

Streamlining Climate Model Accessibility for Integration into Site-Specific Life Science Research

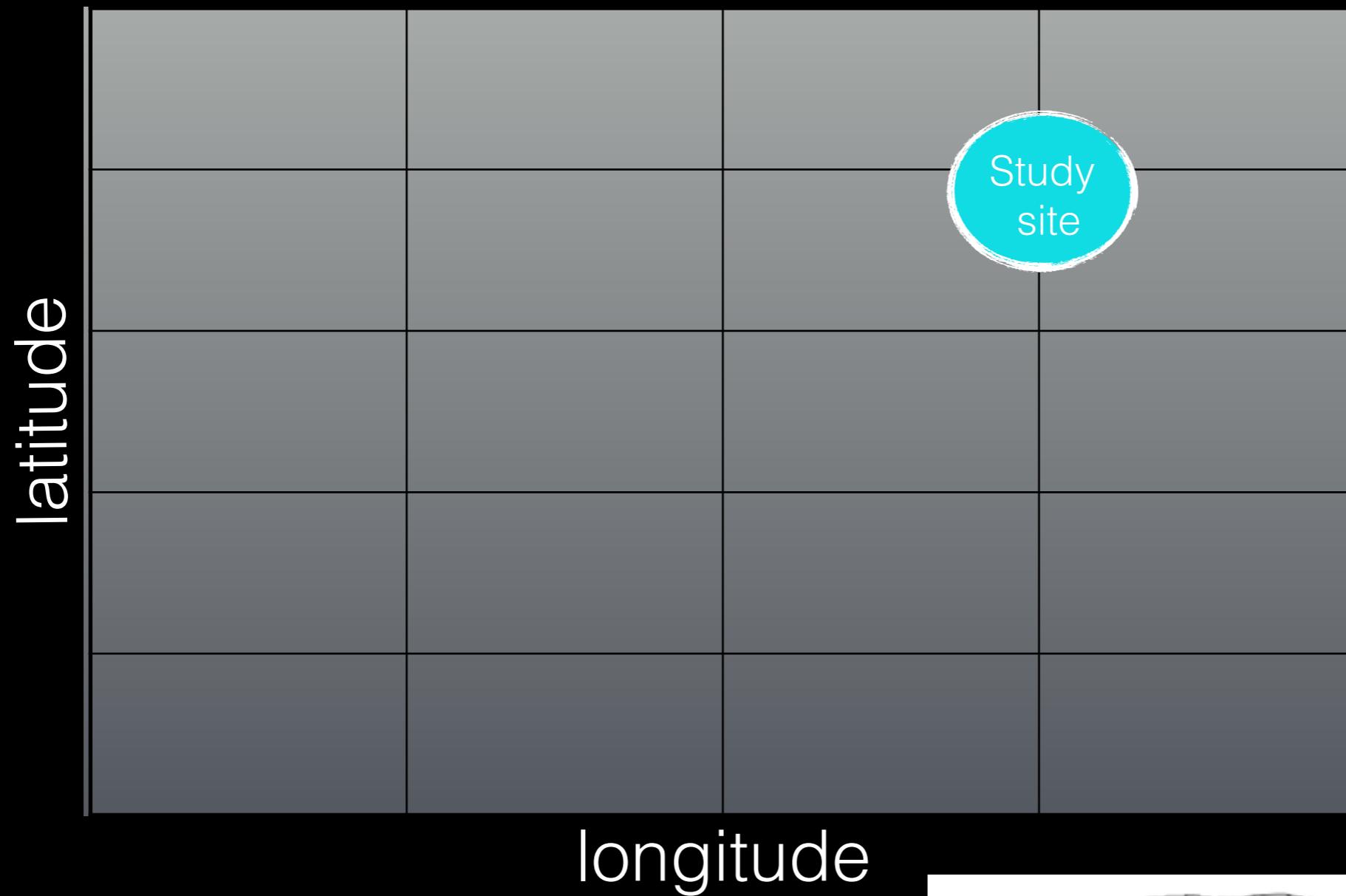
Jenna Baughman and Sara Stoudt

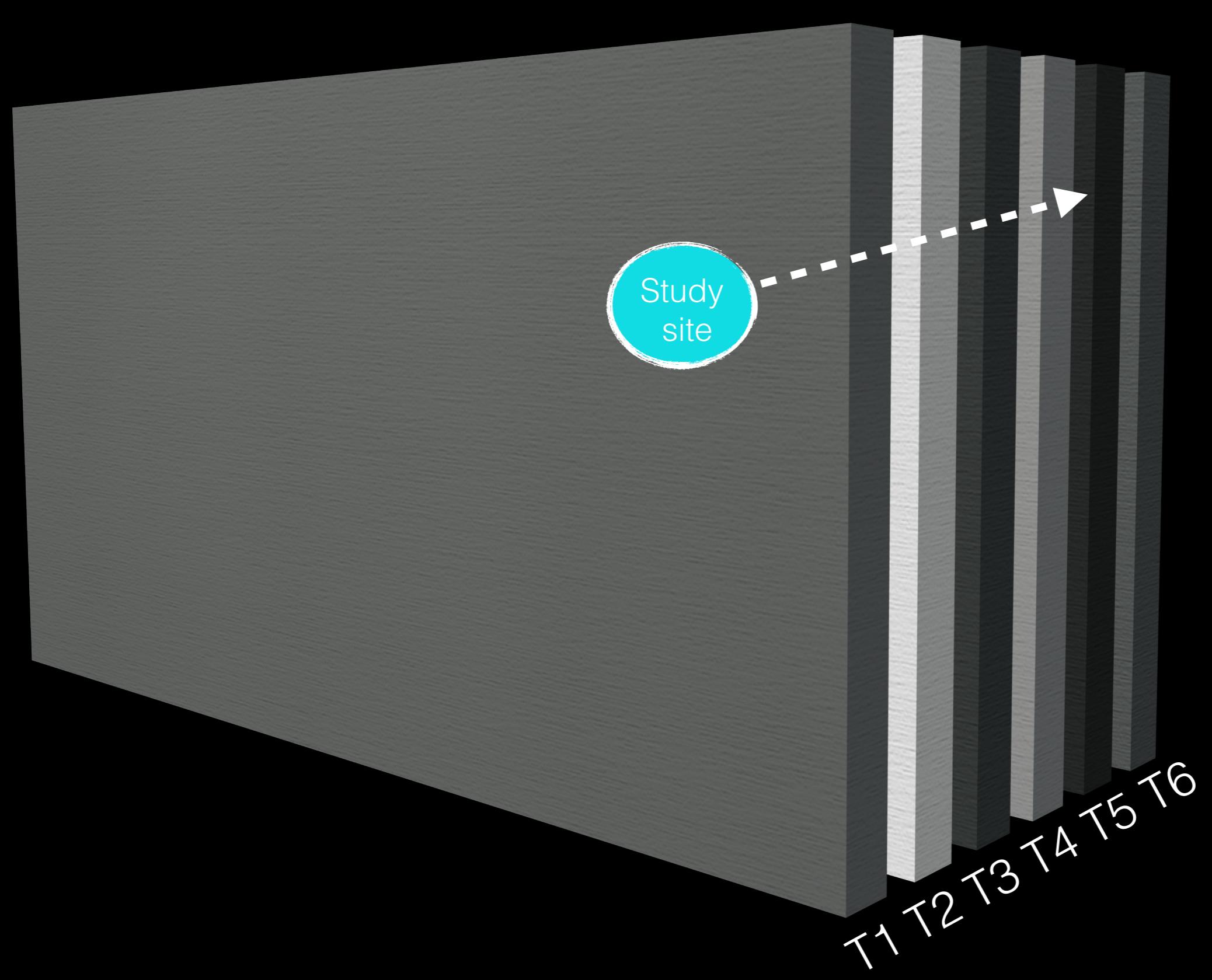


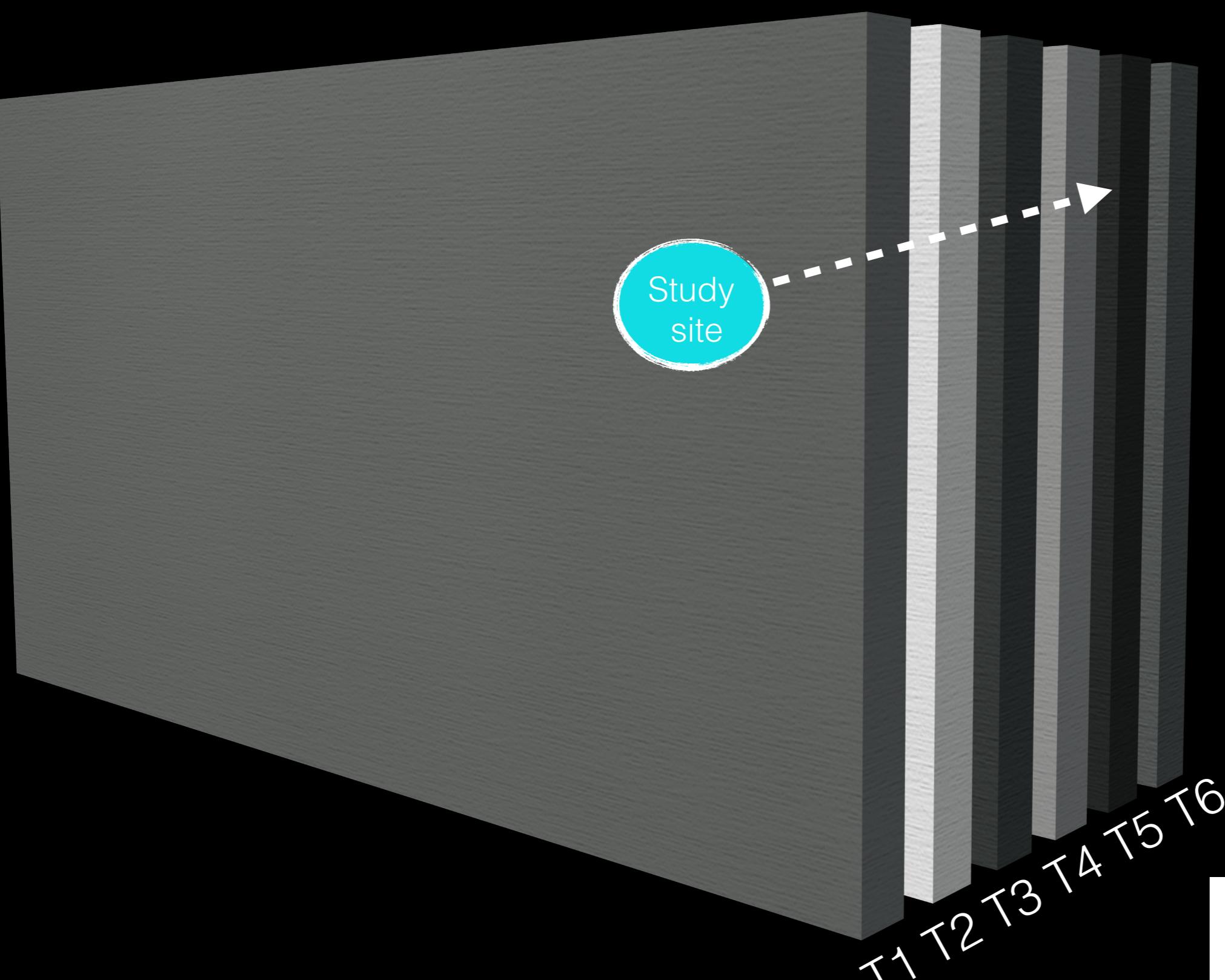


the problem

