwan, China
10	CSIR-CSIRO	South Africa	21	MOHC	UK	32	THU	China
11	CSIRO-BOM	Australia	22	MPI-M	Germany	33	Seoul Nat.Uni	Republic of Korea

New in CMIP:

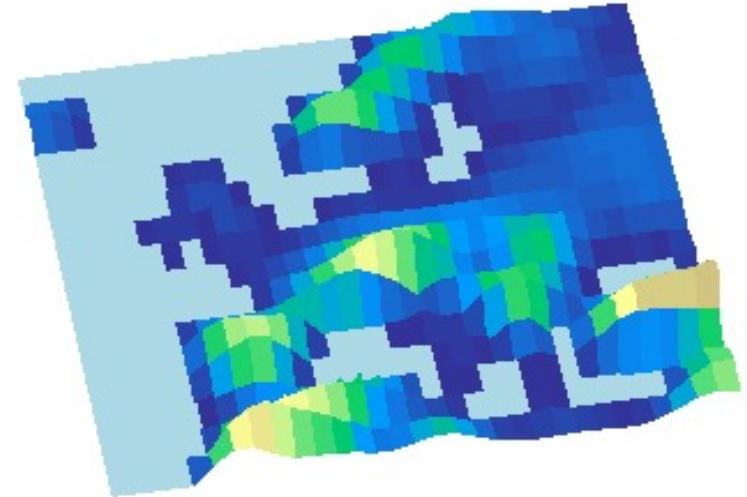
- 2 new model groups from Germany (AWI, MESSY-Consortium)
 - 4 new model groups from China (CAMS, CasESM, NUIST, THU)
 - 1 new model group from Brazil (INPE)
 - 1 new model group from India (CCCR-IITM)
 - 1 new model group from Taiwan, China (TaiESM)
 - 1 new model group from USA (DOE)
 - 2 new model group from Republic of Korea (NIMS-KMA, SAM0-UNICON)
 - 1 new model group from South Africa / Australia (CSIR-CSIRO)
-

More models (>70)
New models
More complex models
Higher resolution models

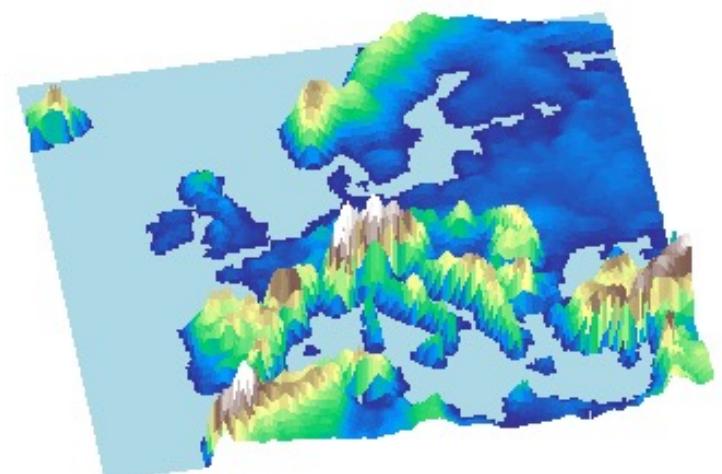
Los modelos aumentan en complejidad y resolución



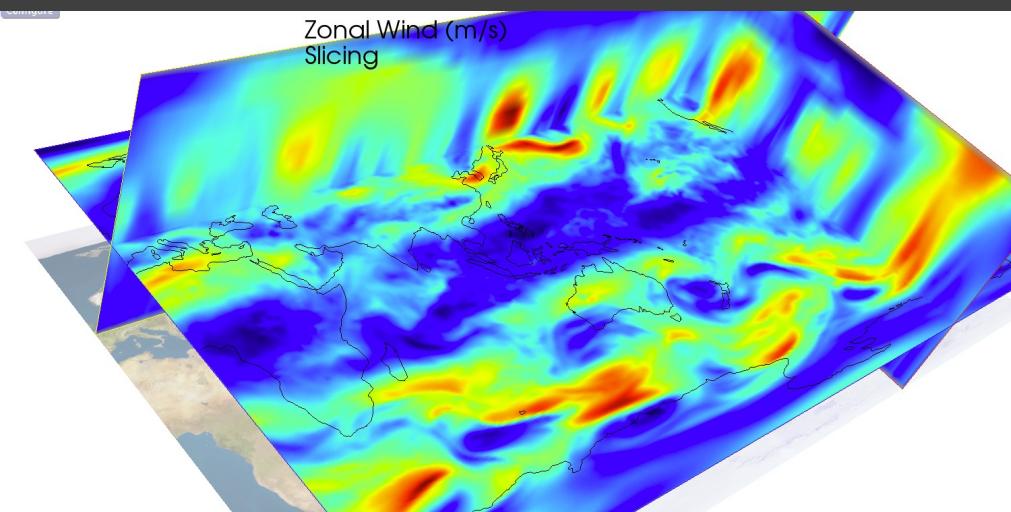
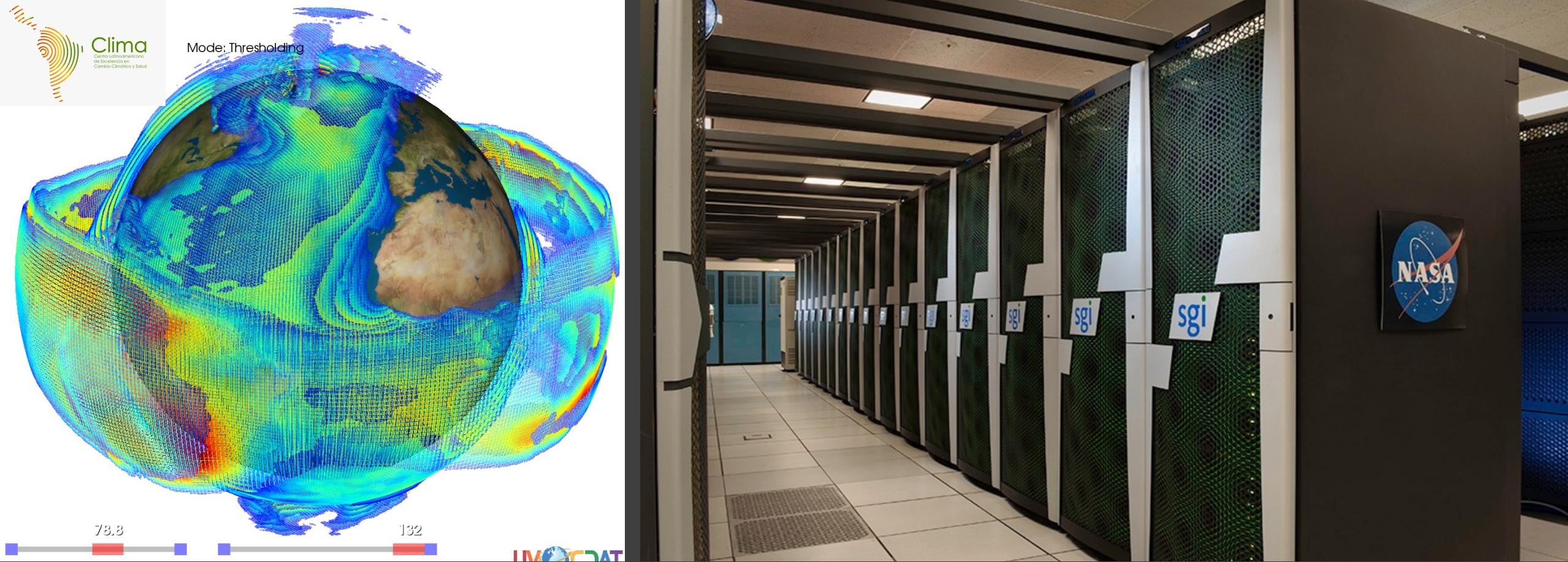
130 km resolución



