

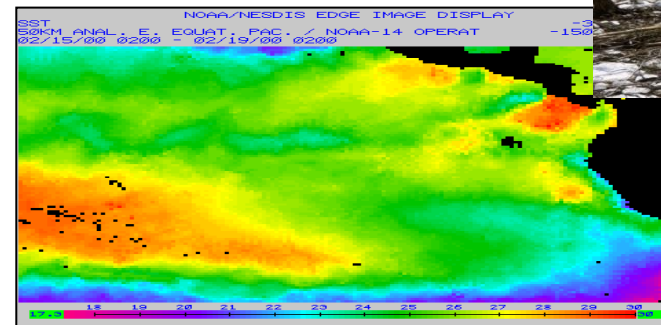
Entendendo as mudanças climáticas e seus impactos

Ana Maria H de Avila

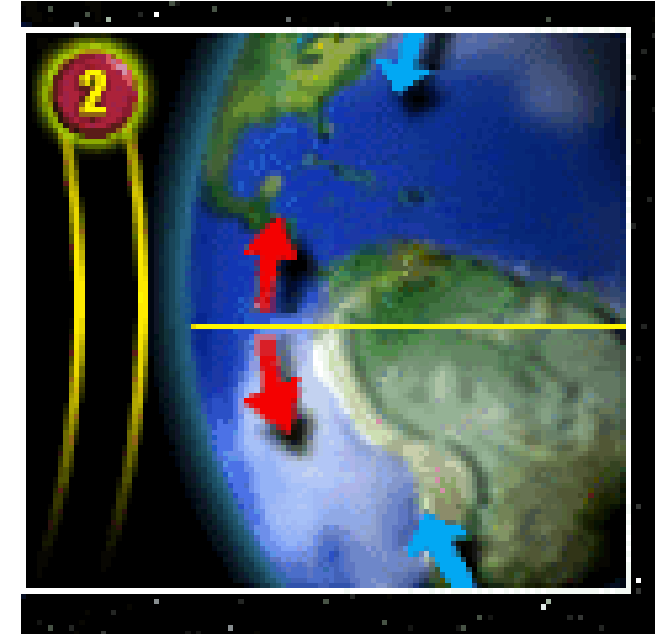
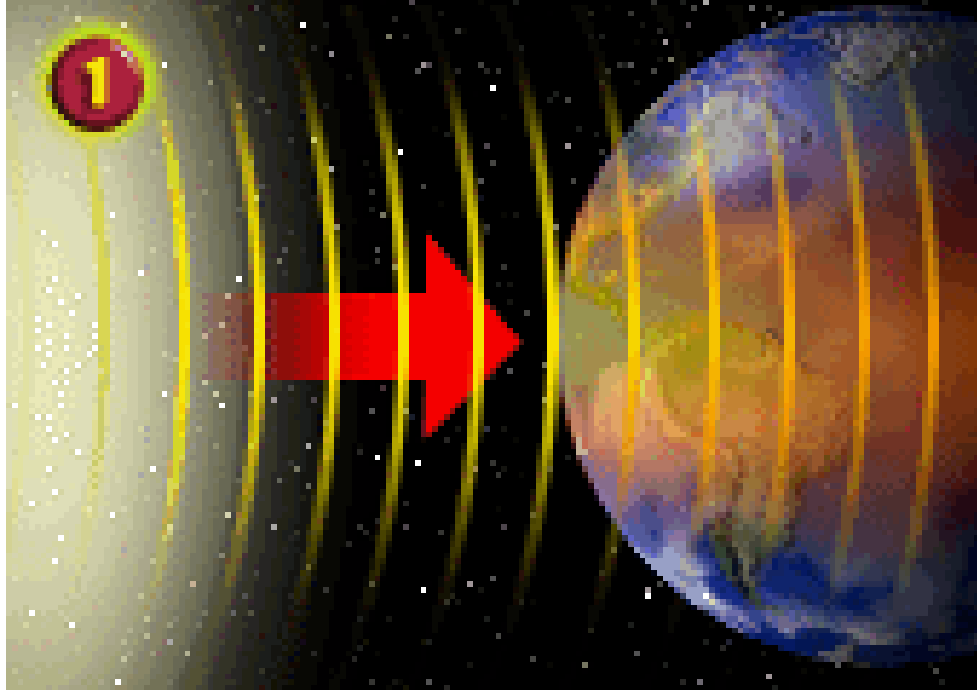
V Seminário de Áreas Protegidas das Bacias PCJ

Mudança Climática Global

“Mudanças no meio ambiente global (incluindo modificações no clima, na produtividade do solo, nos oceanos ou outros recursos hídricos, na química da atmosfera e em sistemas ecológicos) que possam alterar a capacidade da Terra para sustentar a Vida”



O Sol: a principal fonte de energia



Atmosfera terrestre: frágil equilíbrio

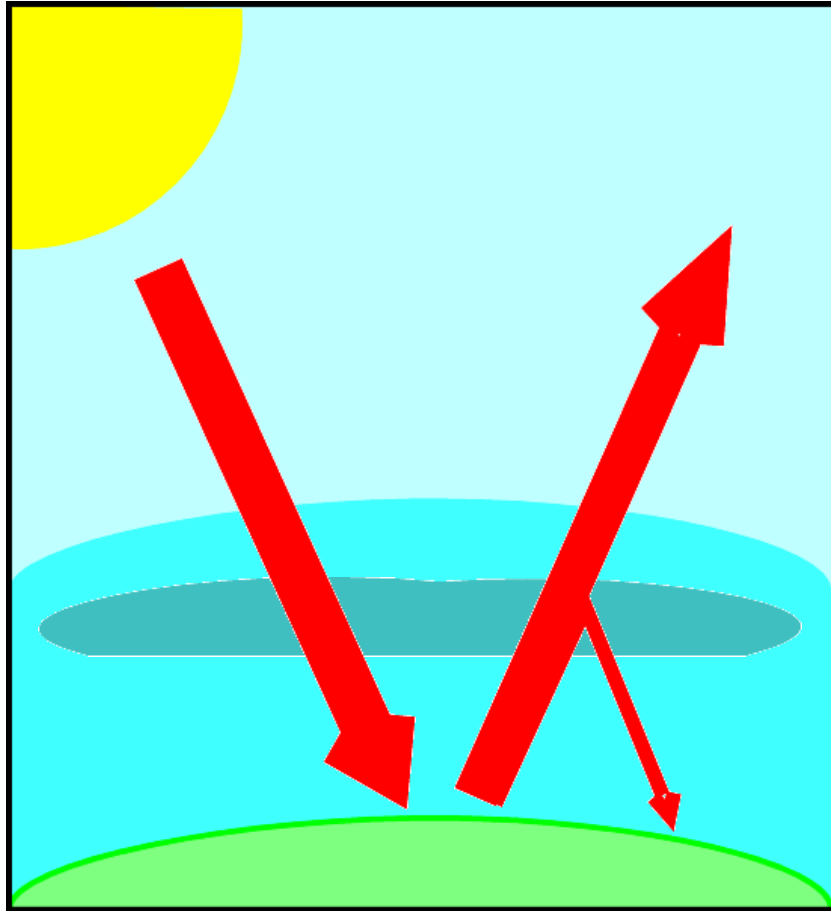
A superfície da terra seria 33 graus Celsius mais fria se não existissem na sua atmosfera os gases do efeito estufa



Gases de Efeito Estufa

- Dióxido de Carbono (CO_2)
- Metano (CH_4)
- Óxido Nitroso (N_2O)
- Hexafluoreto de Enxofre (SF_6)
- Perfluormetano (CF_4)
- Perfluoretano (C_2F_6)
- Hidrofluorcarbonos (HFC)
- Clorofluorcarbono (CFC)