spatial climate data



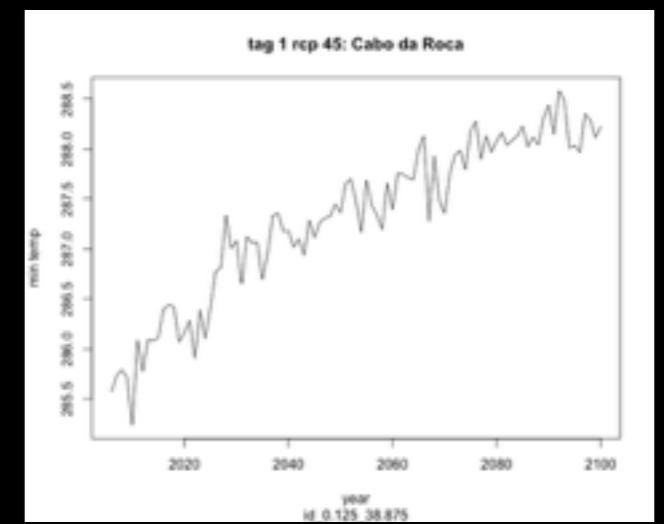
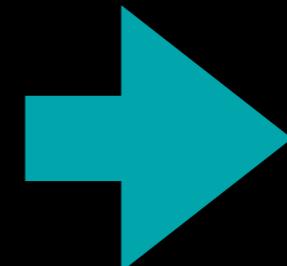


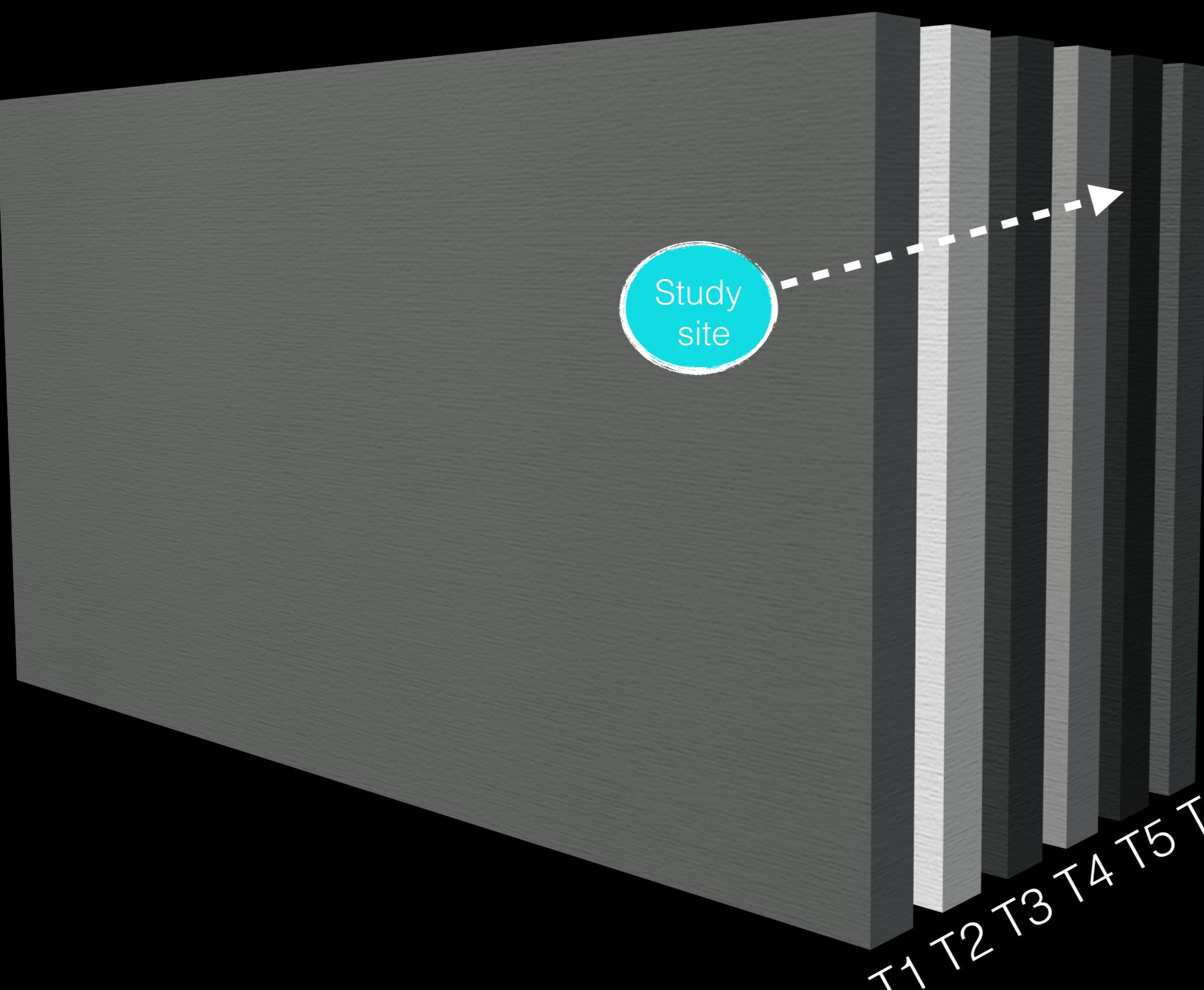


Study
site

T1 T2 T3 T4 T5 T6

data you want:



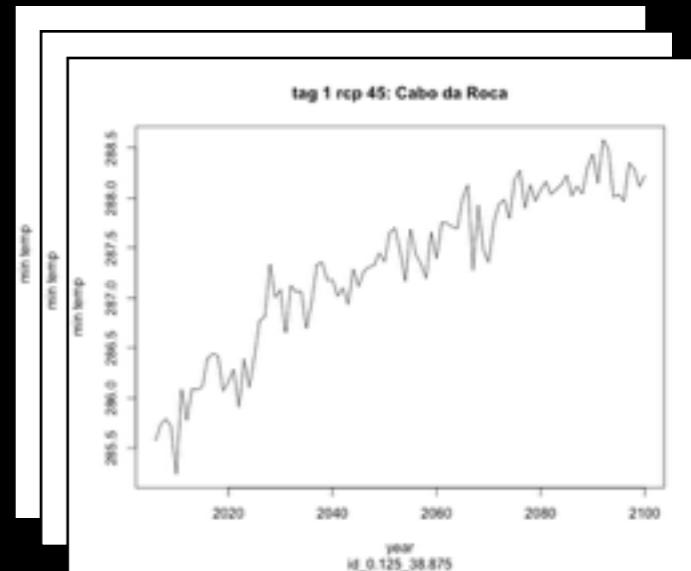
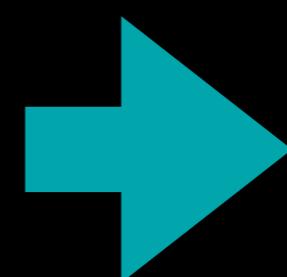