25 km resolución



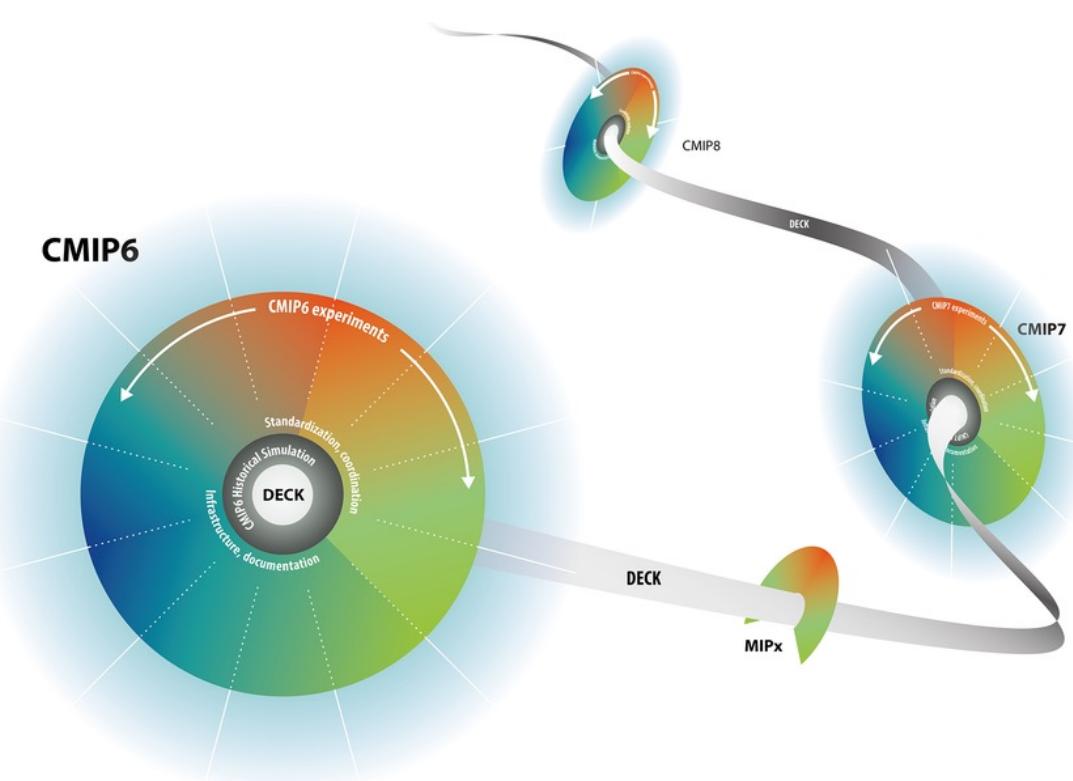
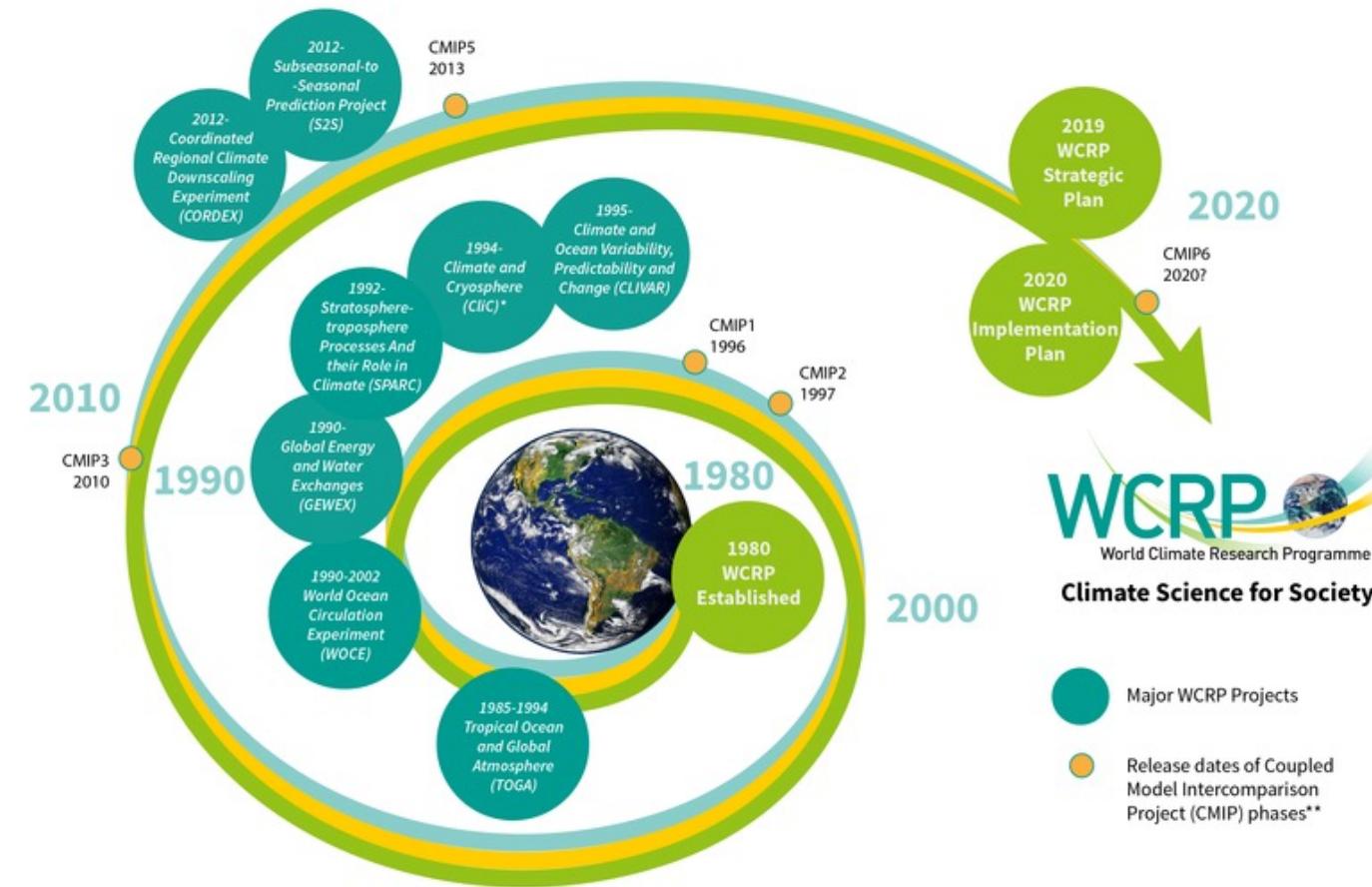
Desde los modelos de circulación general atmósfera-océano, hasta los modelos del sistema terrestre con ciclos biogeoquímicos, desde la baja resolución hasta la alta resolución



Grupos de modelización del
CMIP6 -Supercomputadoras

Fase 6 del CMIP (CMIP6)

Visión general del diseño y la organización de los experimentos de la CMIP



* CliC was formerly the Arctic Climate System Study (ACSYS)

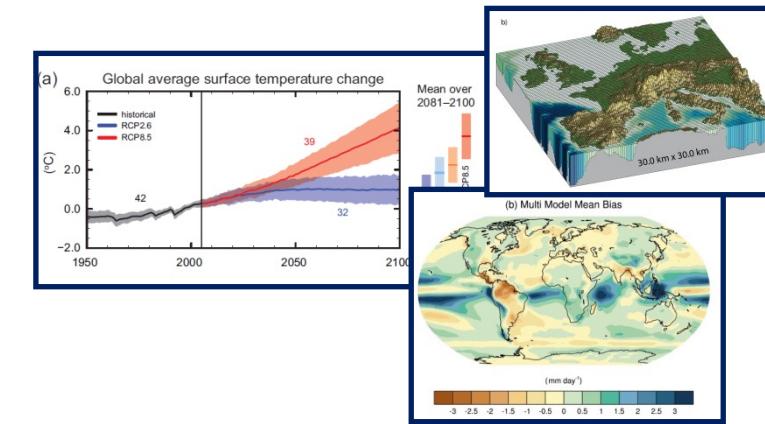
** There was no CMIP4



Diseño del CMIP6: Enfoque científico

El objetivo y el gran reto científico del CMIP6 :

- Son las nubes, la circulación y la sensibilidad del clima:
- Nubes, Circulación y Sensibilidad Climática
- Cambios en la círosfera
- Extremos climáticos
- Aumento regional del nivel del mar
- Disponibilidad de agua
- Predicción del clima a corto plazo
- Ciclos biogeoquímicos y cambio climático.