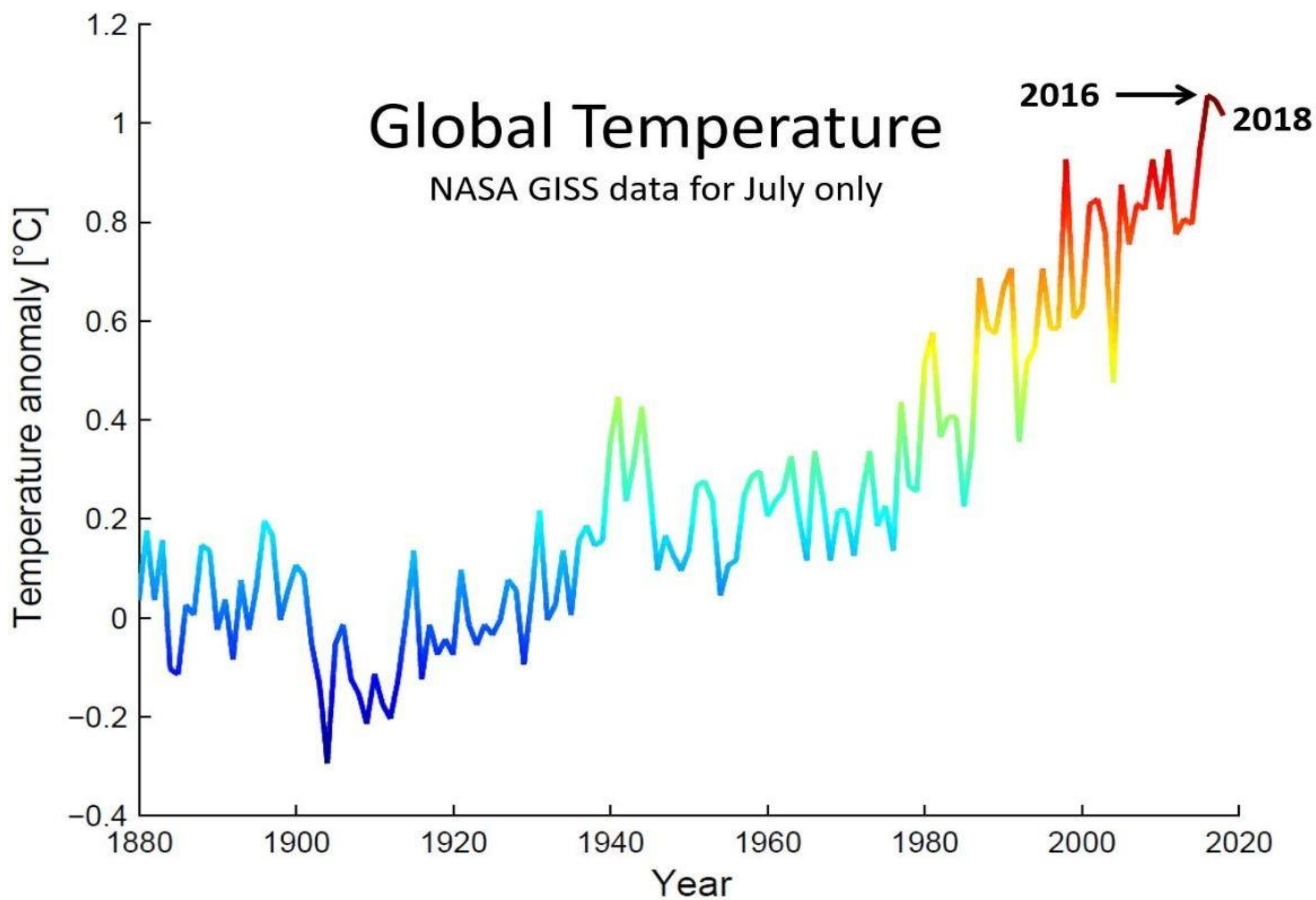
O efeito estufa natural



$T_m = 15\text{ }^{\circ}\text{C}$



MUDANÇAS CLIMÁTICAS OBSERVADAS



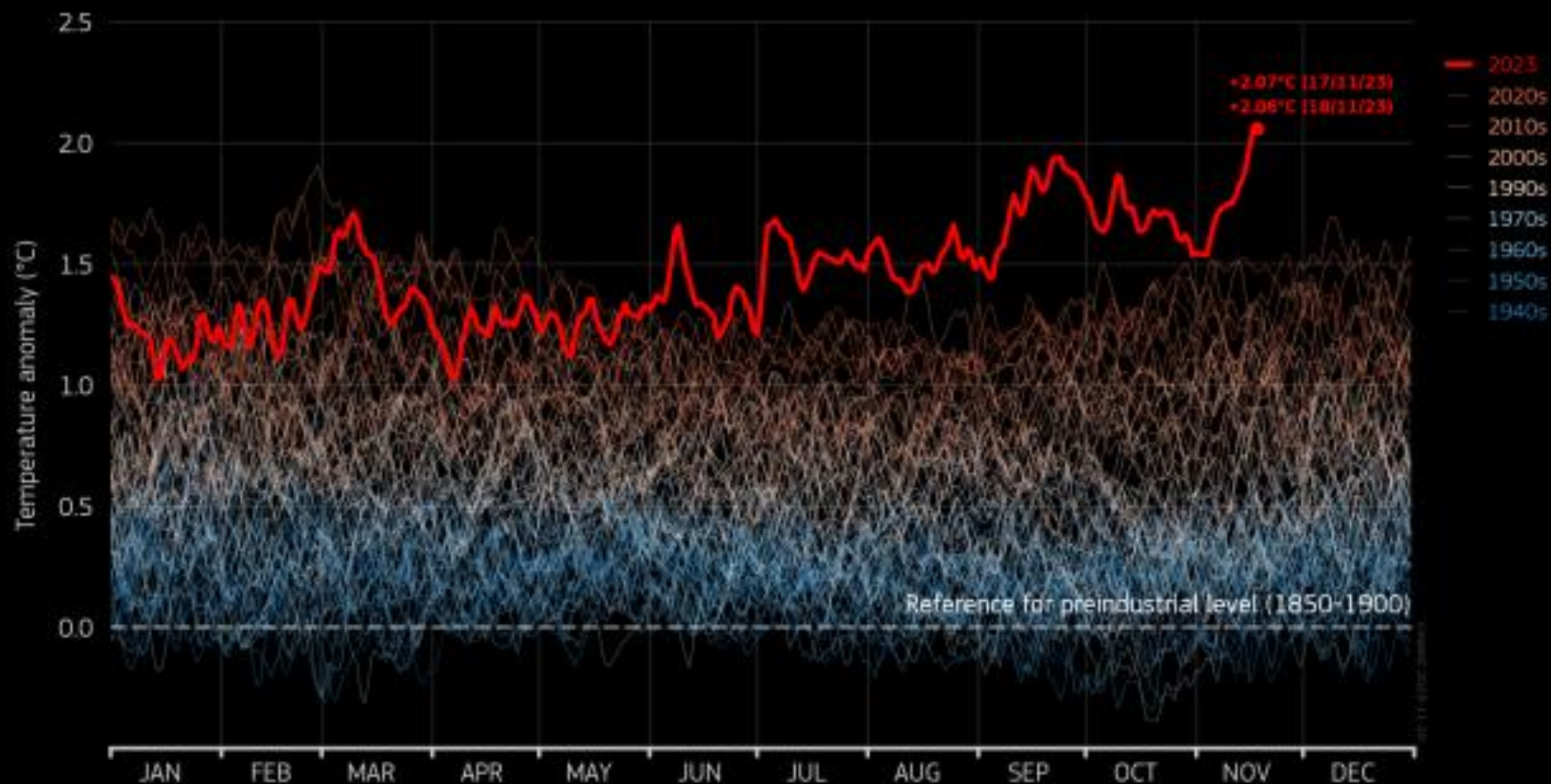
DAILY GLOBAL SURFACE AIR TEMPERATURE ANOMALY