Study
site

T1 T2 T3 T4 T5 T6

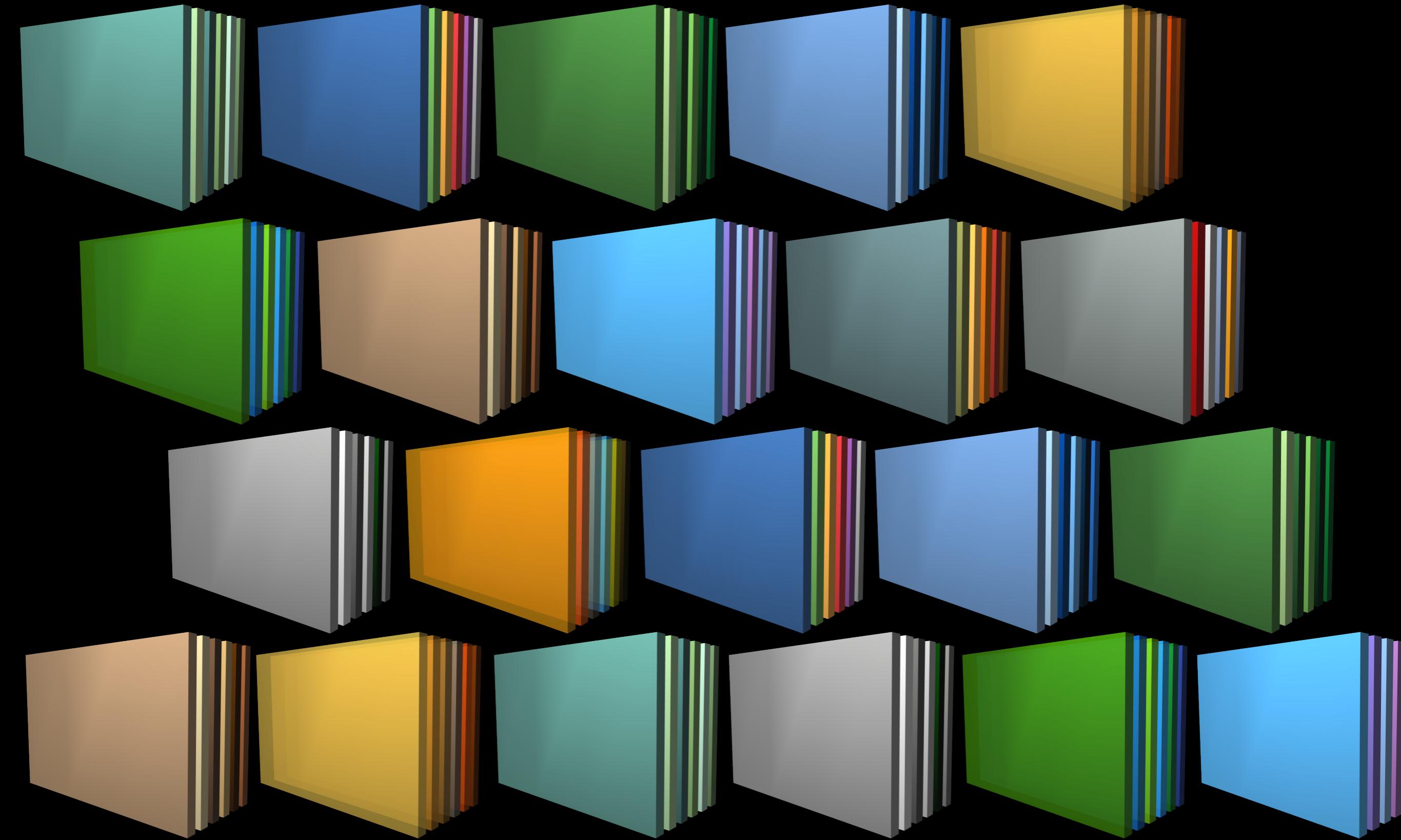
precipitation
minimum temperature
maximum temperature

data you want:





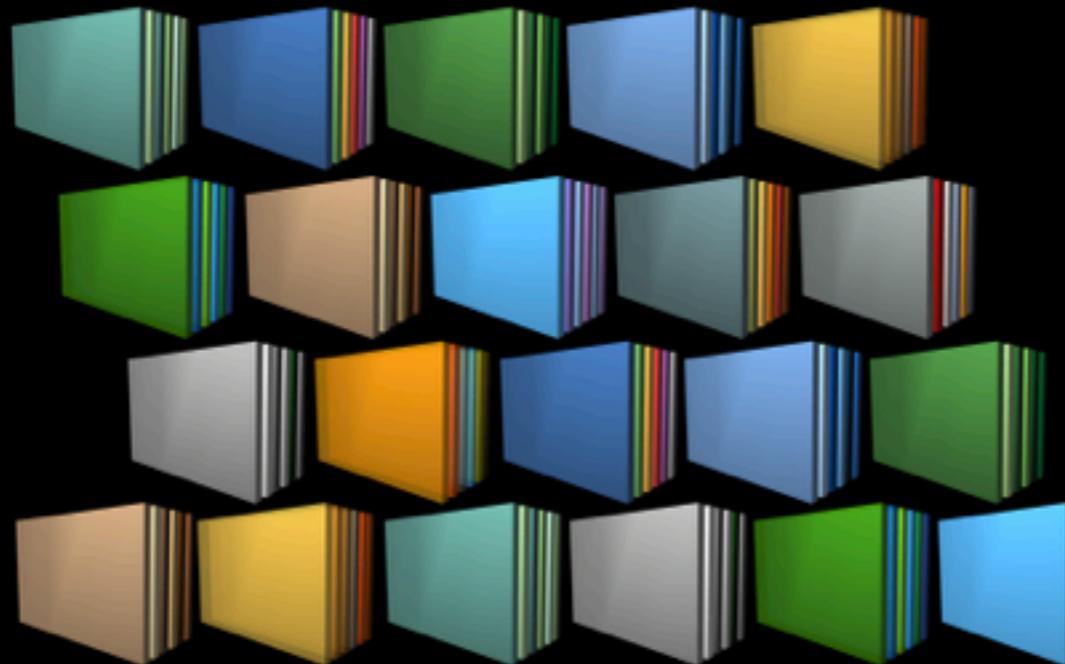
21 climate models



2 climate scenarios
+ historical

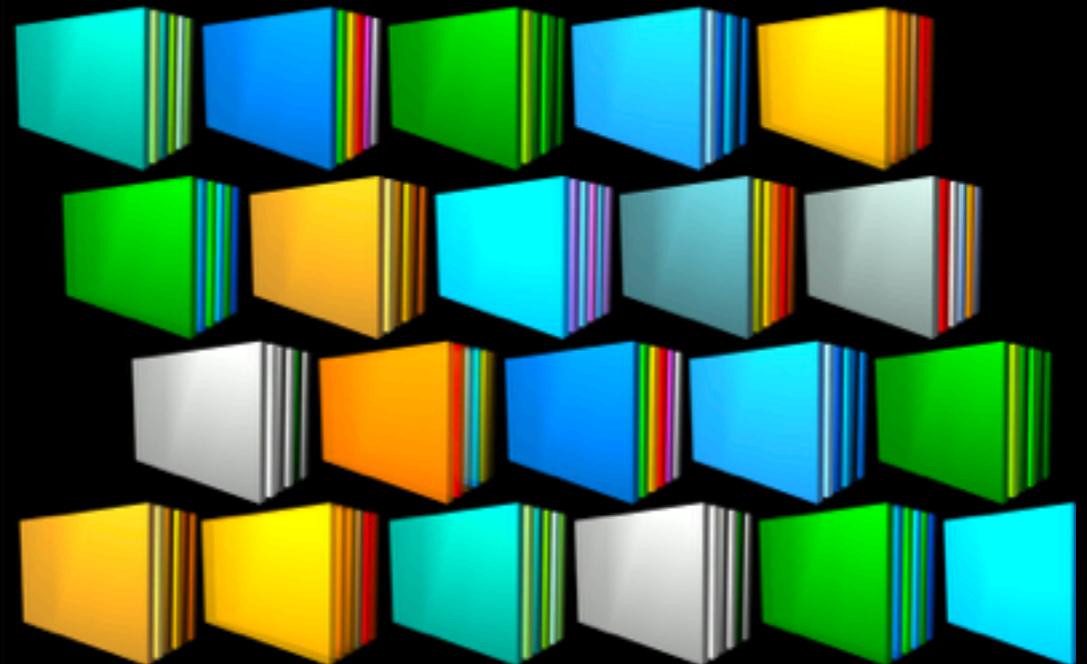
rcp45

21 climate models



rcp85

21 climate models



history

21 climate models

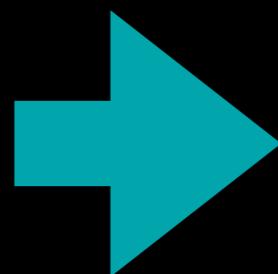


for 3 different
variables

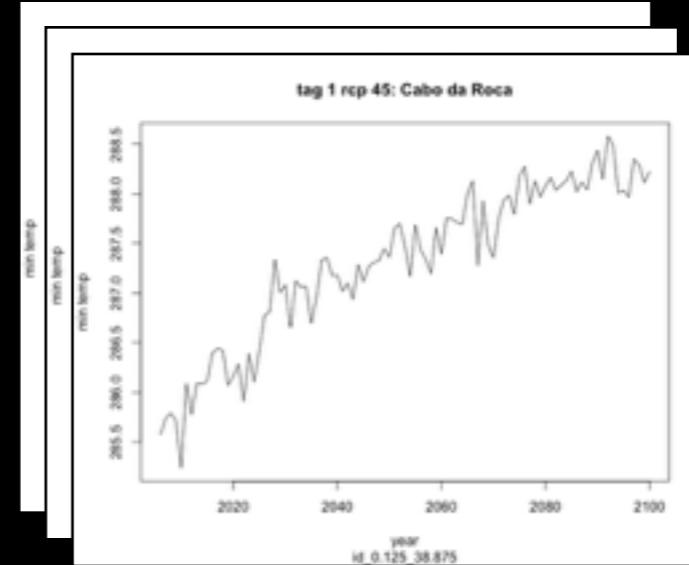
11 TB of data

11 TB of data

all you want:



precipitation
minimum temperature
maximum temperature





where we come in

- **our goals:**
 - create a simplified method for scanning the 21 climate models for different properties and weather variables over small regions across the globe
 - make pipeline for obtaining site specific temporal data
- precipitation, maximum temperature, and minimum temperature
 - **both directional trends and variability shifts in future scenarios until 2100**
 - 55 years of annual modeled historical climate

methods

- bash scripting: download data (*takes weeks)
- R: aggregate daily to yearly, make map images and time series plots (*takes many hours for one model/variable combo)
- d3: interactive slider stitching together historical maps over time, dropdown menus for comparing snapshot summaries of climate products (learning curve, requires JavaScript and html)
- summary statistics
 - directional trends (robust OLS) & variability shifts (track SD over time)