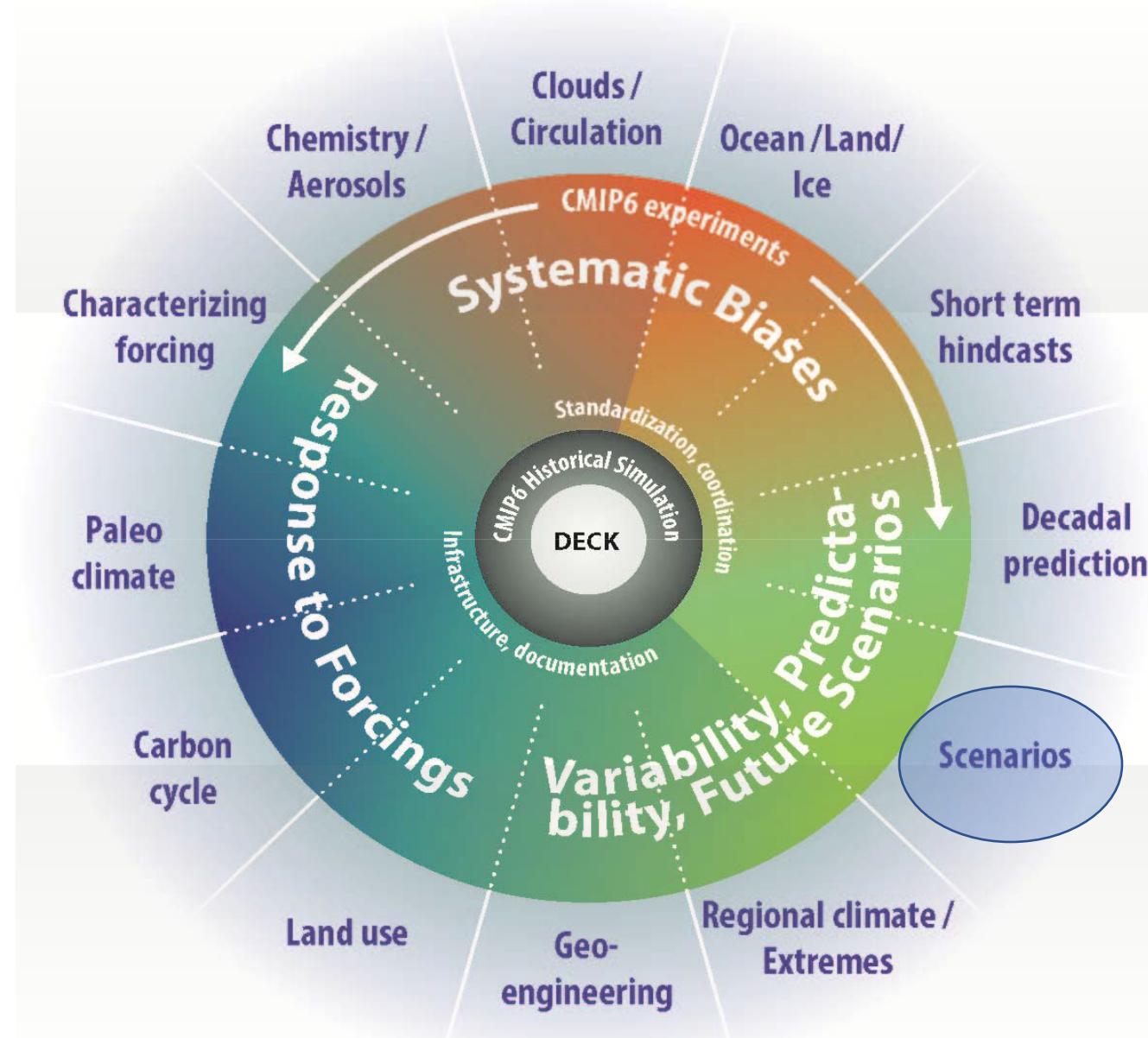
El diseño experimental específico se centra en tres grandes cuestiones científicas:

¿Cómo responde el Sistema Tierra al forzamiento?

¿Cuáles son los orígenes y las consecuencias de los sesgos sistemáticos de los modelos?

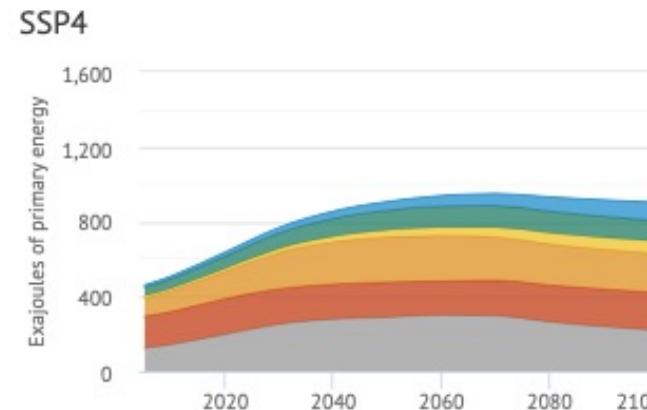
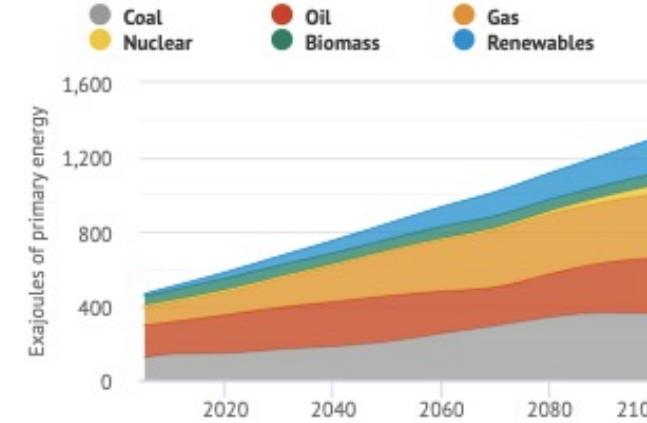
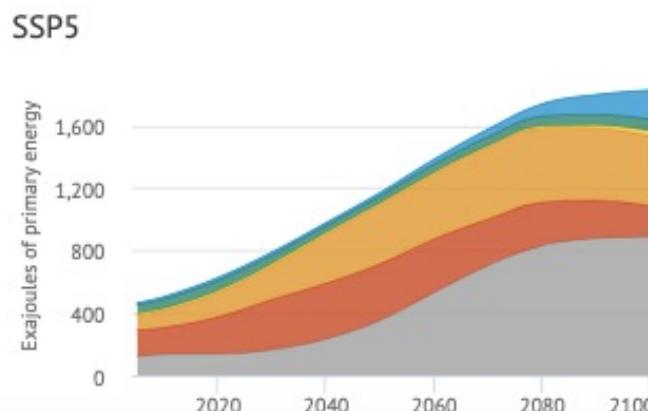
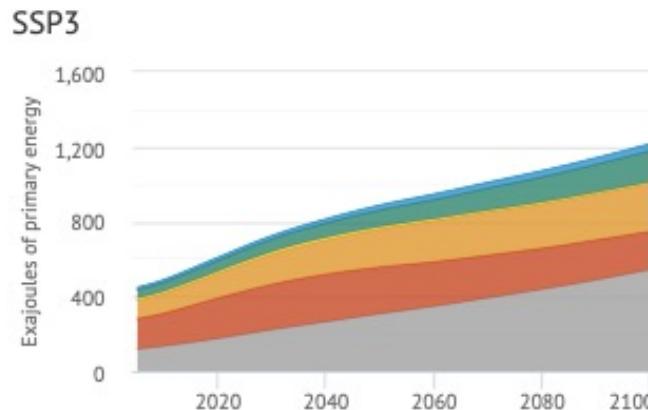
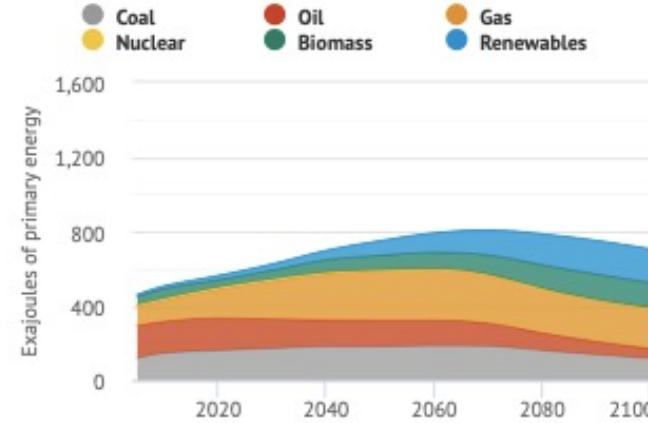
¿Cómo podemos evaluar los futuros cambios climáticos teniendo en cuenta la variabilidad del clima, la previsibilidad y las incertidumbres de los escenarios?