Data: ERA5 1940-2023 • Reference period: 1850-1900 • Credit: C3S/ECMWF



Climate
Change Service

climate.copernicus.eu



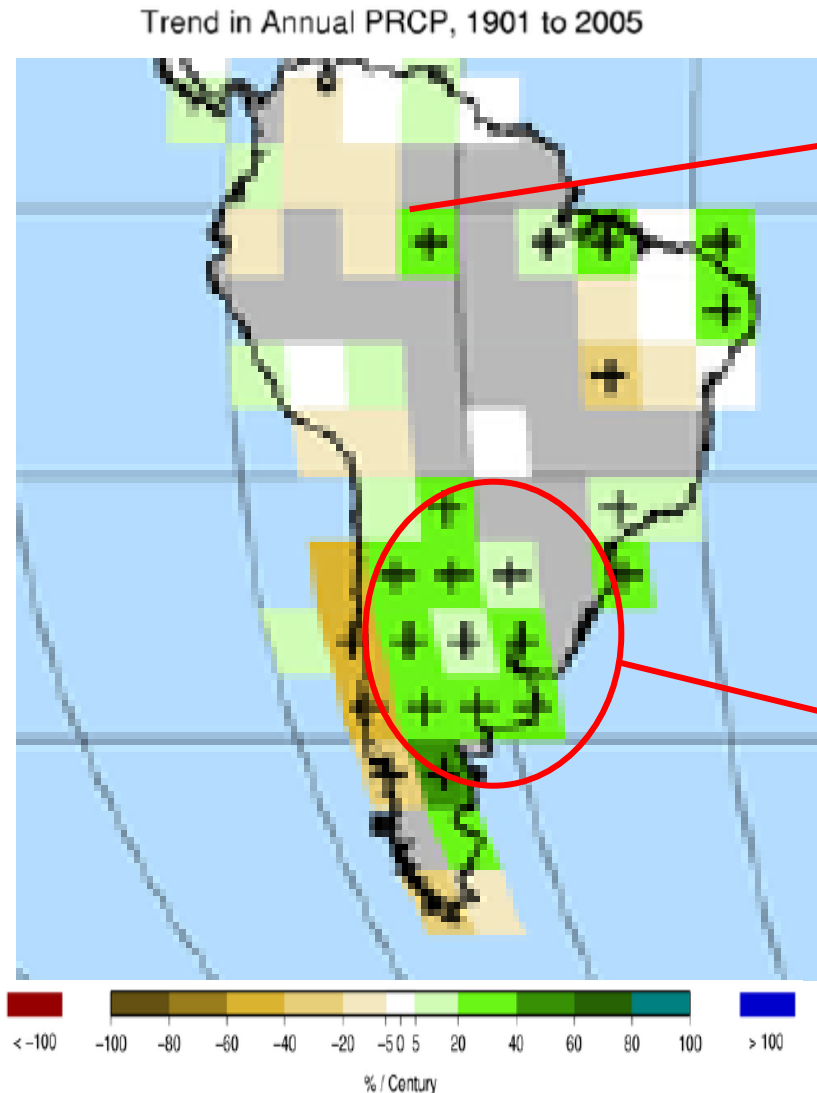
PROGRAMME OF
THE EUROPEAN UNION



IMPLEMENTED BY



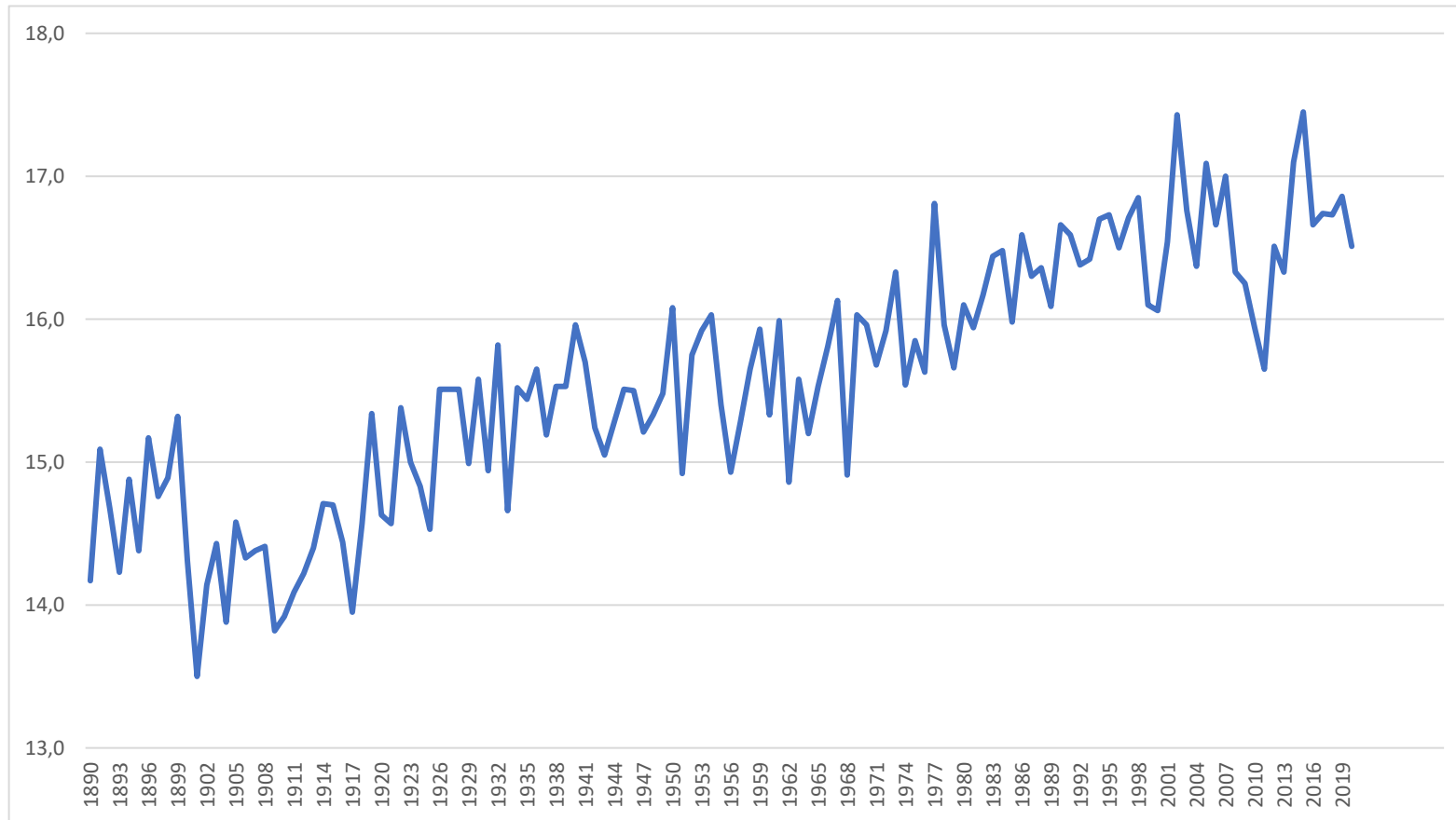
Sul do Brasil tem tendência observada de aumento de chuvas : tendências da chuva de 1901-2005 (IPCC 2007)



Não tem sinais de redução de chuva na Amazônia devido ao desmatamento ou aumento na concentração de GEE. Secas associadas a variabilidade interanual de clima.

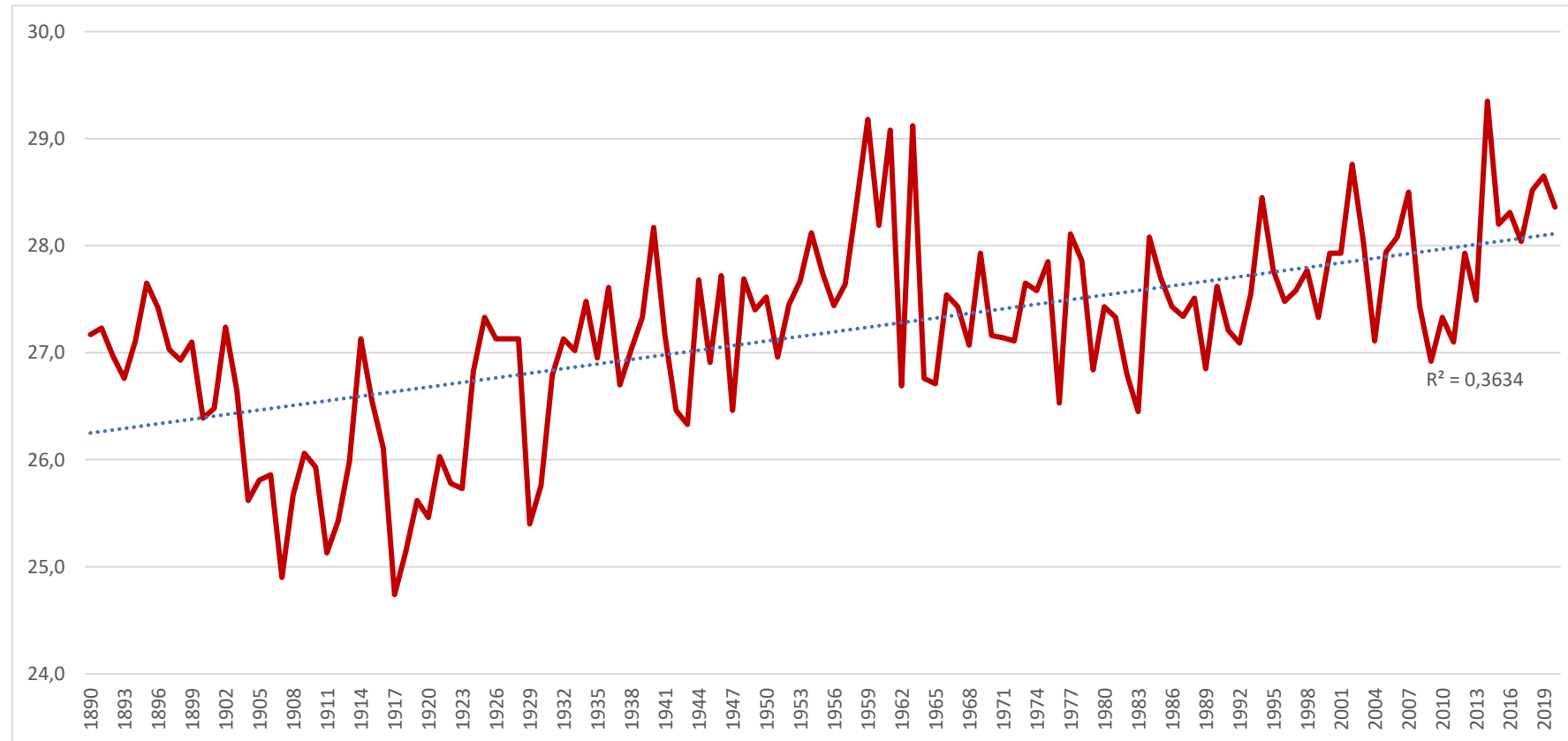
Causa do Aumento das Chuvas:
Variabilidade Natural ou Aquecimento Global?