*all computational times are for a personal laptop

case study

- bird researcher in Portugal
- collects daily population data for all birds at a particular site
- wants to know how climate change will affect the populations



user research question



- Q: how will bird population demographics change with future climate scenarios?
 - what if we get warmer winters?
 - what if we get less precipitation?
 - what if we get more variable precipitation?

user work flow



- look through future climate scenarios
- choose climate products with properties of interest for research question
- check historical data

user work flow



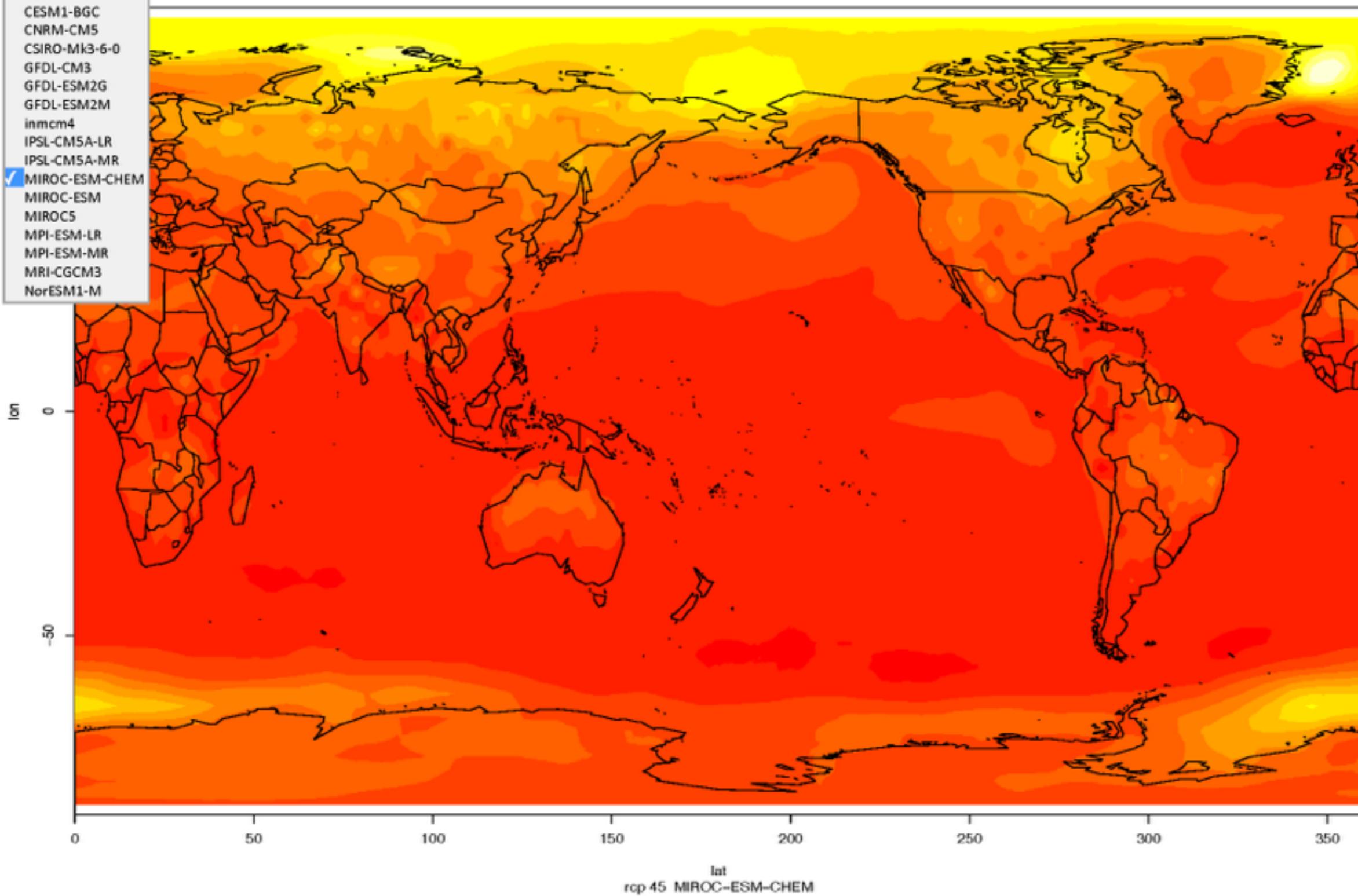
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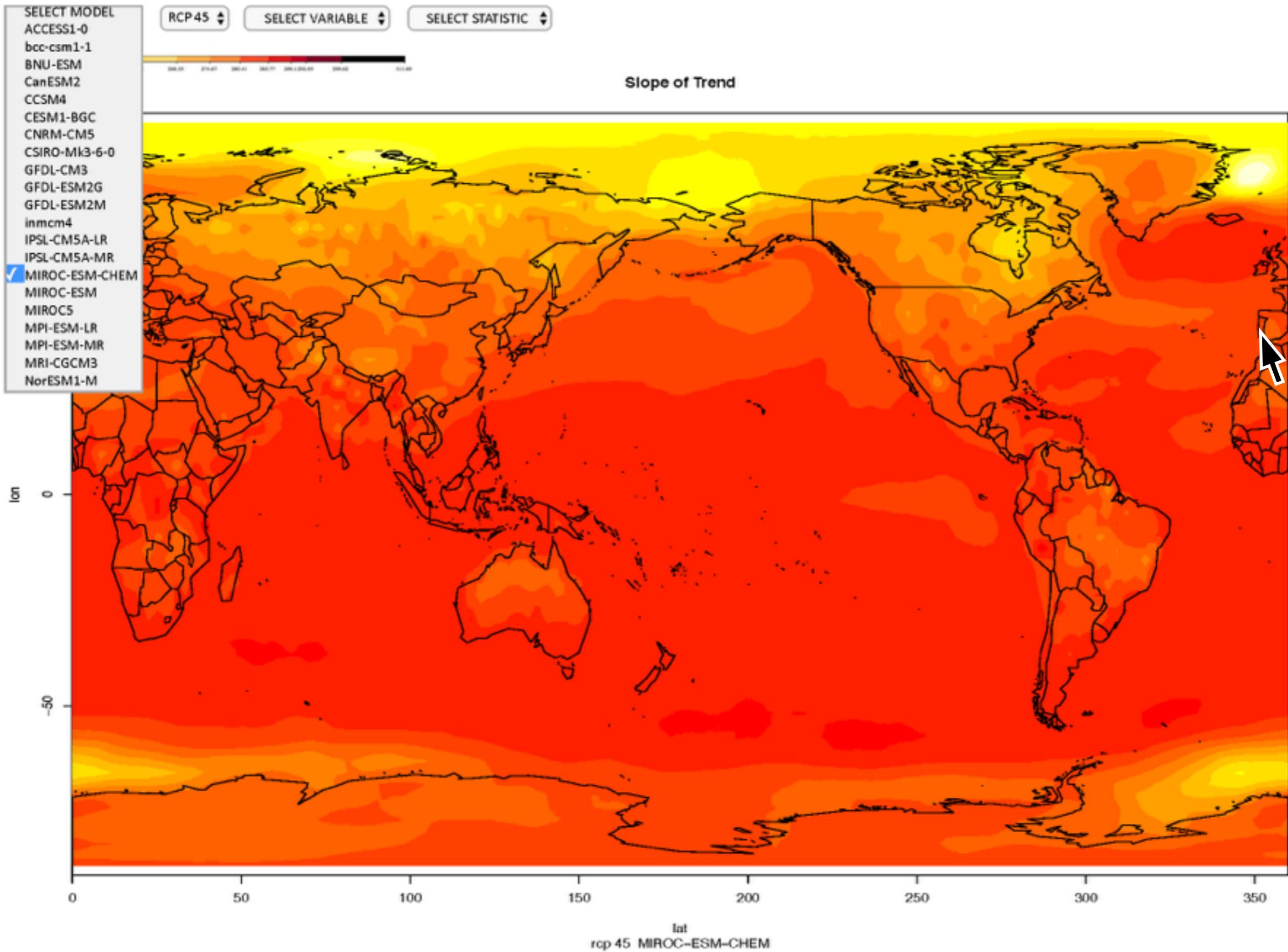
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ACCESS1-0
bcc-csm1-1
BNU-ESM
CanESM2
CCSM4
CESM1-BGC
CNRM-CM5
CSIRO-Mk3-6-0
GFDL-CM3
GFDL-ESM2G
GFDL-ESM2M
inmcm4
IPSL-CM5A-LR
IPSL-CM5A-MR
 MIROC-ESM-CH
MIROC-ESM
MIROC5
MPI-ESM-LR
MPI-ESM-MR
MRI-CGCM3
NorESM1-M

RCP45 ▾ SELECT

SELECT VARIABLE

SELECT STATISTIC





SELECT MODEL

- ACCESS1-0
- bcc-csm1-1
- BNU-ESM
- CanESM2
- CCSM4
- CESM1-BGC
- CNRM-CM5
- CSIRO-Mk3-6-0
- GFDL-CM3
- GFDL-ESM2G
- GFDL-ESM2M
- inmcm4
- IPSL-CM5A-LR
- IPSL-CM5A-MR
- MIROC-ESM-CHEM
- MIROC-ESM
- MIROC5
- MPI-ESM-LR
- MPI-ESM-MR
- MRI-CGCM3
- NorESM1-M