Resumen de los MIPs avalados por el CMIP6



Escenarios de emisiones CMIP6

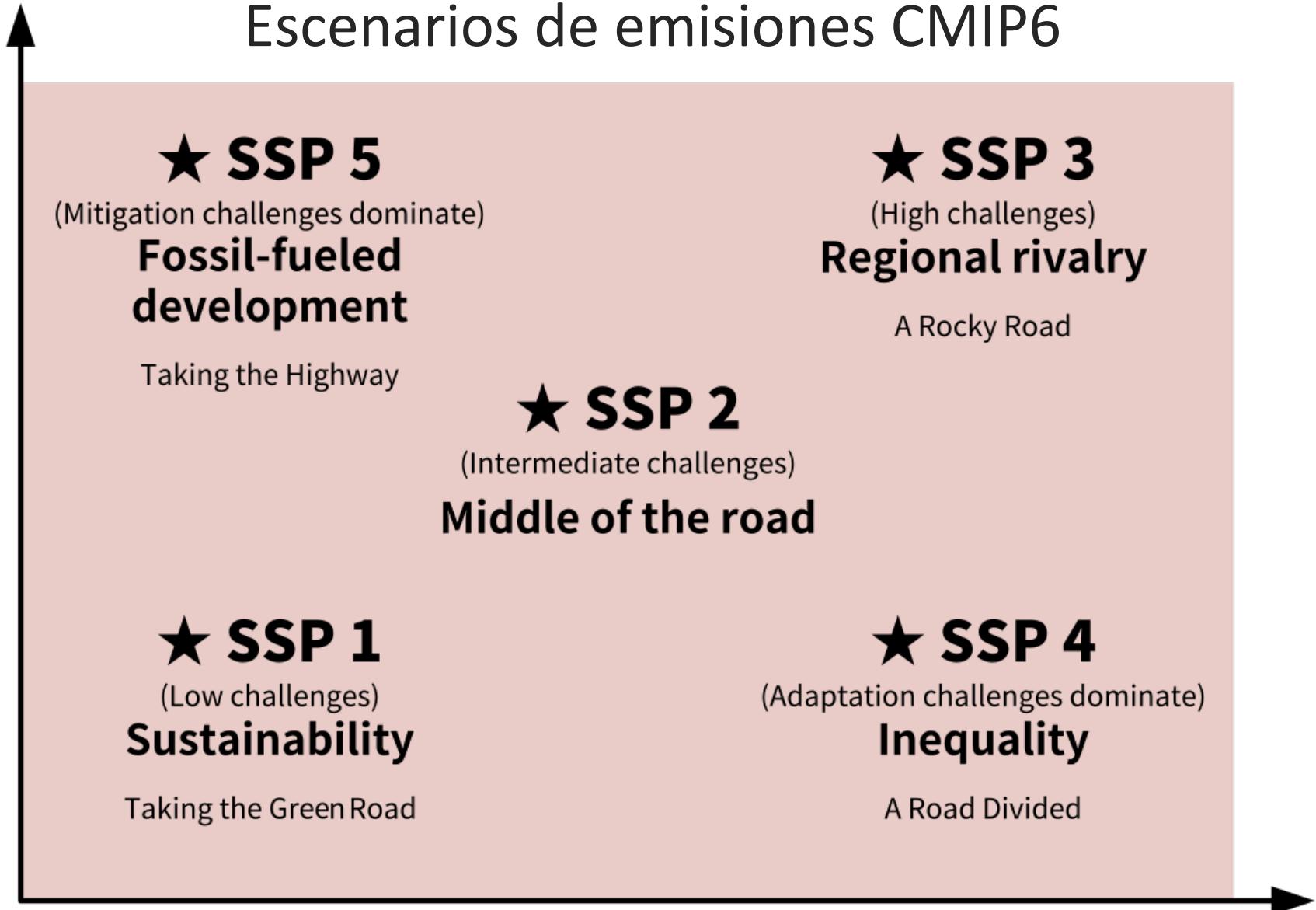
CMIP6 representa una sustancial sobre CMIP5 del número de grupos participantes, el número futuros examinados diferentes experimentos



de evaluación (IE6) del IPCC, la delización ha desarrollado un nuevo ríos de emisiones impulsados por's socioeconómicos. Estas son conómicas concertadas (SSP)". Scenarios de SSP han sido pulsar modelos climáticos para

Escenarios de emisiones CMIP6

Socio-economic challenges
for mitigation



SSP1: Sustainability (Taking the Green Road)

SSP2: Middle of the Road

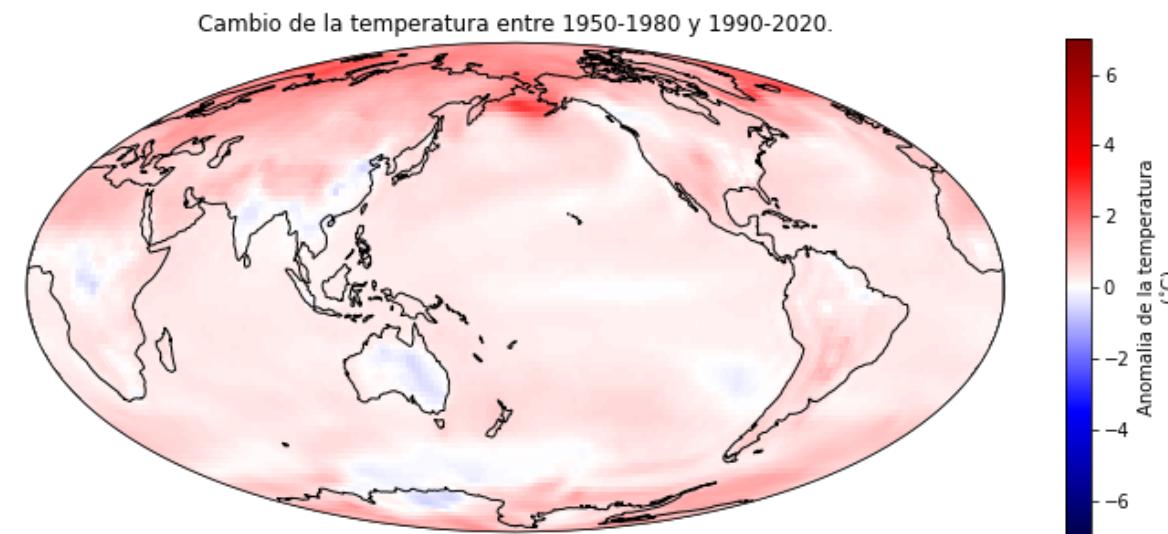
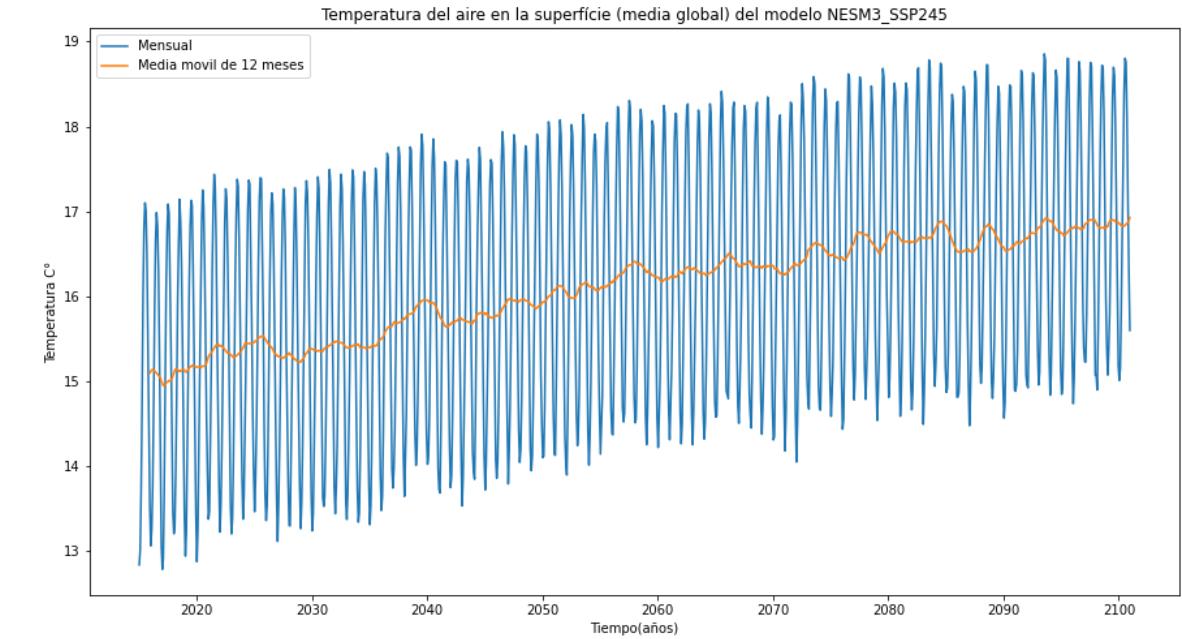
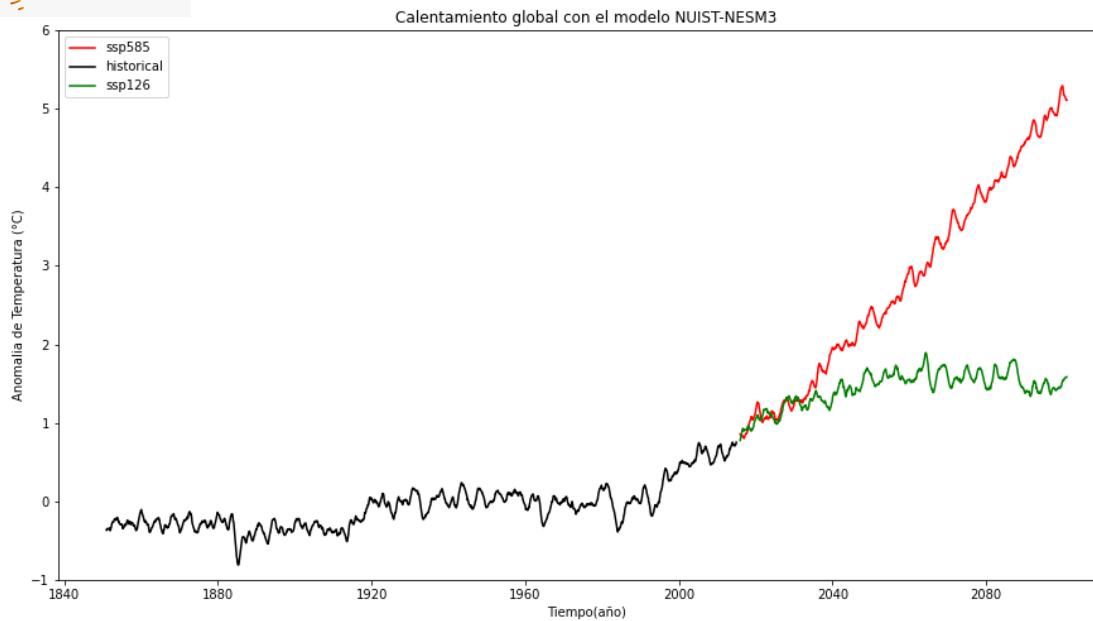
SSP3: Regional Rivalry (A Rocky Road)