Temperatura mínima média anual – Campinas/SP

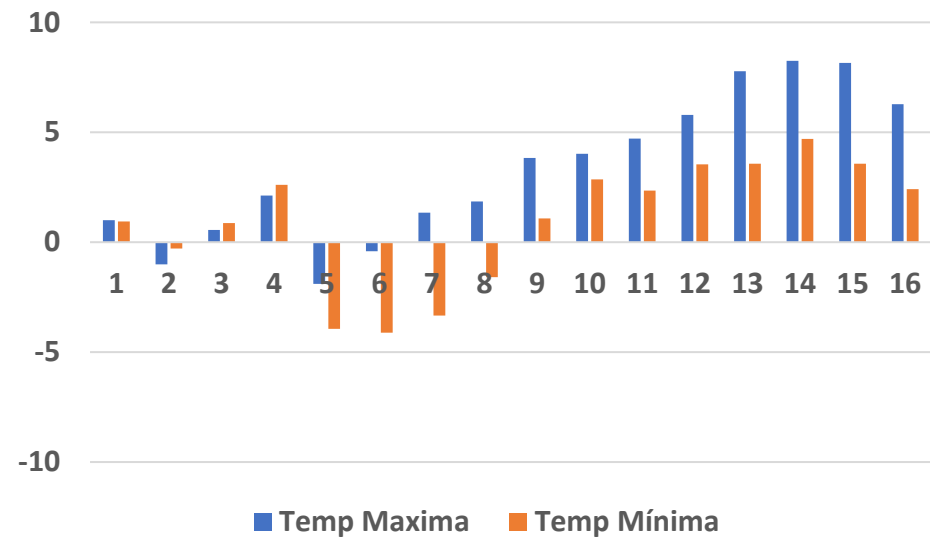
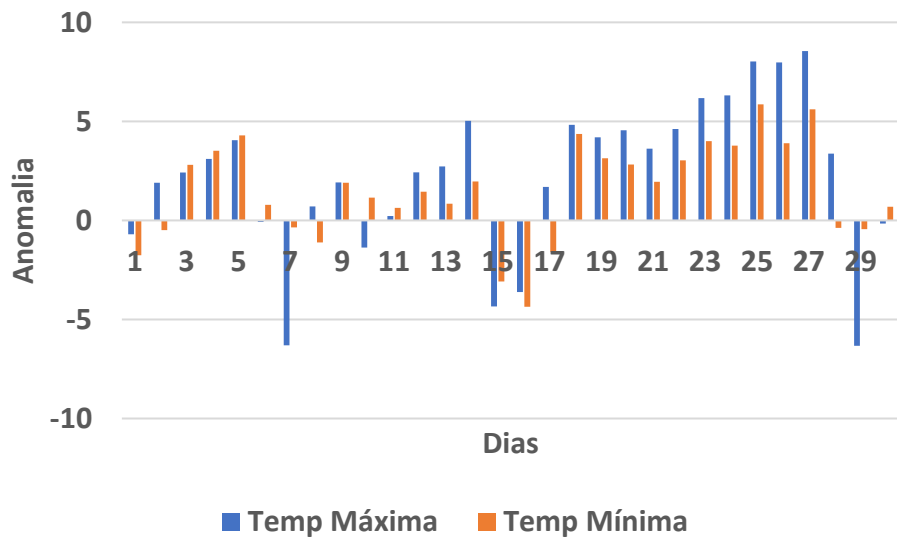


Fonte de dados IAC

Temperatura máxima média anual – Campinas/SP



Anomalia da Temperatura Máxima e Mínima – Campinas SP



Fonte: Cepagri/Unicamp

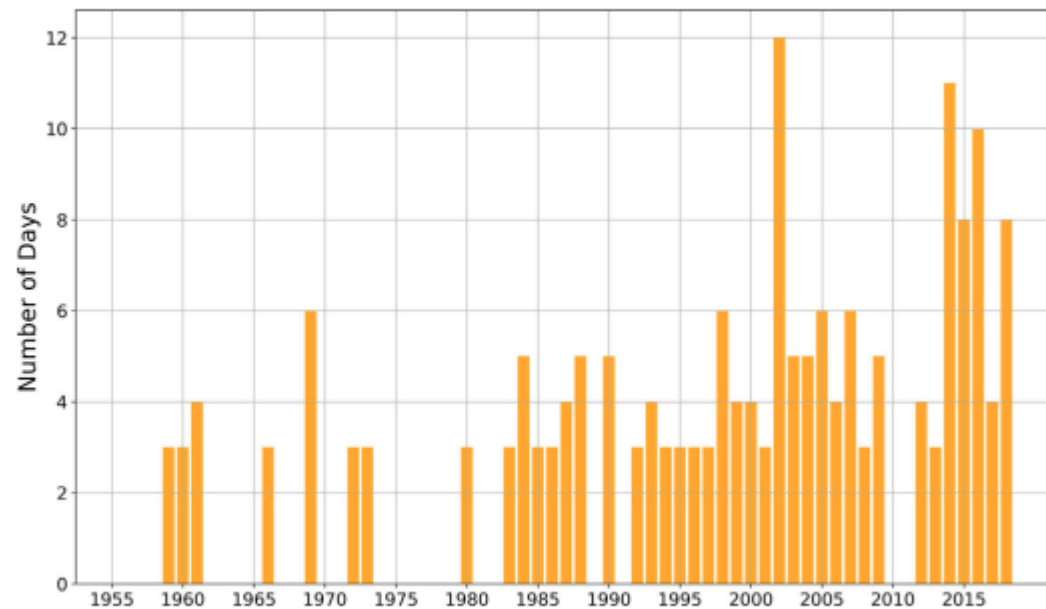


Figure 3 - Longest duration of heatwaves in days per year (HWD) for IAC weather station in the period of 1956-2018.

*** 2002, 2014, 2015 e 2016 – El Niño
Oscilação -Sul**

**Redução ou ausência de eventos em
1999, 2000, 2010 e 2011 coincidem com
La Niña**

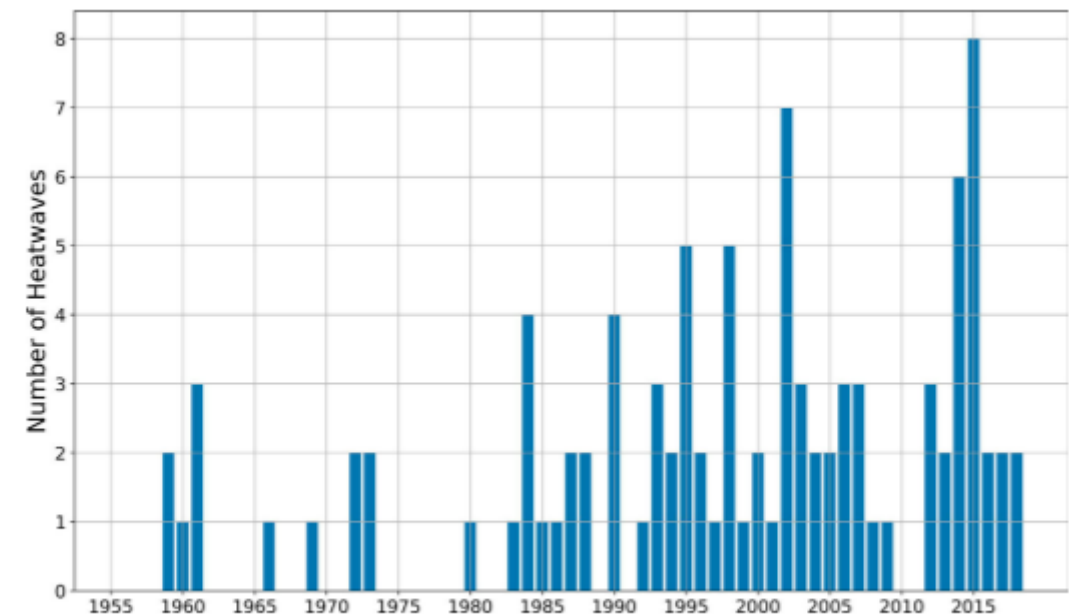
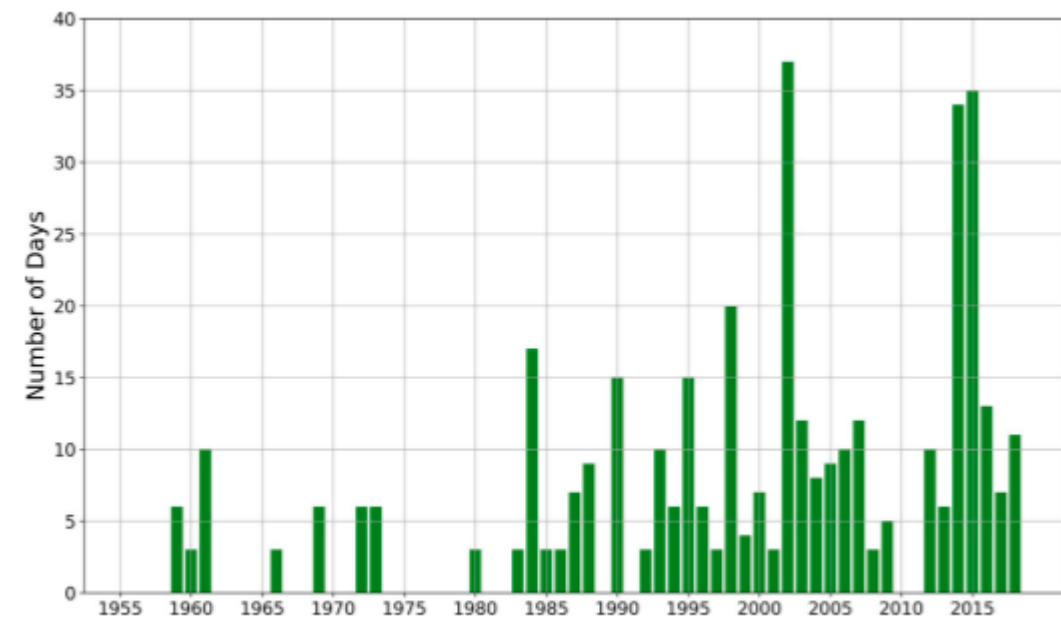


Figure 2 - Annual number of heatwaves (HWN) for IAC weather station in the period of 1956-2018.