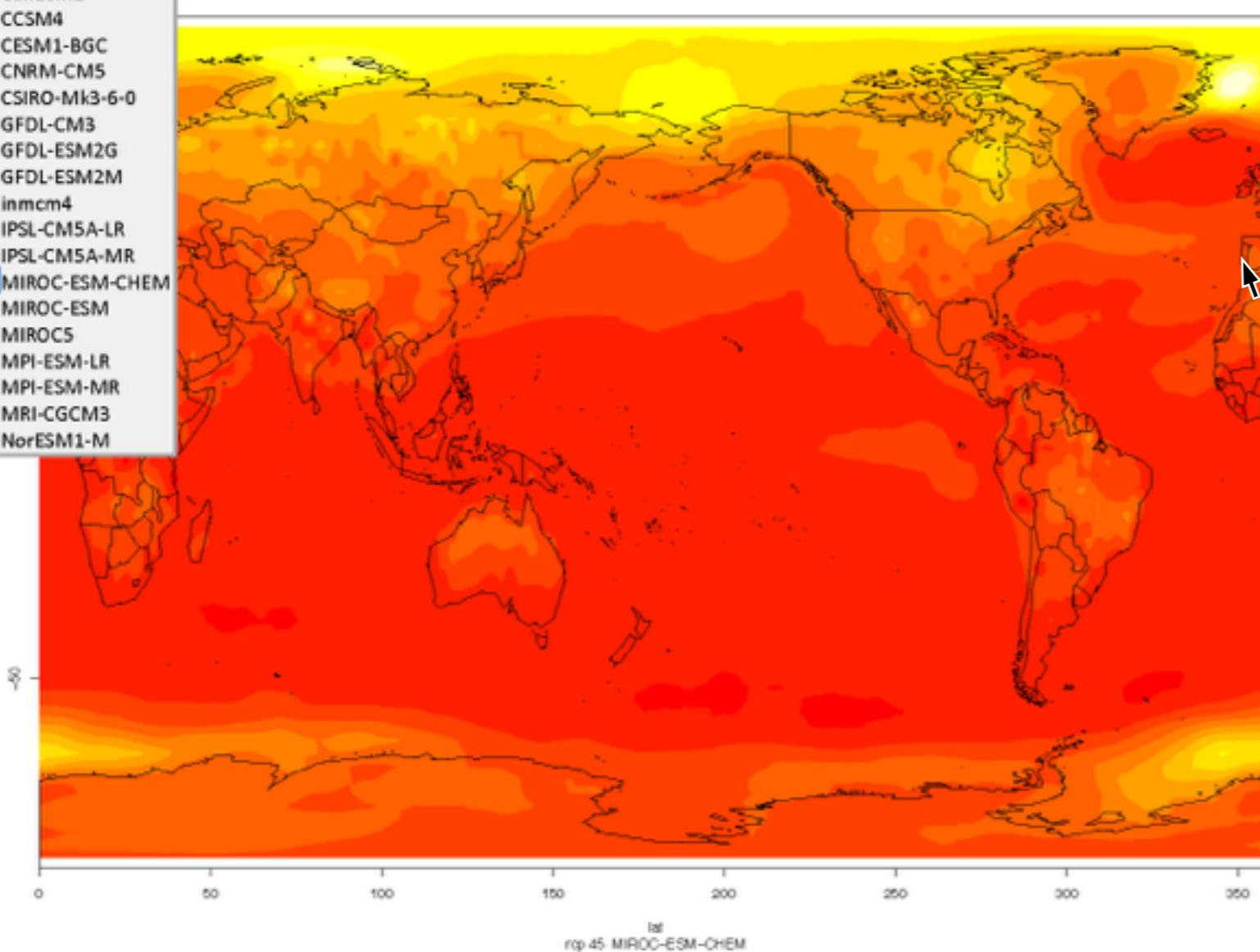
RCP 45 ▾

SELECT VARIABLE ▾

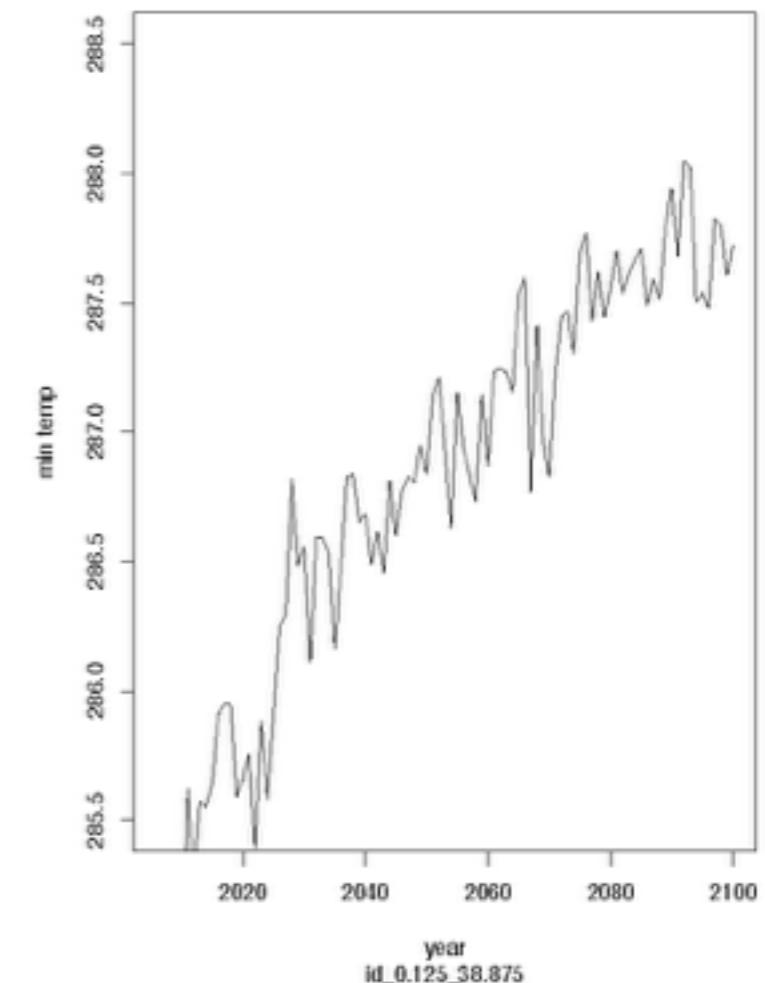
SELECT STATISTIC ▾



Slope of Trend



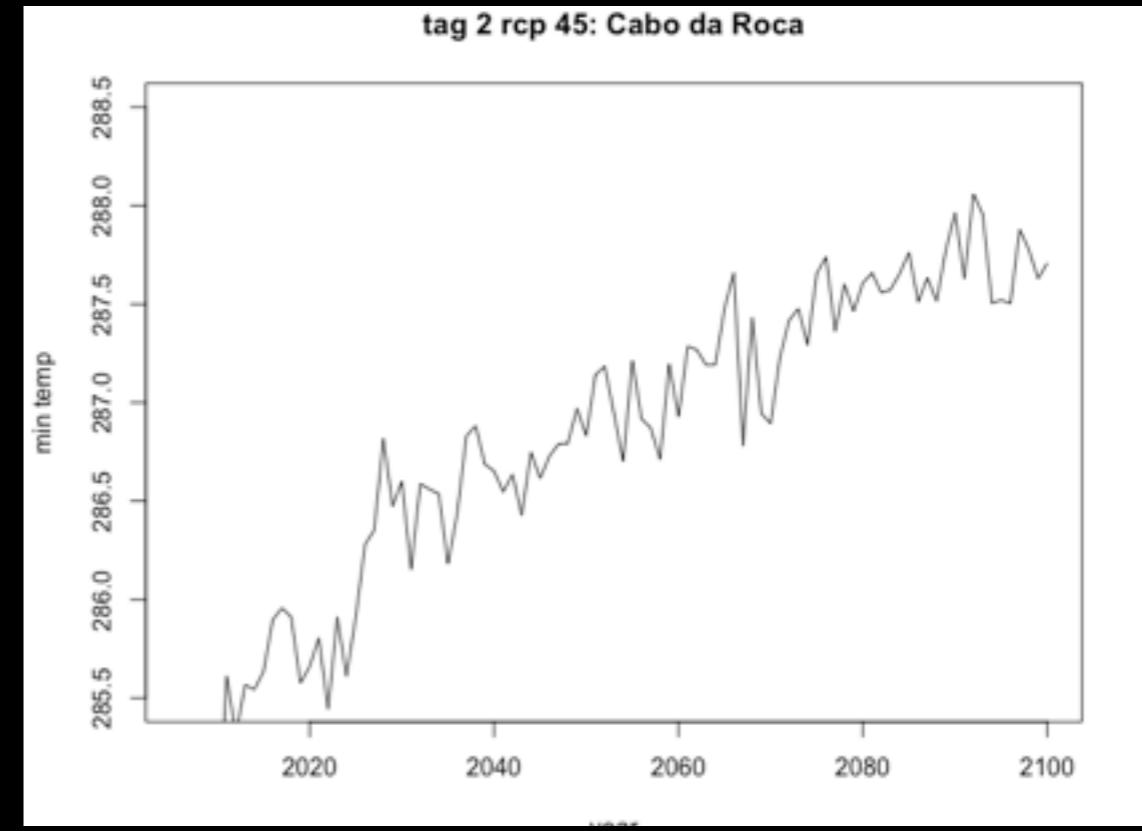