SSP4: Inequality (A Road divided)

SSP5: Fossil-fueled Development (Taking the Highway)

Socio-economic challenges
for adaptation

Escenarios CMIP6



Manejo de modelos climáticos usando Python

 python

 jupyter

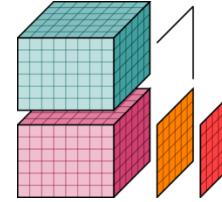
 pandas

 NumPy



Learn programming with Python

 matplotlib

 xarray

 Cartopy

 seaborn

Manejo de modelos climáticos usando Python - 1



Consultar el catálogo PANGEO CMIP6 y cargar los datos utilizando python

 PANGEO CATALOG

Blog Forum

NOAA-GFDL CM2.6 IN GOOGLE CLOUD STORAGE

Load in Python

```
from intake import open_catalog

cat = open_catalog("https://raw.githubusercontent.com/pangeo-data/pangeo-datasetore/master/intake-catalogs/climate.yaml")
ds = cat.GFDL_CM2_6()
```

Working with requester pays data

Several of the datasets within the cloud data catalog are contained in [requester pays](#) storage buckets. This means that a user requesting data must provide their own billing project (created and authenticated through Google Cloud Platform) to be billed for the charges associated with accessing a dataset. To set up an GCP billing project and use it for authentication in applications:

- [Create a project on GCP](#); if this is the first time using GCP, a prompt will appear to choose a Google account to link to all GCP-related activities.
- [Create a Cloud Billing account](#) associated with the project and [enable billing for the project](#) through this account.
- Using [Google Cloud IAM](#), add the **Service Usage Consumer** role to your account, which enables it to make billed requests on the behalf of the project.
- Through command line, install the [Google Cloud SDK](#); this can be done using conda:

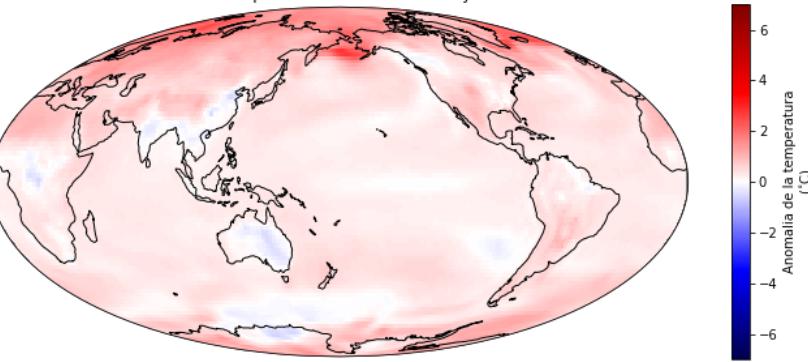
```
conda install -c conda-forge google-cloud-sdk
```

- Initialize the [gcloud](#) command line interface, logging into the account used to create the aforementioned project and selecting it as the default project; this will allow the project to be used for requester pays access through the command line:

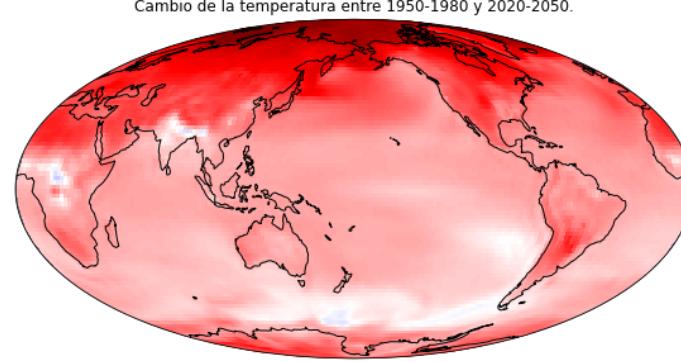
```
gcloud auth login
gcloud init
```

Manejo de modelos climáticos usando Python - 1

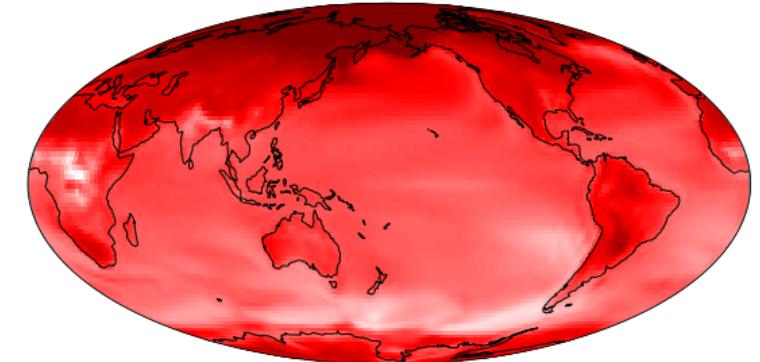
Cambio de la temperatura entre 1950-1980 y 1990-2020.



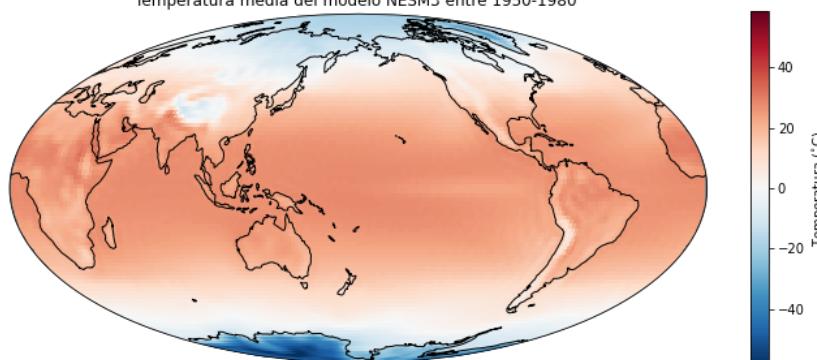
Cambio de la temperatura entre 1950-1980 y 2020-2050.