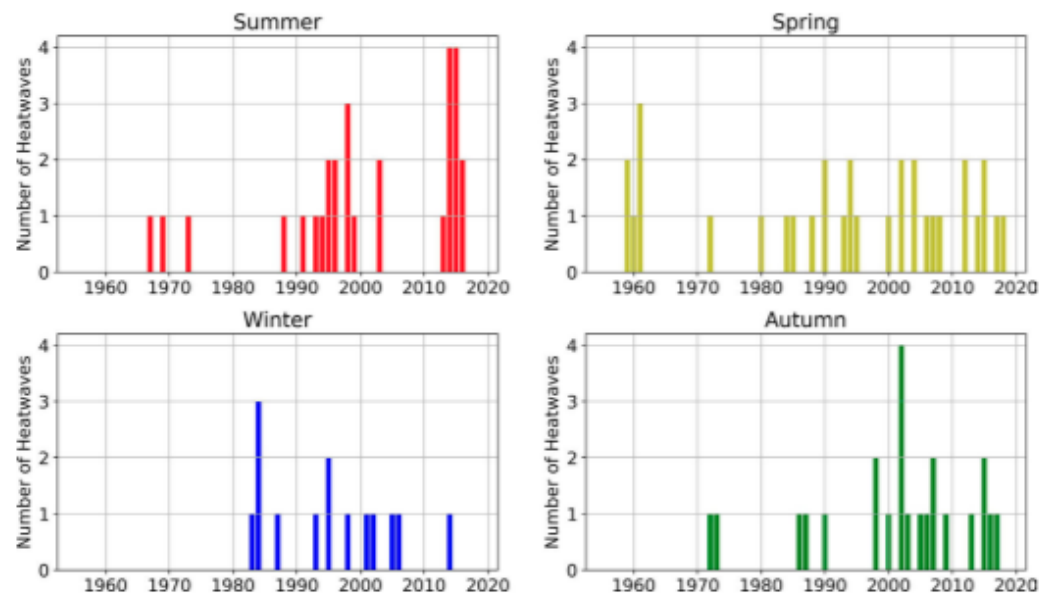


Figure 5 - Seasonal number of heatwaves (HWN) for IAC weather station in the period of 1956-2018.

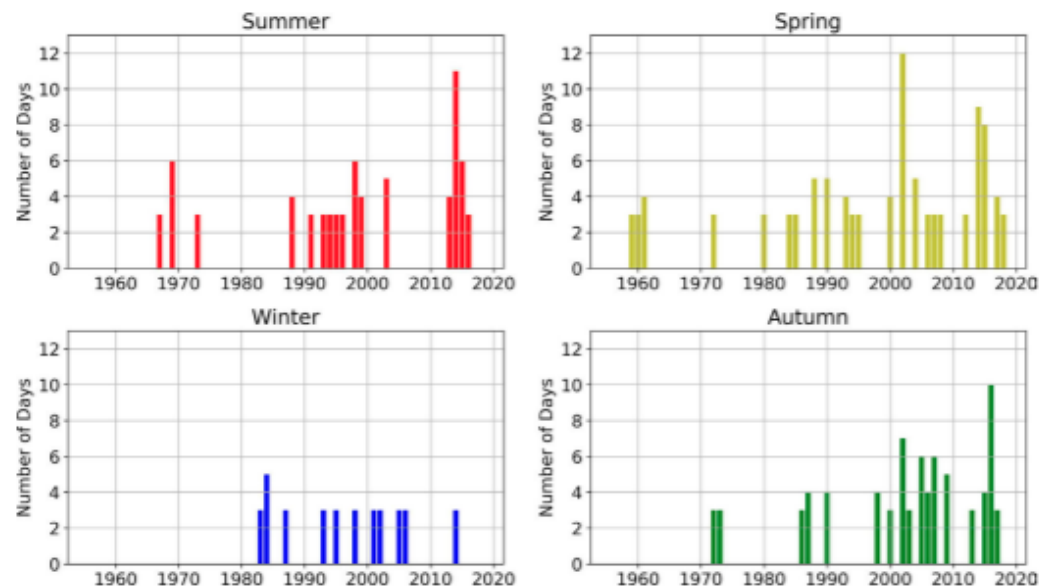


Figure 6 - Longest duration of heatwaves in days/season (HWD) for IAC weather station in the period of 1956-2018.

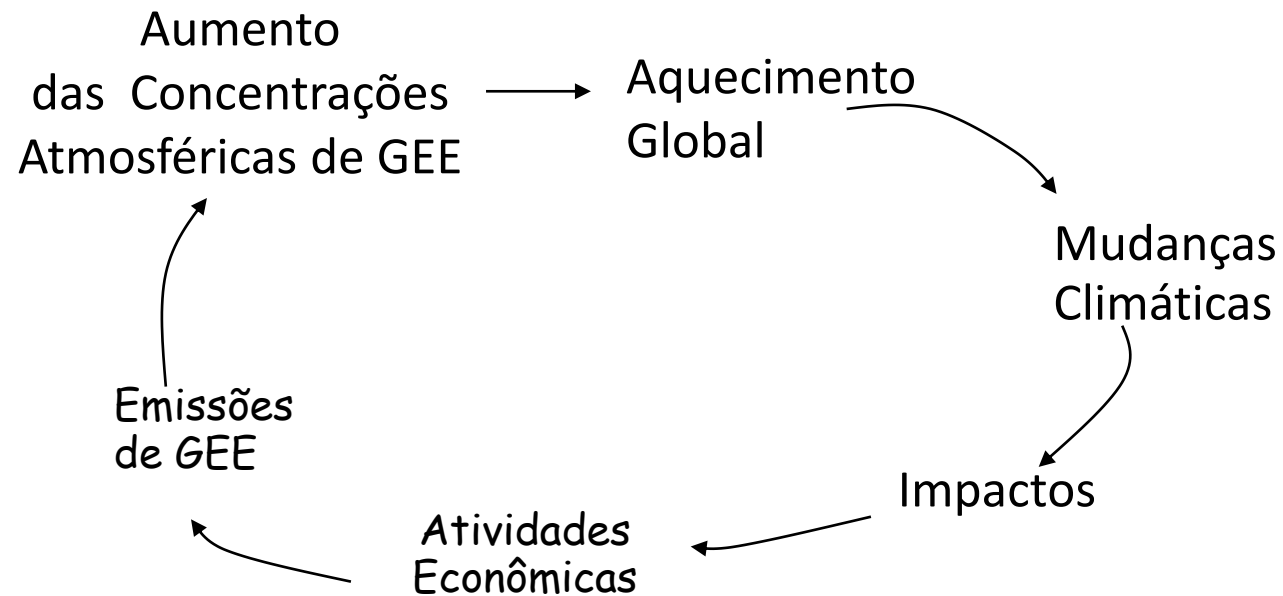
O que fazer?