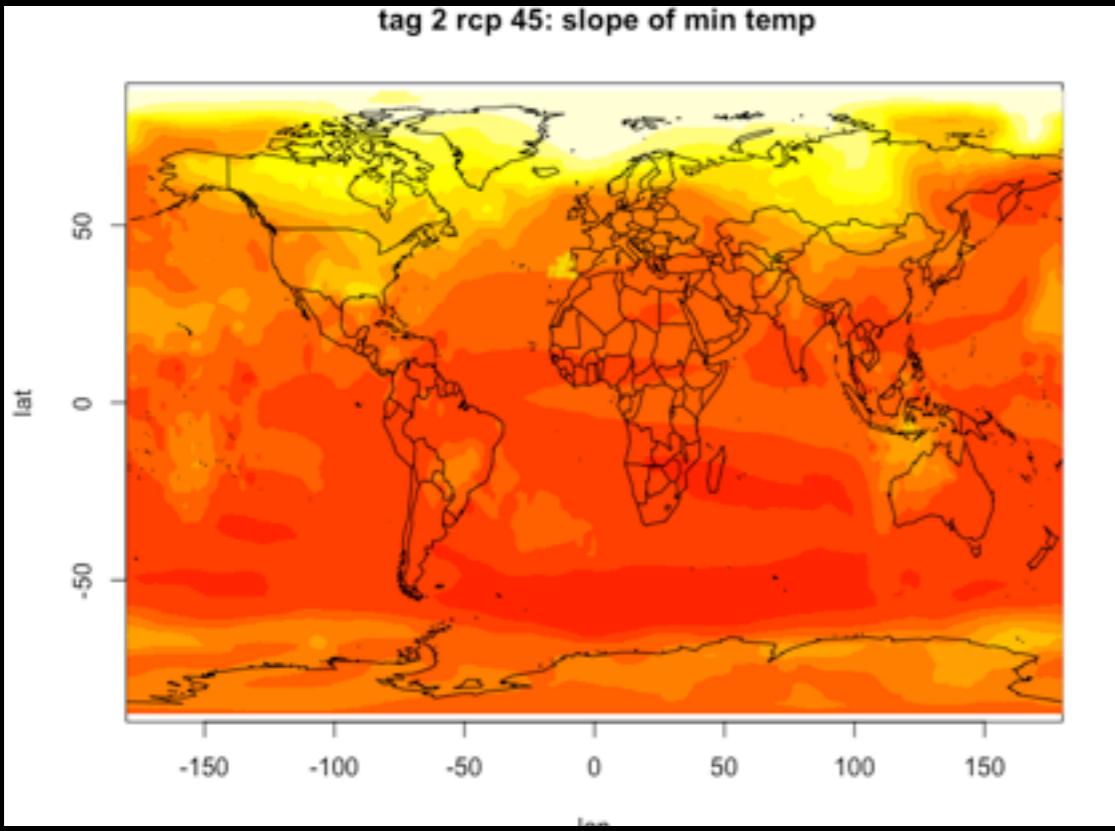
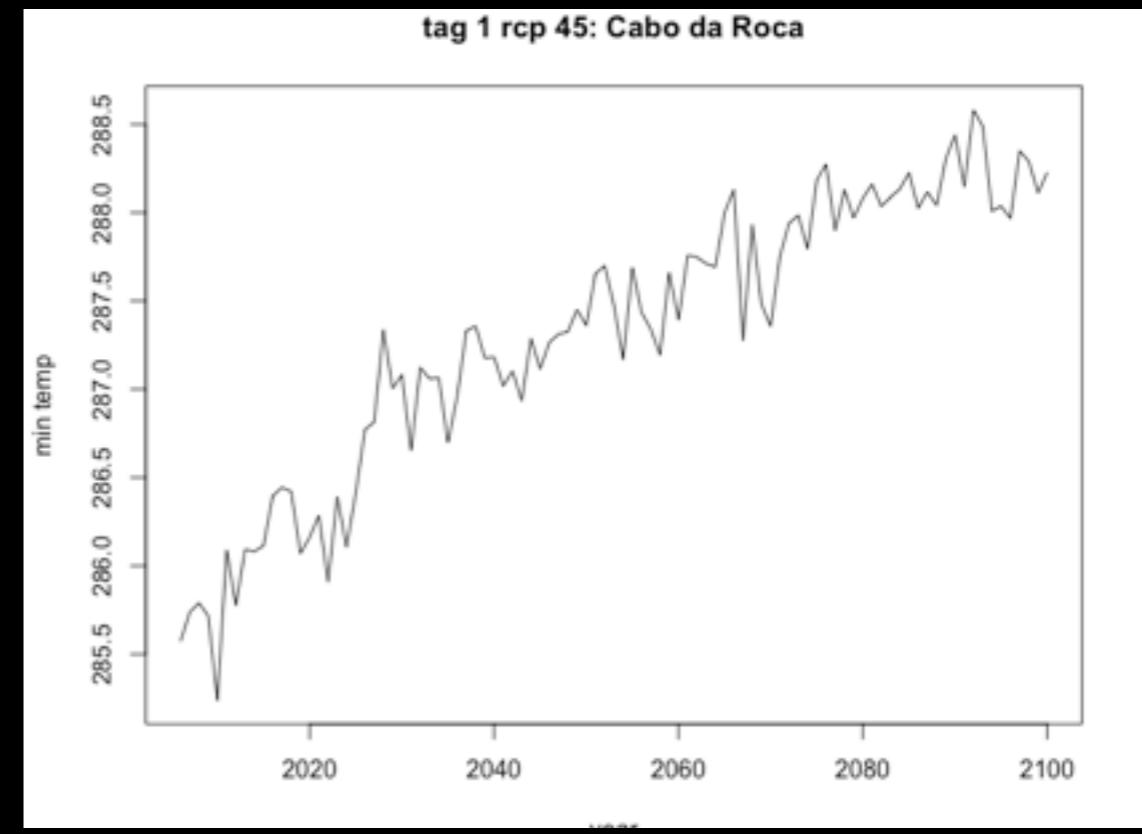
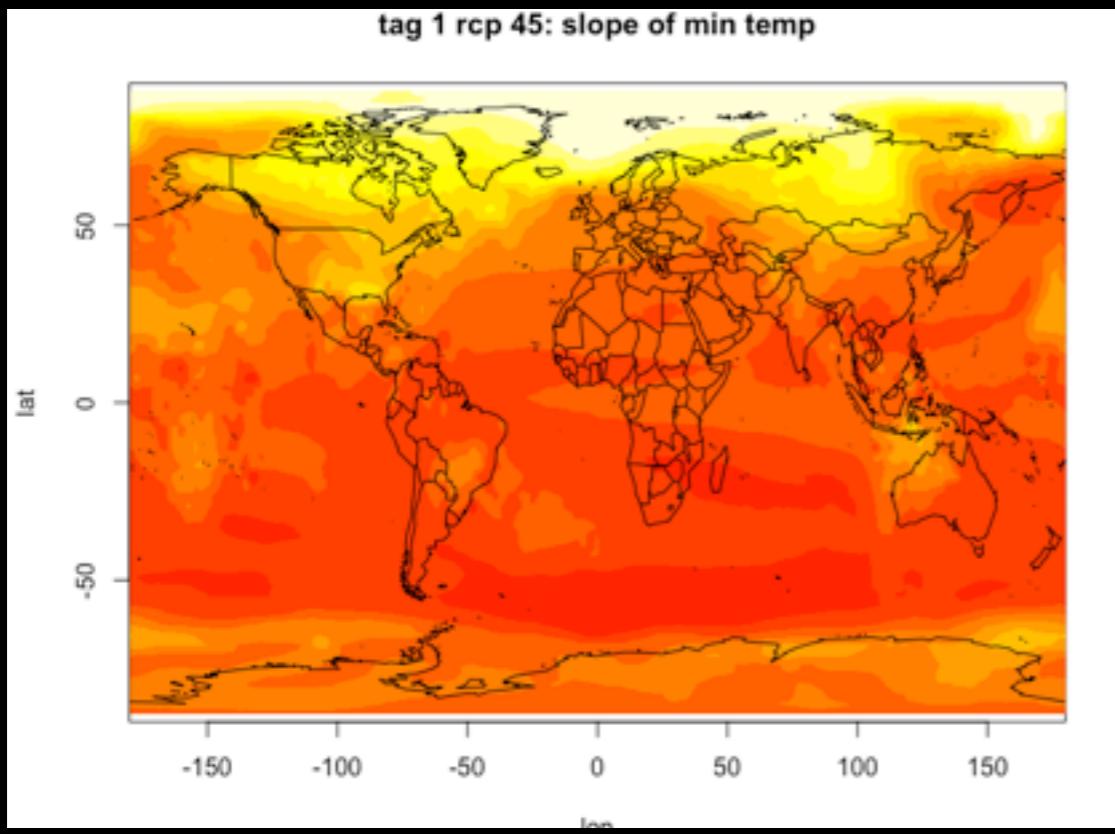
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