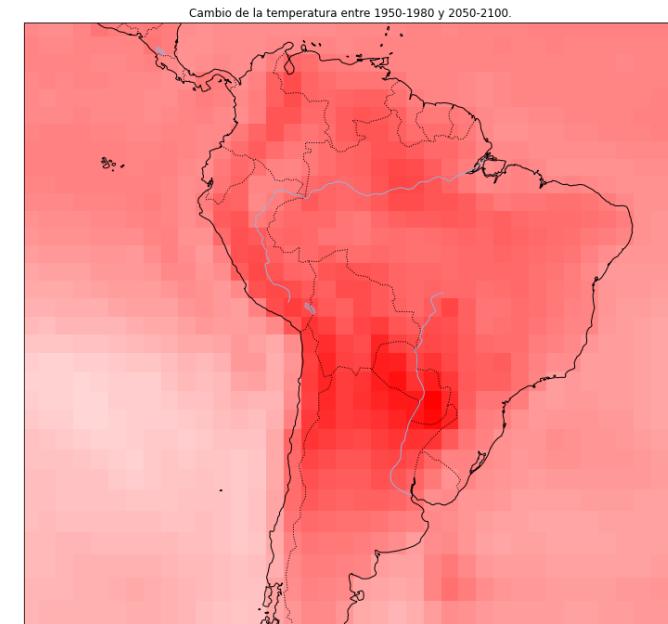
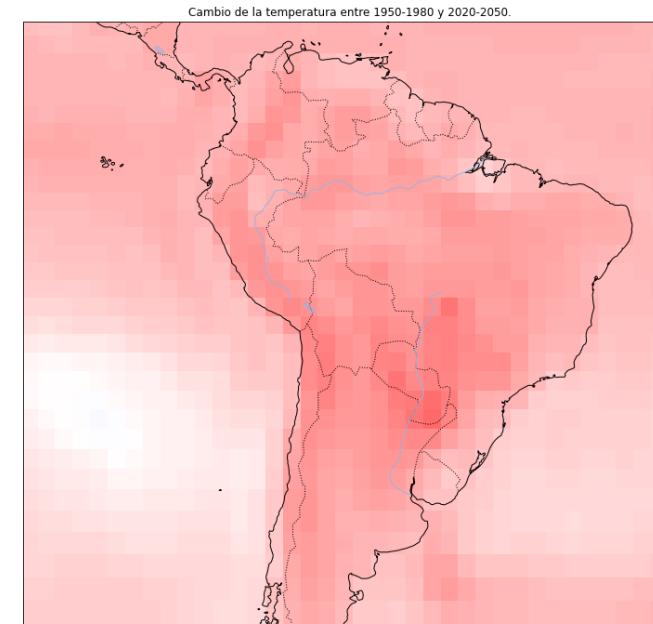
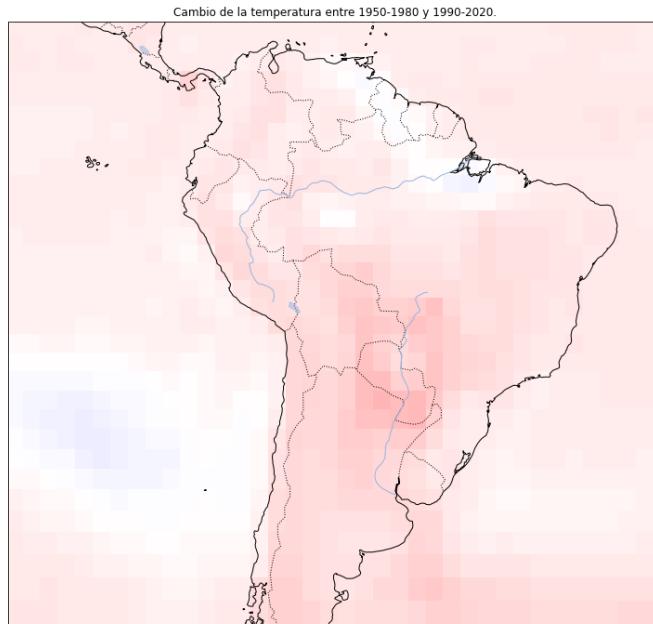
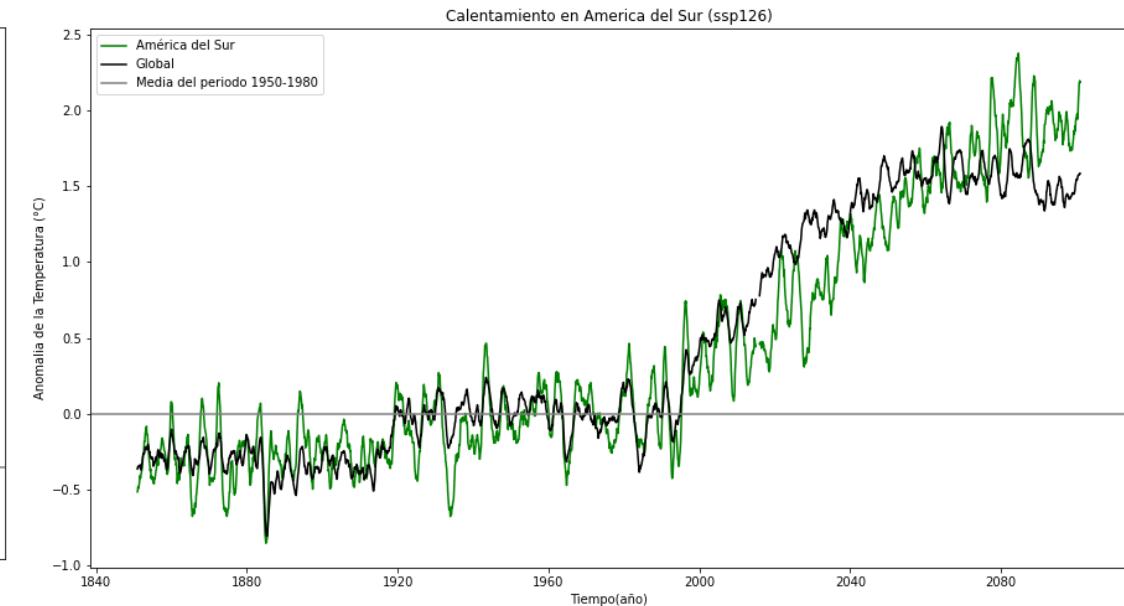
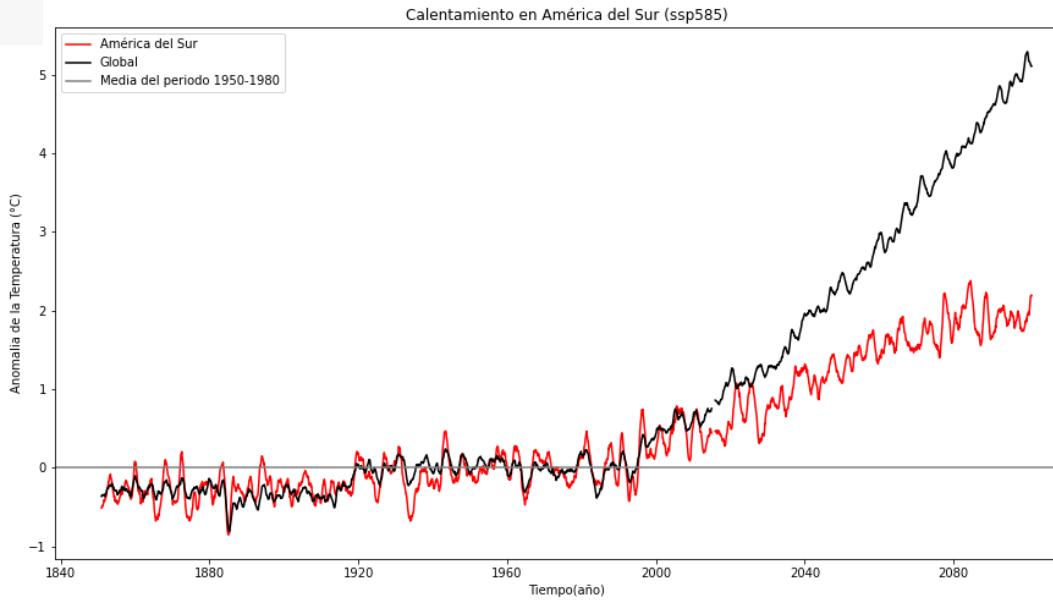
Cambio de la temperatura entre 1950-1980 y 2050-2100.



Temperatura media del modelo NESM3 entre 1950-1980



Manejo de modelos climáticos usando Python -1



— América del Sur
— Global
— Media del periodo 1950-1980

Manejo de modelos climáticos usando Python -2

Sponsored By  NCAR | UCAR | COMMUNITY EARTH SYSTEM MODEL CESM ®

PUBLICATIONS ABOUT HELP SEARCH ... ADMINISTRATION WORKING GROUPS MODELS EVENTS

/ CESM Models / CESM Projects / CESM - CMIP

Coupled Model Intercomparison Project



A Short Introduction to Climate Models - CMIP & CMIP6

Copiar vínclo...