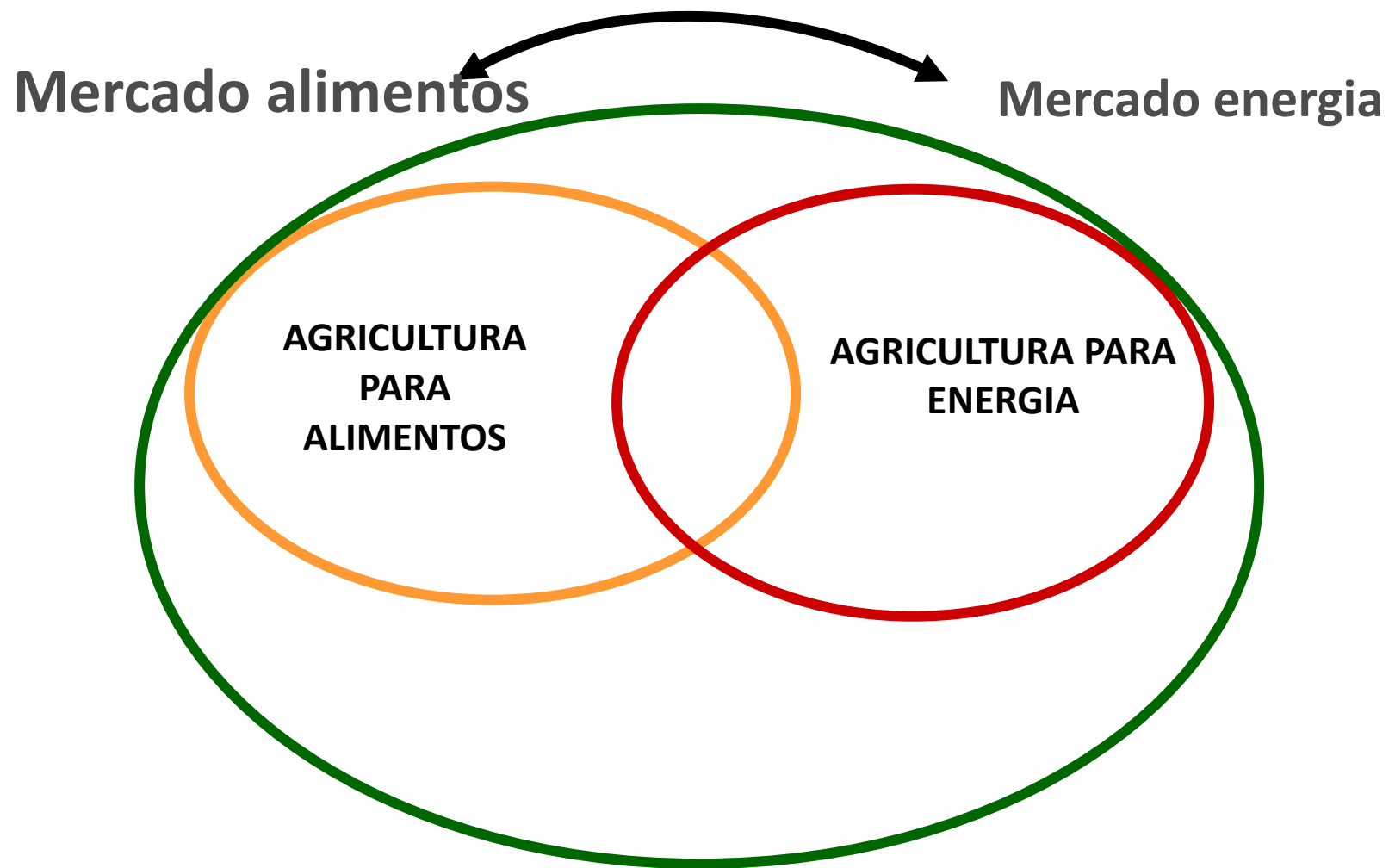
Entrelaçadas!

Modelos Integrados Clima - Economia

Cadeia de Causas e Efeitos



Desafios globais

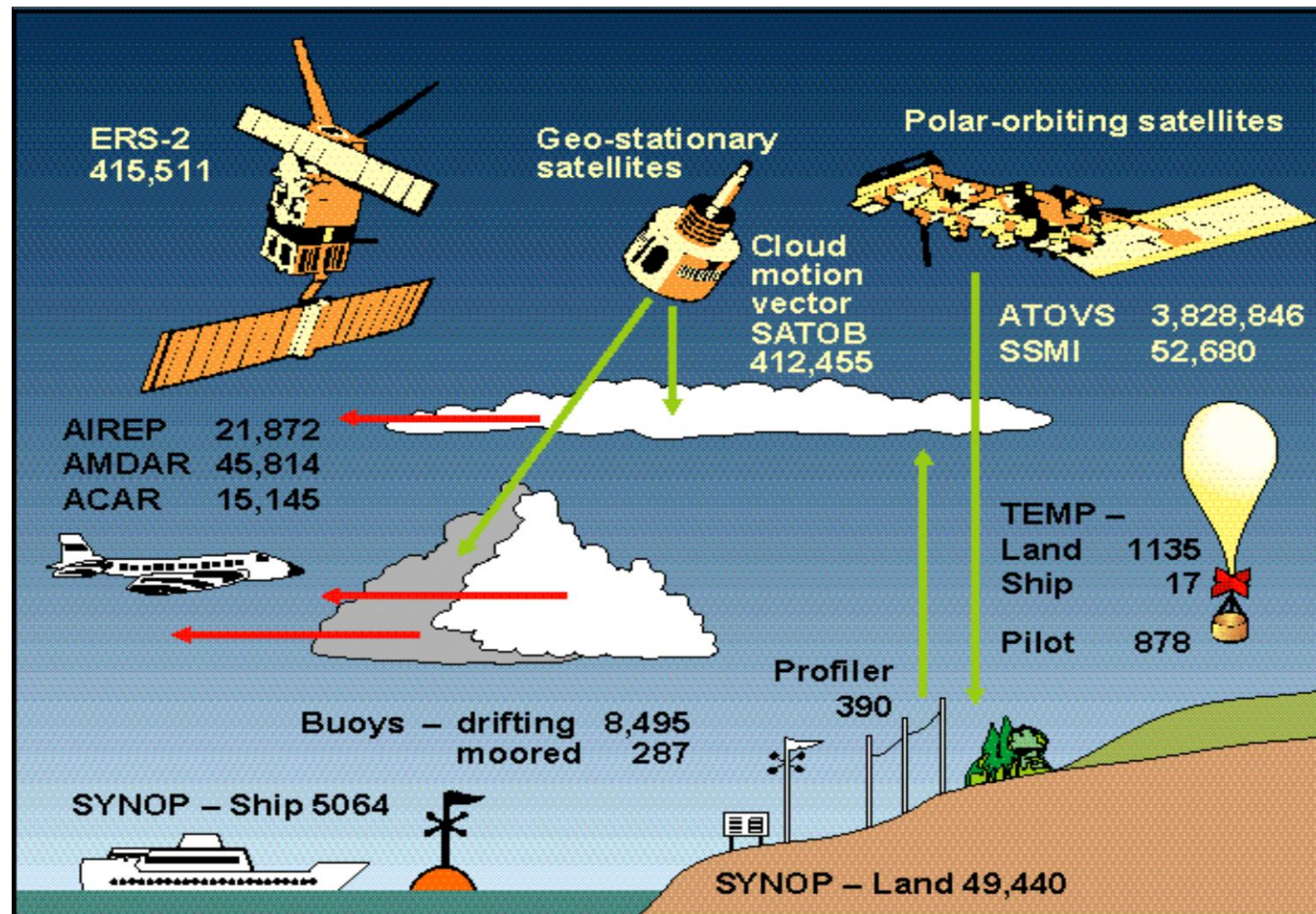


+ Como são feitas as previsões?

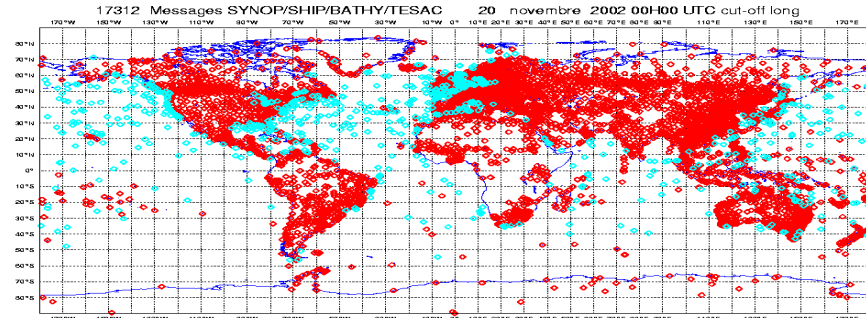


QUE DADOS UTILIZA?