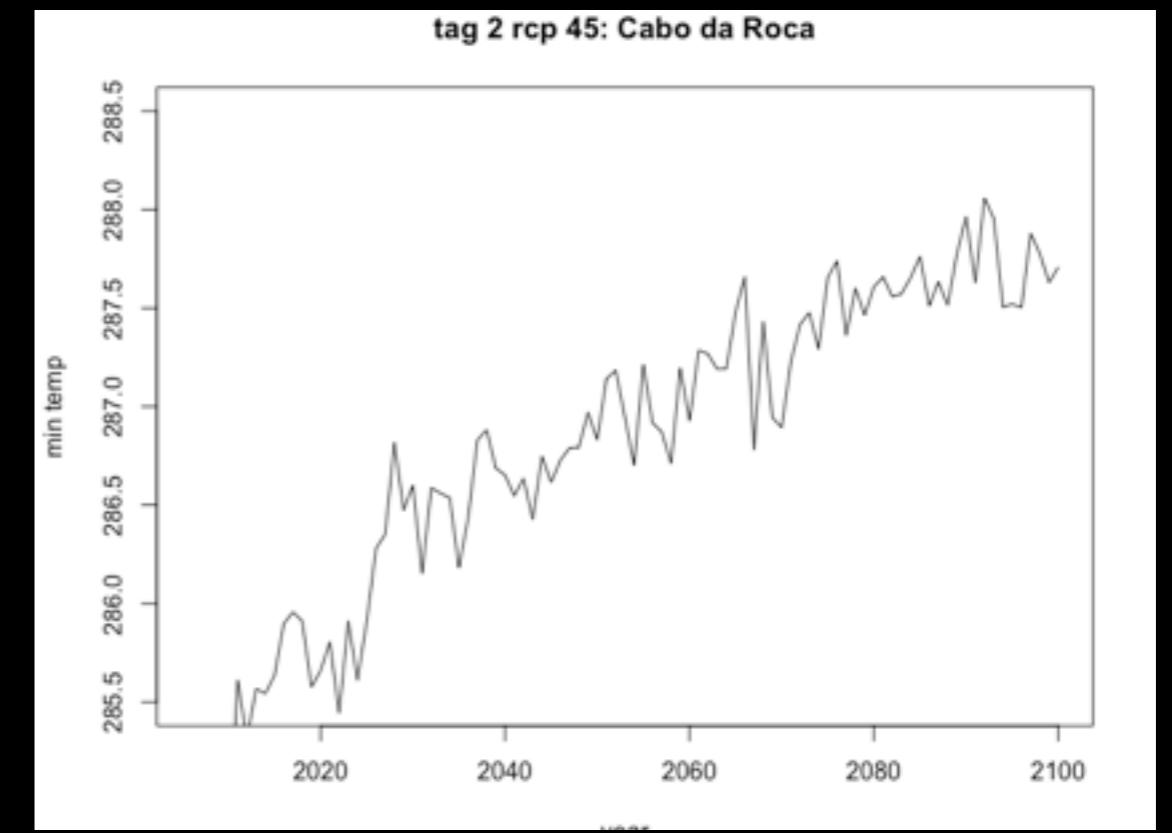
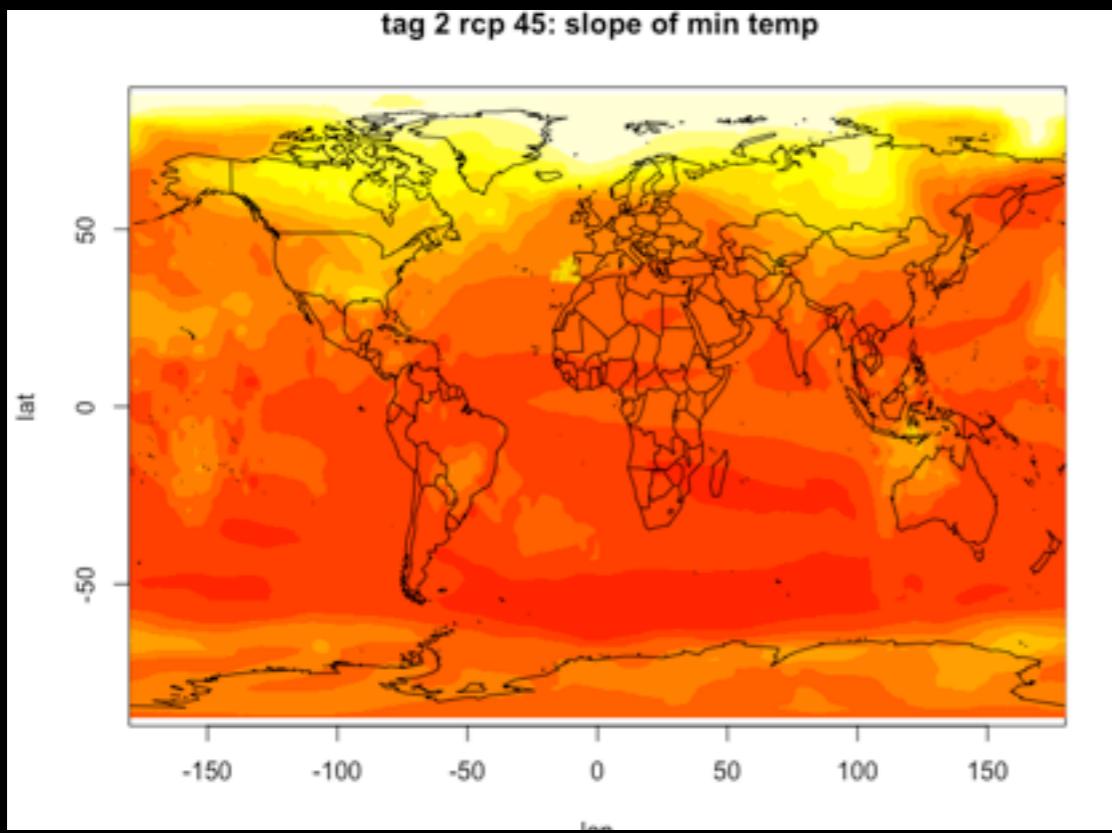
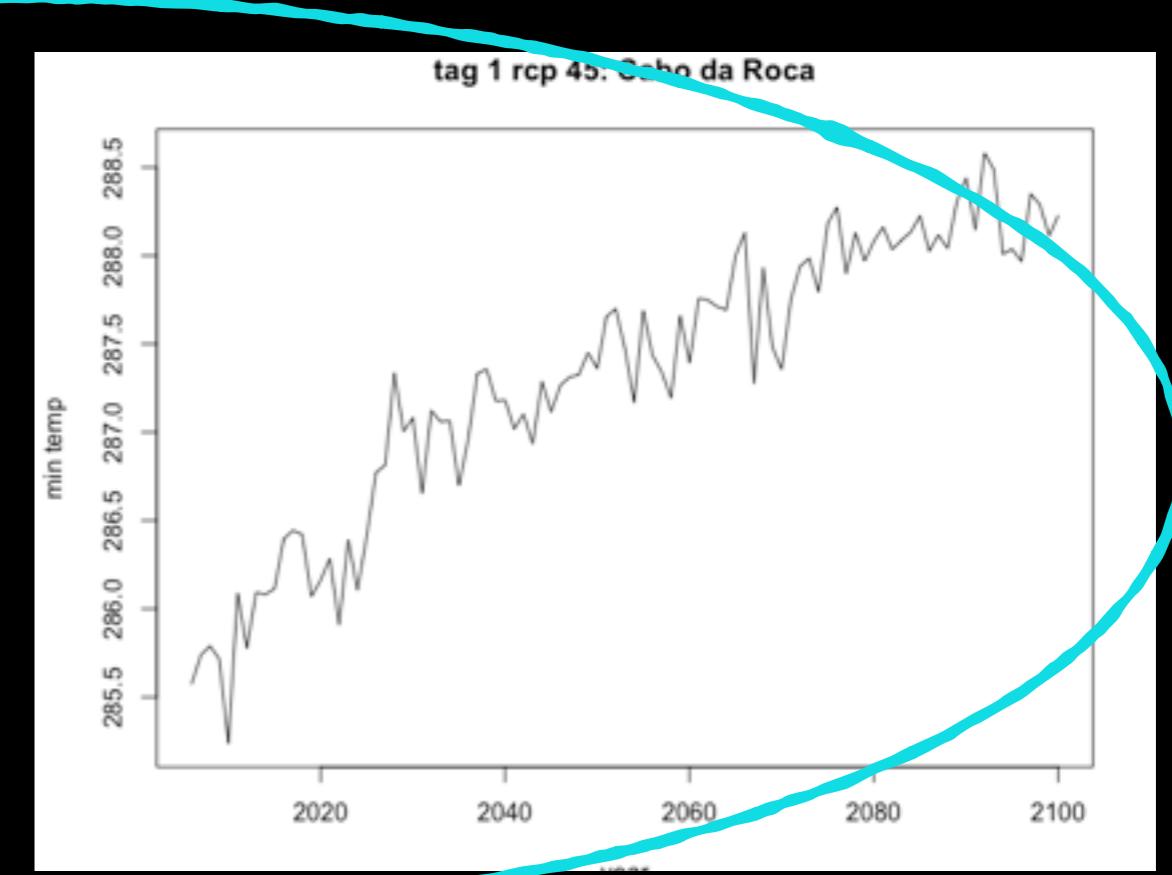
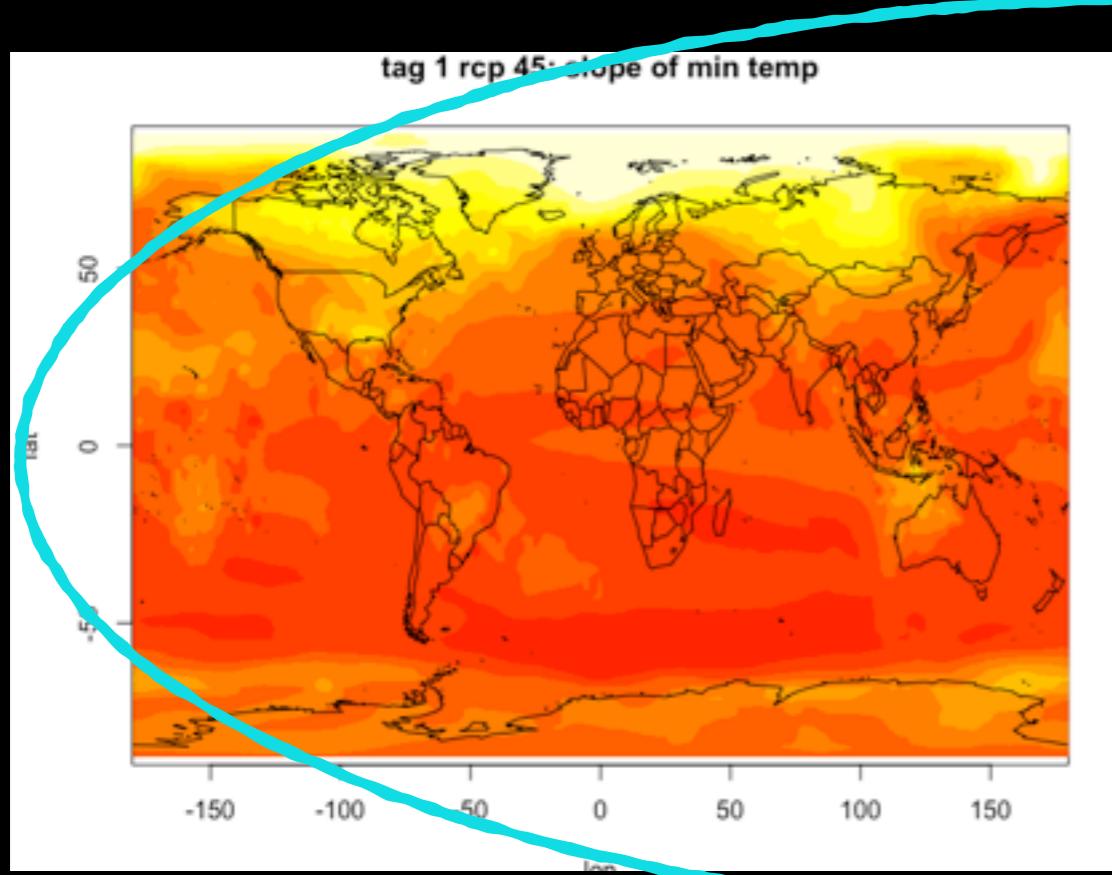