WCIP

CMIP

The World Climate Research Programme's Coupled Model Intercomparison Project

CESM PROJECTS

- Overview
- CDG - Climate Data Guide
- CMIP - Coupled Model Intercomparison Project
- EaSM - Earth System Modeling

CESM - CMIP6 PROJECTS

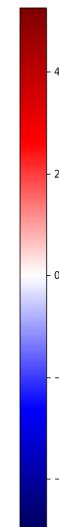
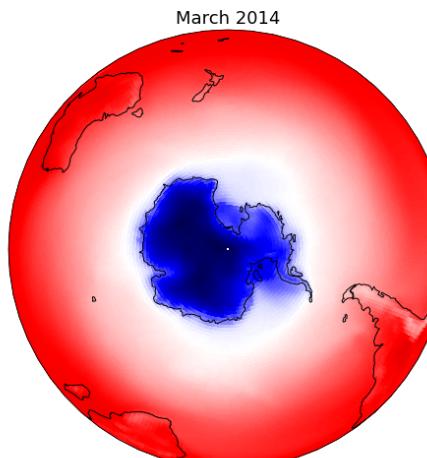
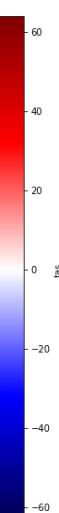
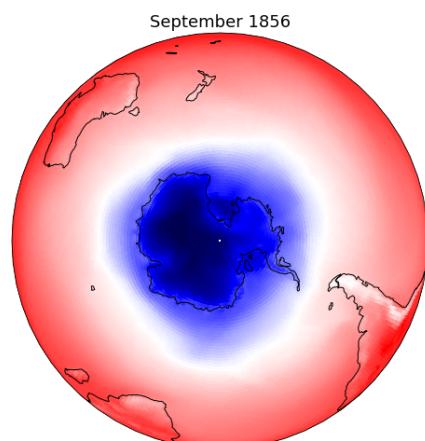
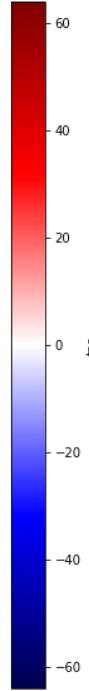
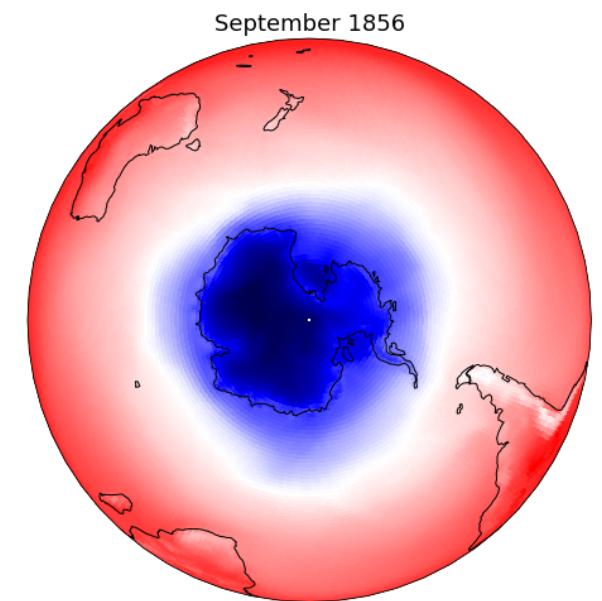
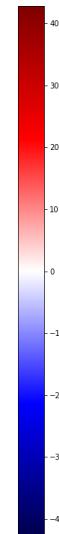
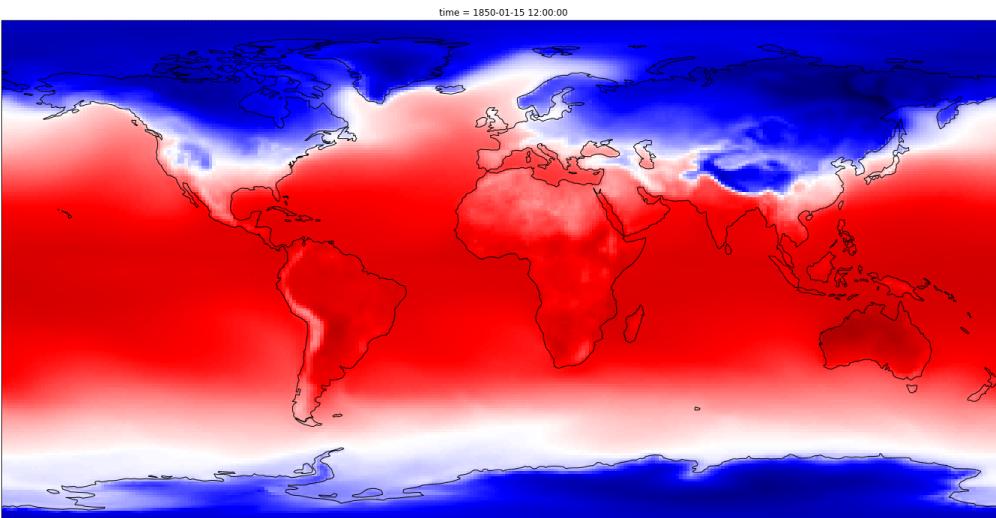
- Overview
- LUMIP - Land Use Intercomparison Project
- OMIP - Ocean Model Intercomparison Project
- *Coming soon
- PAMIP - Polar Amplification Model Intercomparison Project
- ScenarioMIP - Scenario Model Intercomparison Project