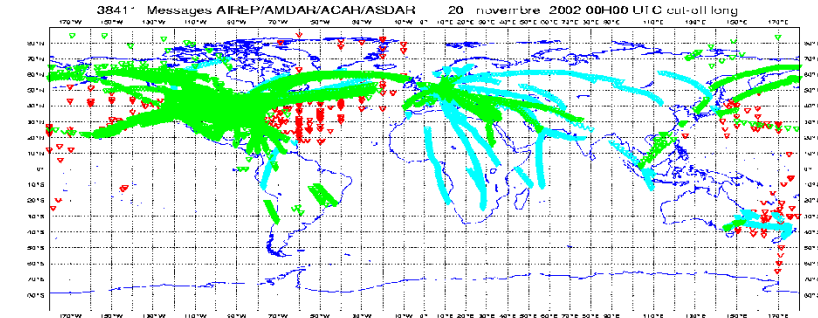
Os números indicam observações recebidas - por dia em um centro de previsão de tempo



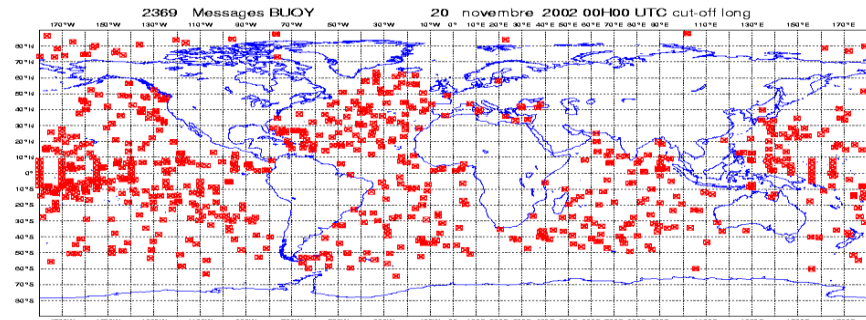
SYNOP e SHIP surface P,T,UR,wind



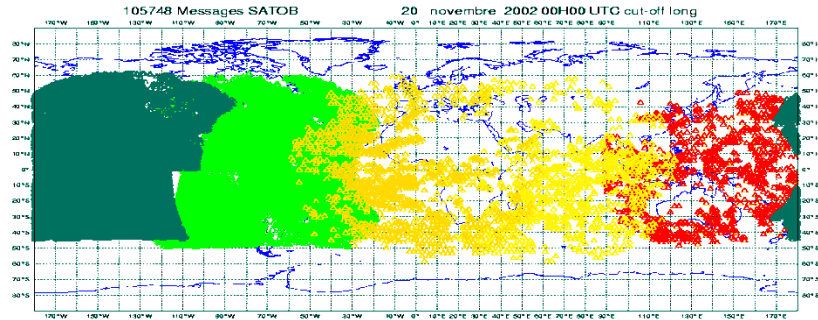
aviões T,vento



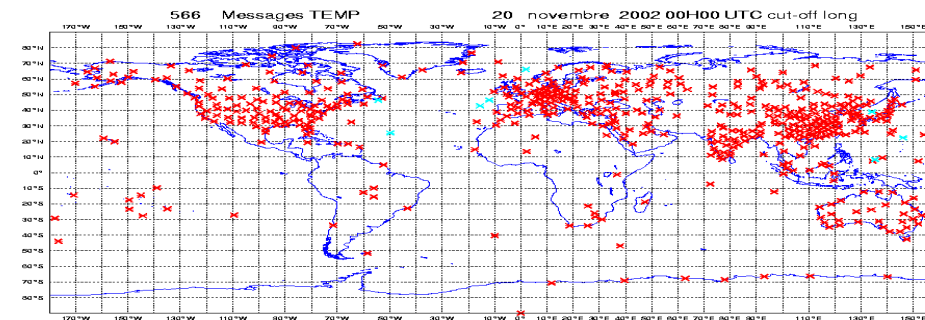
bóias, superfície P,T,UR,wind



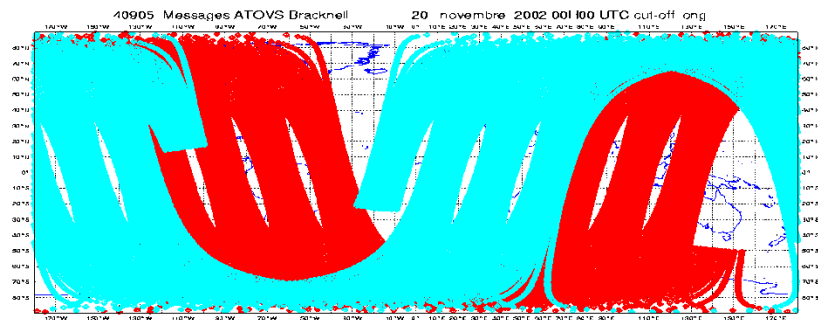
Ventos de satélite geoestacionário



radiosondas P,T,UR,wind



Radiâncias ATOVS NOAA

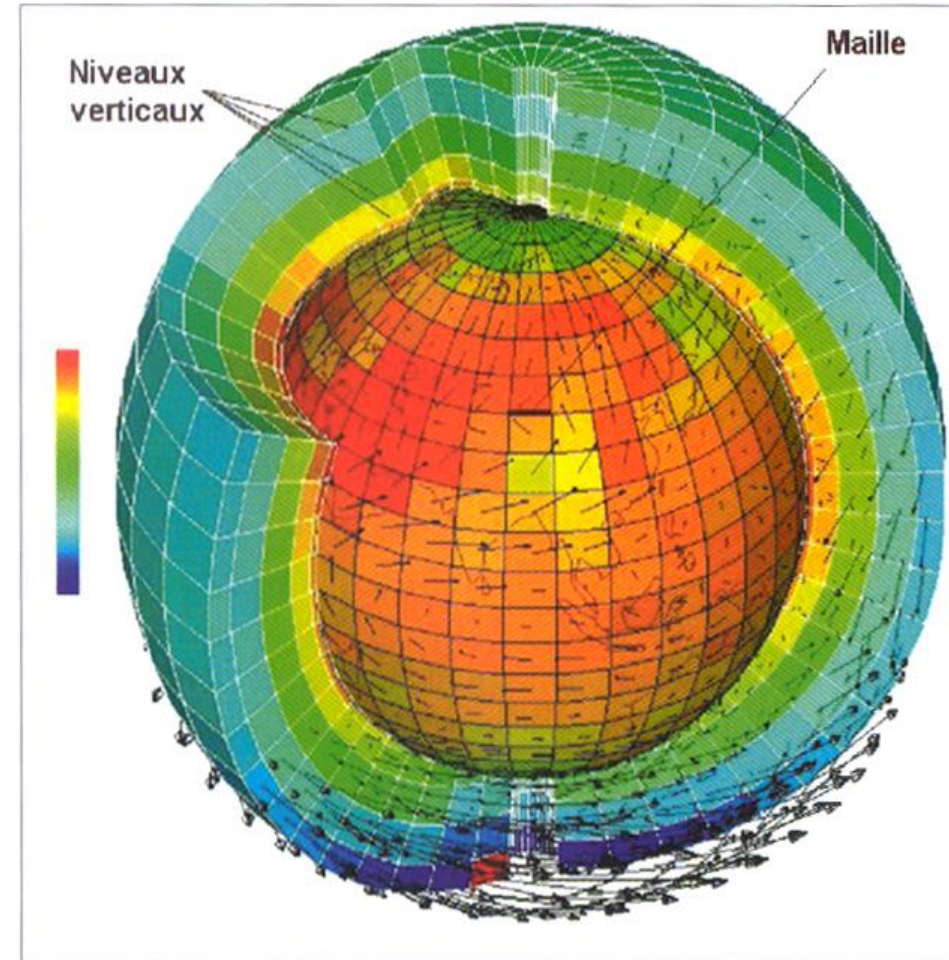


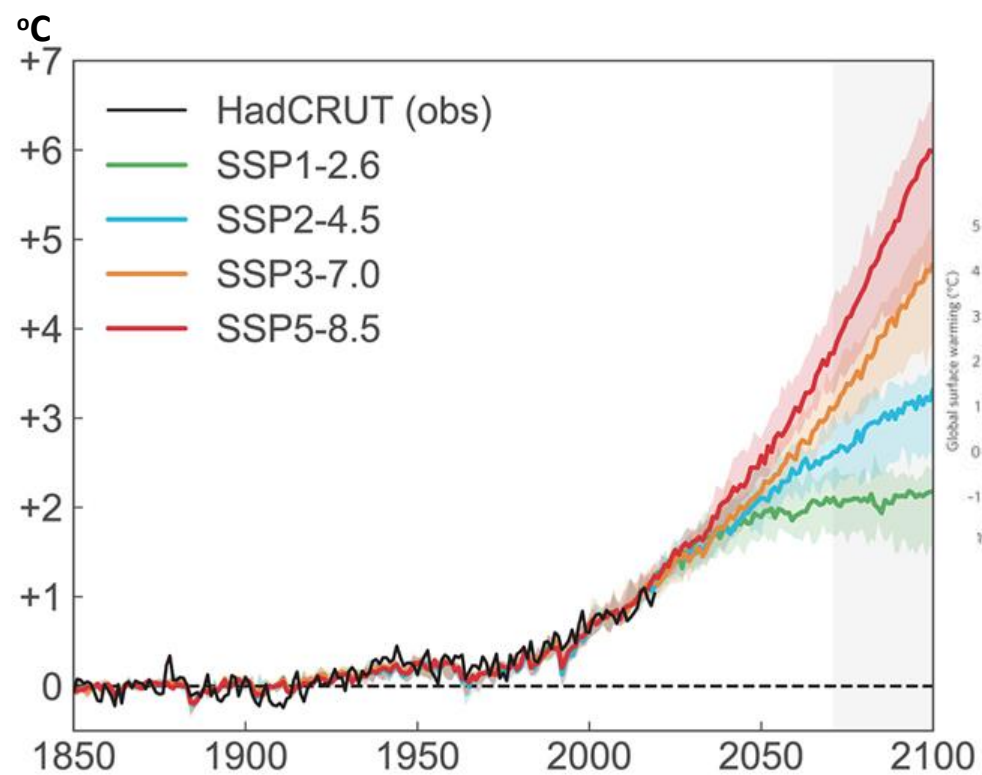
CENÁRIOS FUTUROS IPCC

O espaço é dividido em caixas definidas por grades horizontais e níveis verticais.