user work flow



- look through future climate scenarios
- choose climate products with properties of interest for research question
- check historical data





user work flow



- look through future climate scenarios
- choose climate products with properties of interest for research question
- access historical data

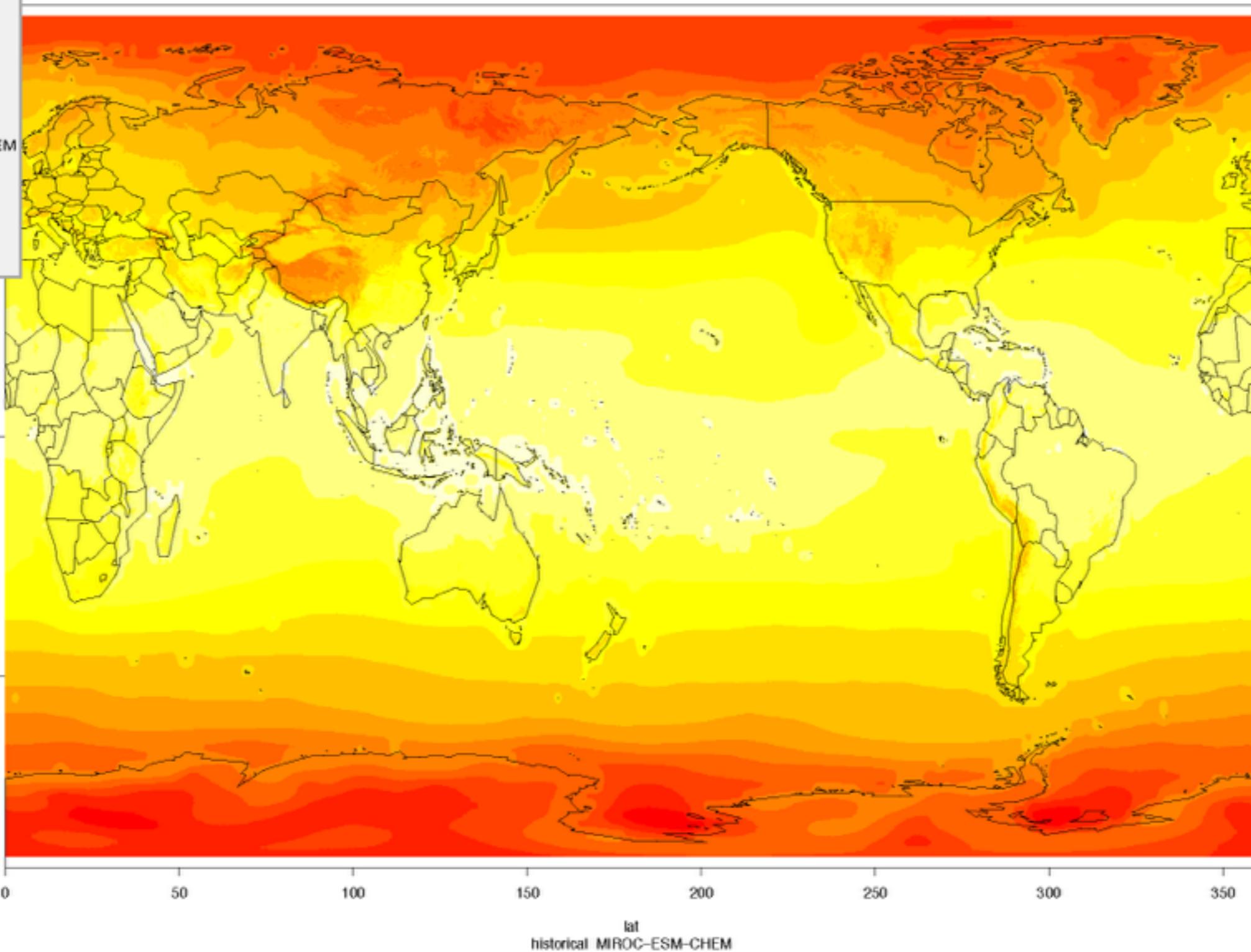
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 - MPI-ESM-MR
 - MRI-CGCM3
 - NorESM1-M

SELECT VARIABLE

SELECT STATISTIC



Mean Min Temp 1970



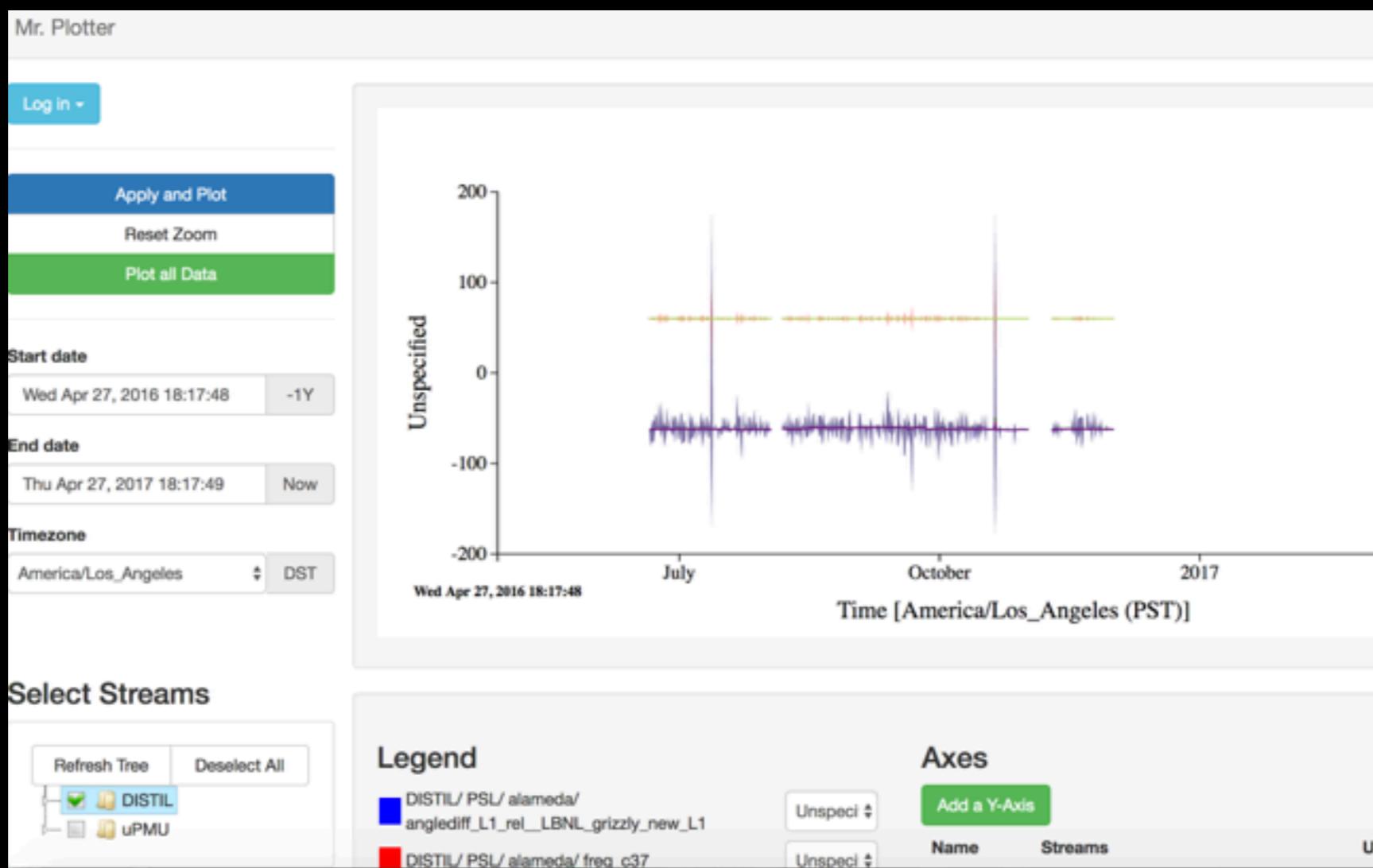
user data pipeline



- using our code on GitHub (https://github.com/sastoudt/UCB_DS421_NEX_partnerProject)
 - scrape chosen model data from NEX
 - process data (ID for grid cell of interest given)

future work

- interface with Berkeley Tree Database
(download time series directly given a location or bounding box)





special thanks to Proxima for her d3 help!