CESM MODELS

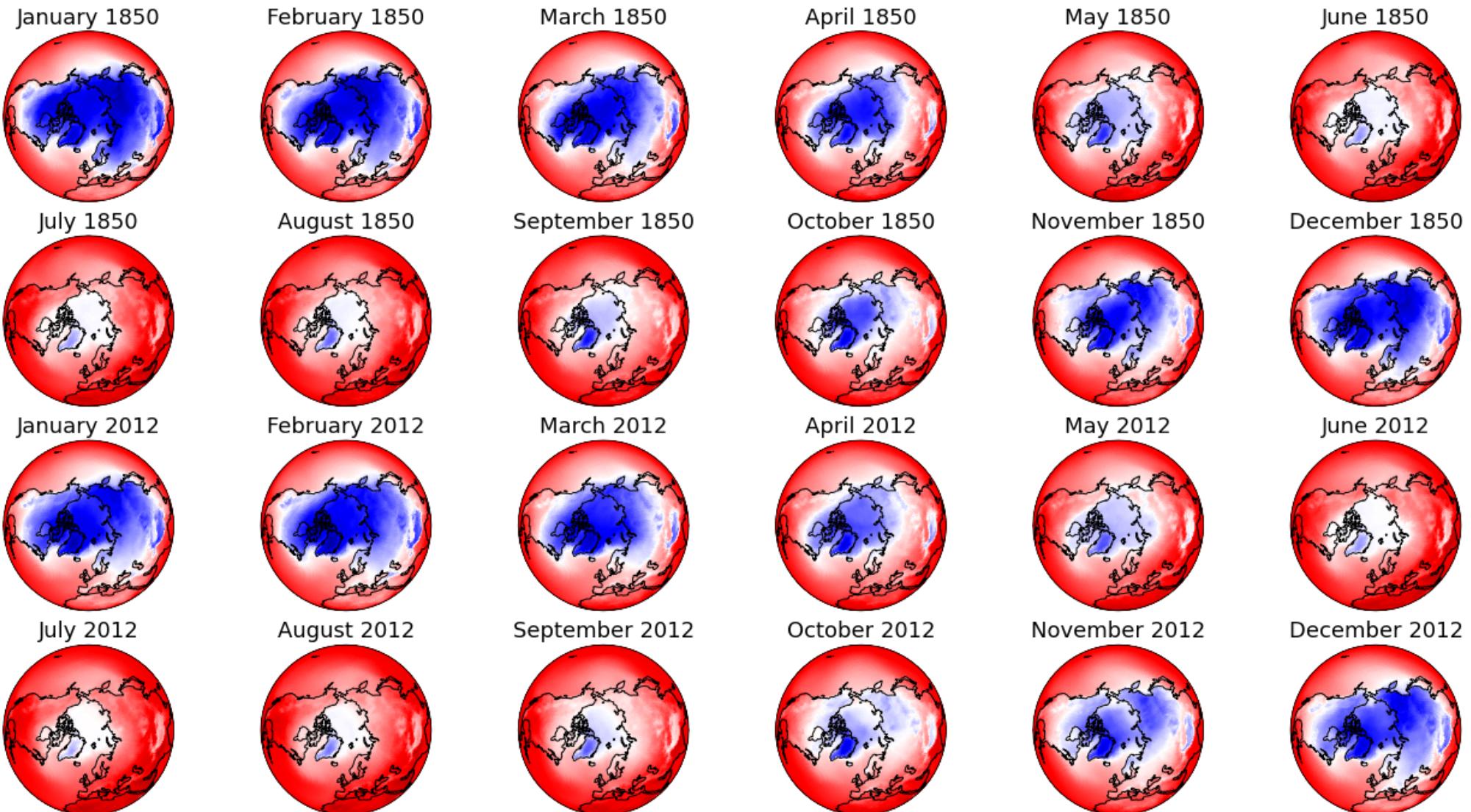
- Overview
- CESM Releases

Manejo de modelos climáticos usando Python - 2

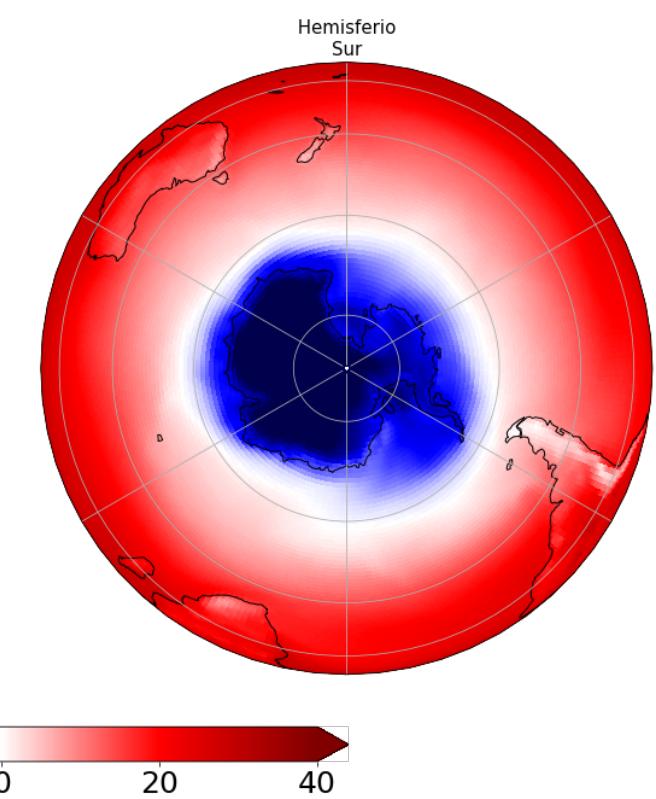
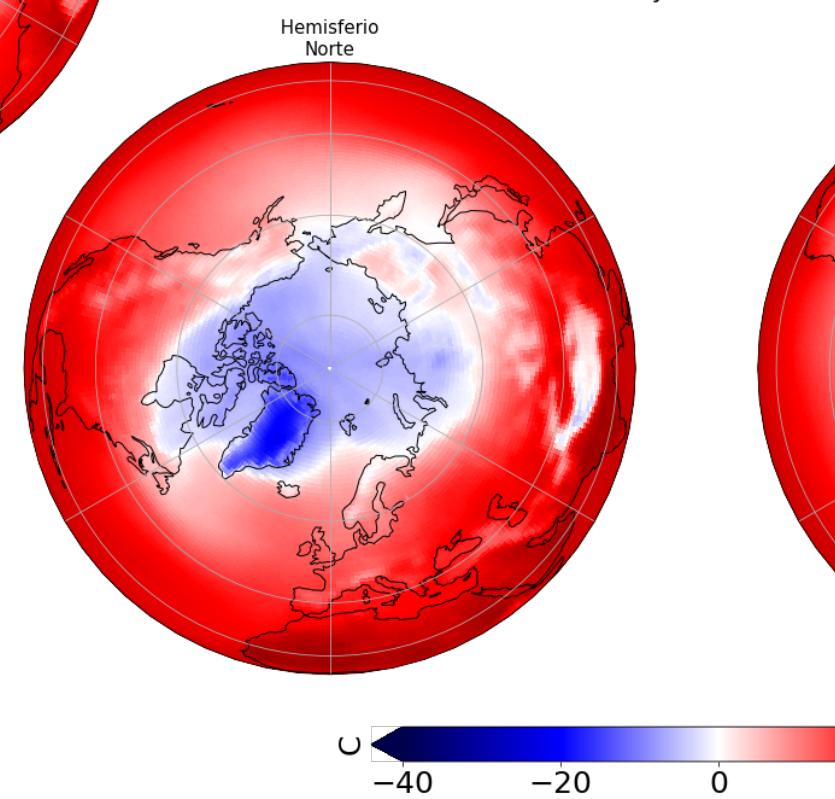
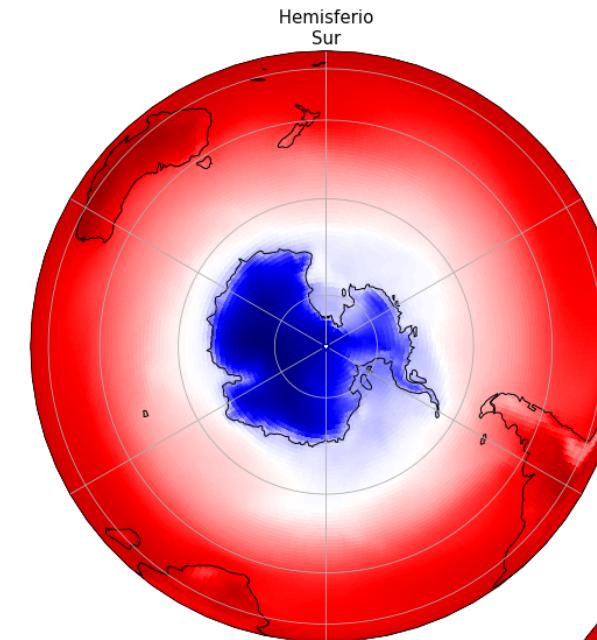
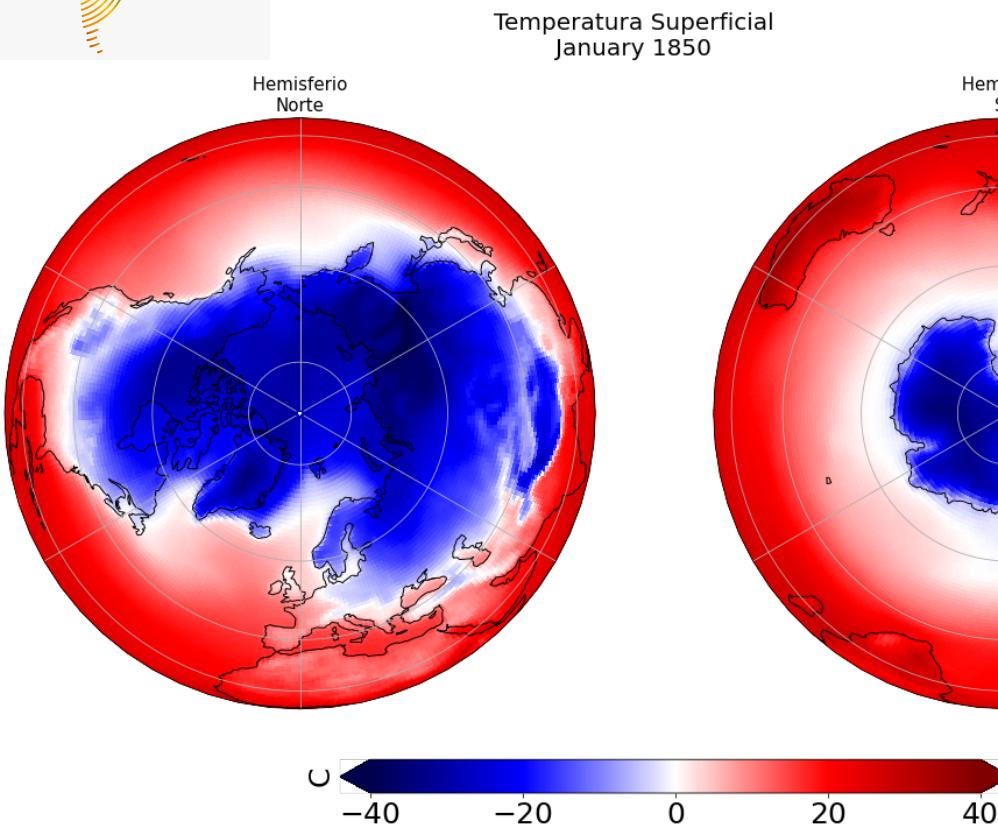
THREDDS del repositorio de UCAR-NCAR y usaremos datos en formato NETCDF



Manejo de modelos climáticos usando Python - 2



Manejo de modelos climáticos usando Python - 2



Manejo de modelos climáticos usando Python – Bonus Track

Vamos a llamar datos en temperaturas superficiales desde la web de NOAA datos globales para hacer nuestro “Warming Stripes” (Lineas de calentamiento) Para cualquiere parte del mundo!!