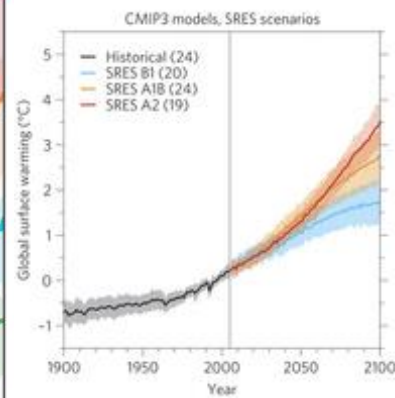
Em cada caixa a atmosfera é homogênea e é suficiente conhecer o valor em 1 ponto da caixa.

Modelo em ponto de grade

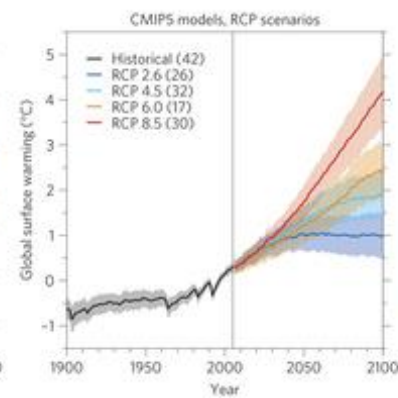




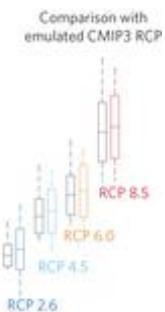
IPCC 2021



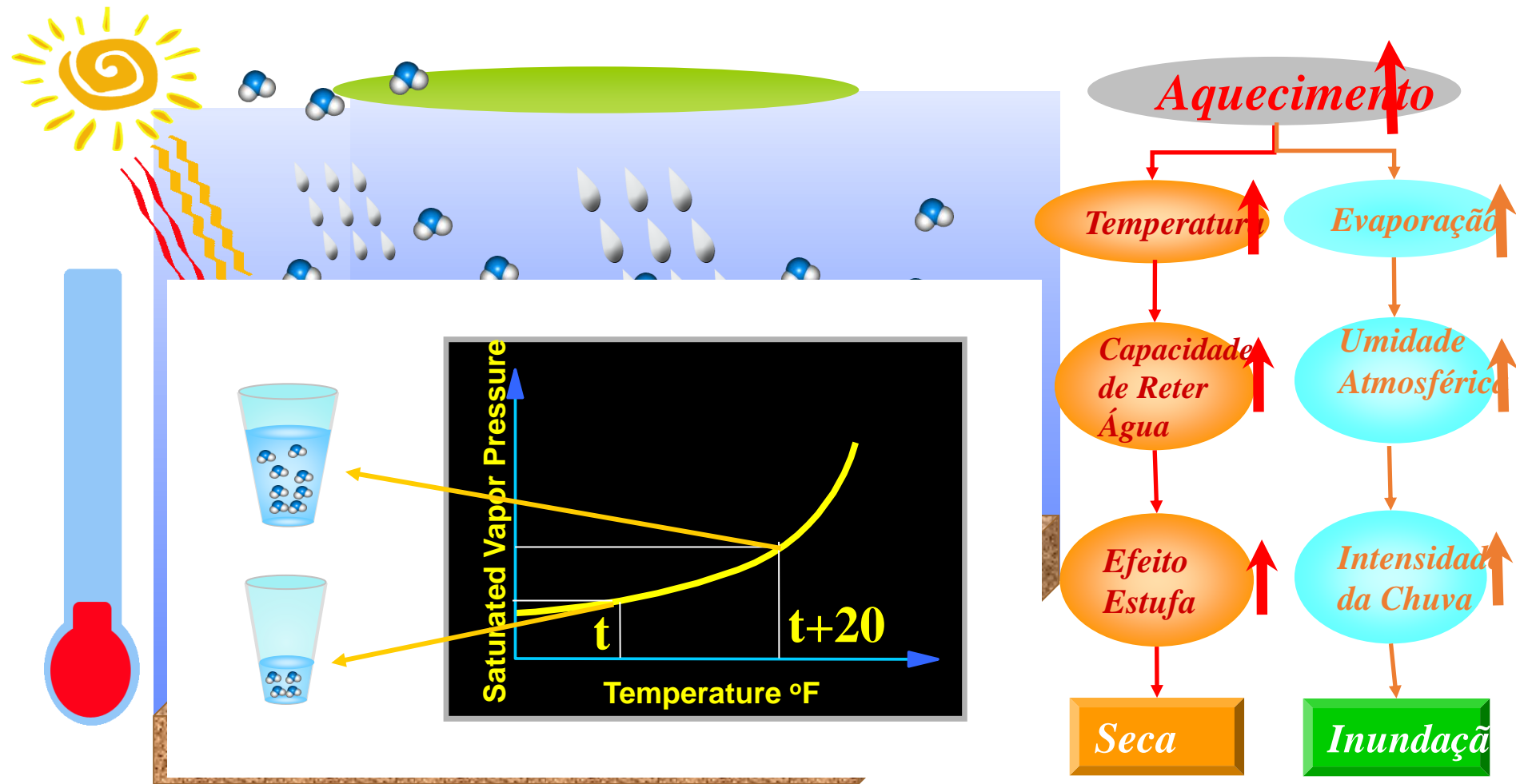
IPCC 2007



IPCC 2013

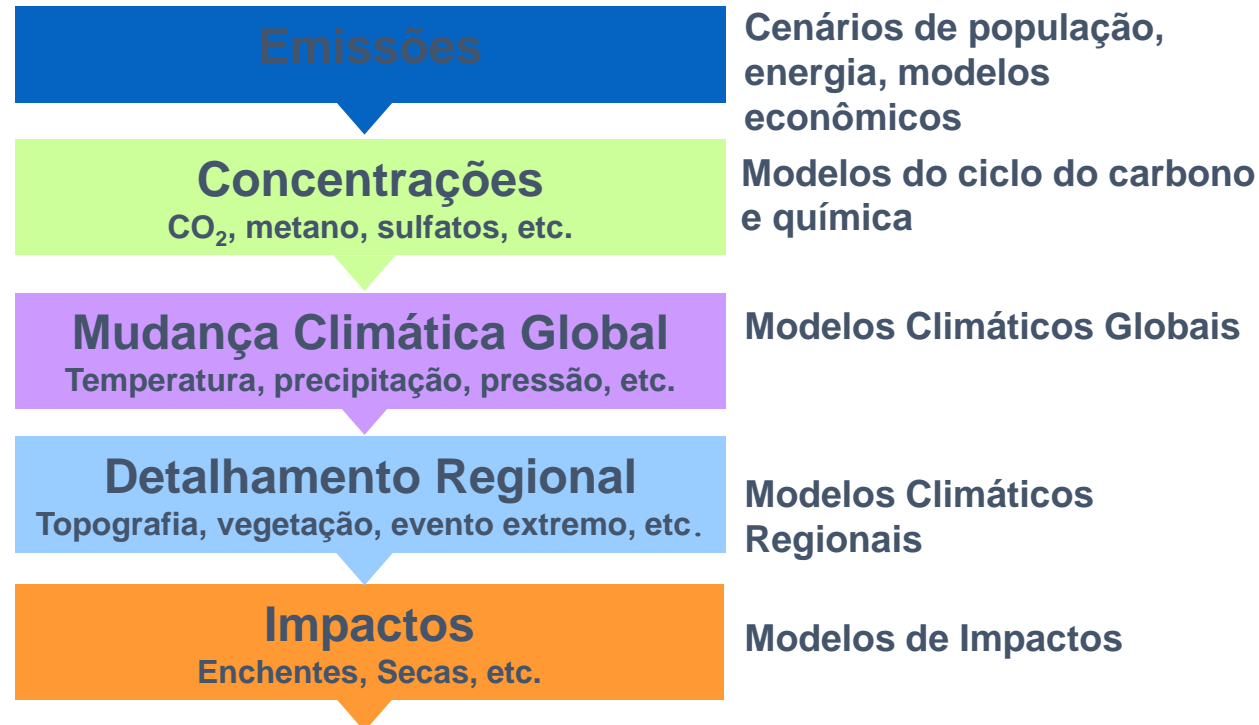


Conexão entre Aquecimento Global e o Ciclo Hidrológico



‘Cascata’ de Incertezas

Projetar os Impactos das Mudanças Climáticas



Cortesia: Dra. Chou

Entendendo as mudanças climáticas e seus impactos

Ana Maria H de Avila

V Seminário de Áreas Protegidas das Bacias PCJ