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BRISTOL

climatearchive.org

the Google Earth for climate data

Sebastian Steinig (@sebsteinig)

Dan Lunt

Paul Valdes

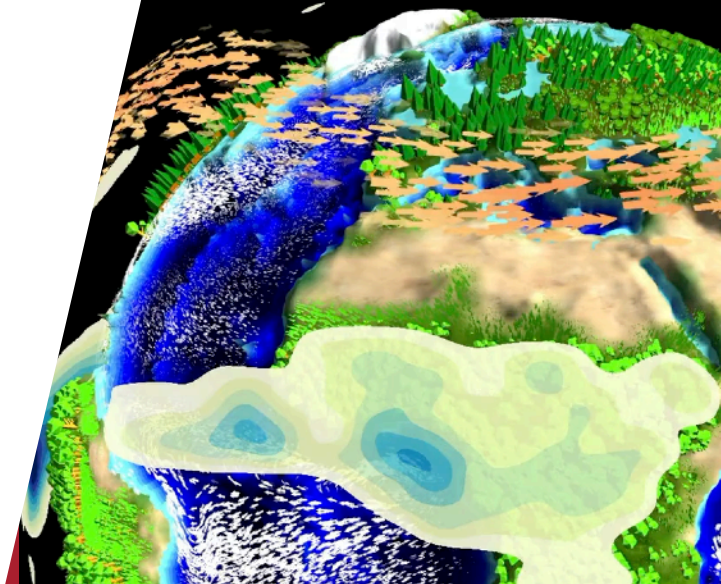
Christopher Scotese

Tessa Alexander

This project has been supported by the Jean Golding Institute for data science and data-intensive research at the University of Bristol.

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climatearchive.org





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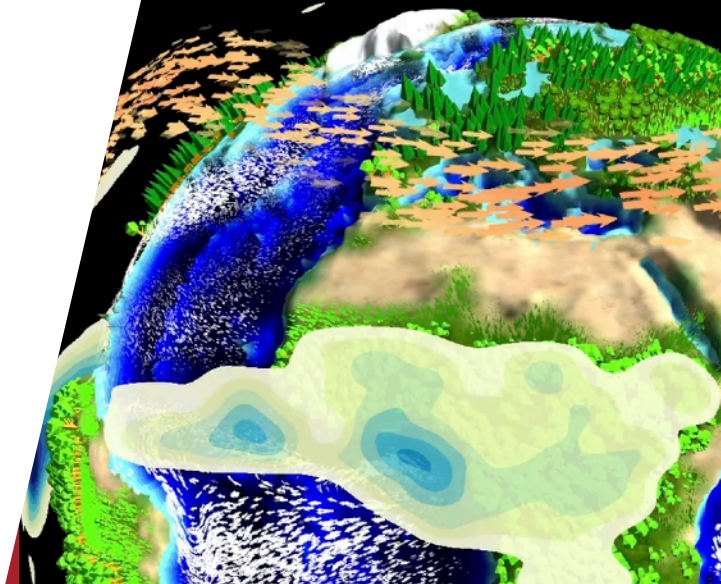
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the Google Earth for climate data

1. Climate model data
2. Technical implementation (coding on the GPU)
3. Demo

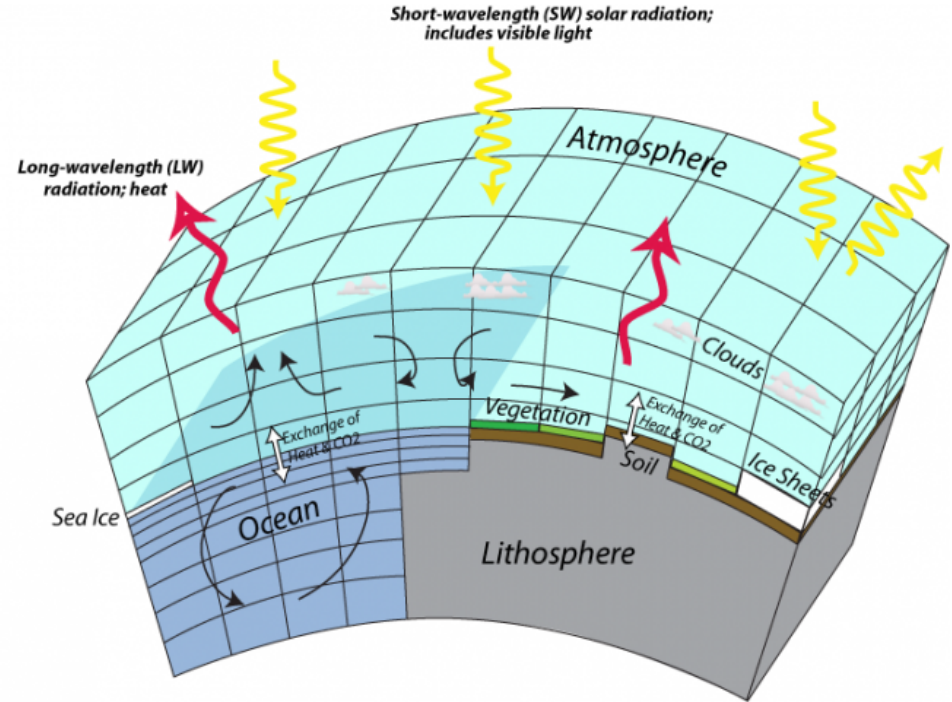
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Climate Models

- numerical representations of physical, chemical and biological processes in the Earth system
- can be used for past, present and future climates and even exoplanets
- output large number of global, gridded datasets



Credit: David Bice © Penn State University

Climate Model Data - CMIP6/IPCC



You are at the [ESGF@DOE/LLNL](#) node

[Home](#) [Contact Us](#) [Data Nodes Status](#)

[Technical Support](#)

MIP Era

Activity

CMIP (30577)

Model Cohort

Product

Source ID

Institution ID

Source Type

Nominal Resolution

Experiment ID

1pctCO2 (30577)

Sub-Experiment

Variant Label

Grid Label

Table ID

Frequency

- 1hr (9)
- 3hr (730)
- 3hrPt (318)
- 6hr (88)
- 6hrPt (211)
- day (4045)
- dec (59)
- fx (533)
- mon (22978)
- monC (478)

WARNING: Not all models include a variant "r1i1p1f1", and across models, identical values of variant_label do not imply identical variants! To learn which forcing datasets were used in each variant, please check modeling group publications and documentation provided through ES-DOC.

CMIP6 project data downloads are unrestricted. Downloads should be performed with the -s option to a wget script without the need to login. When using this method for download, ensure you are not using additional options, eg. -s and -H should never be combined.

For more information about CMIP6 data please consult this guide: <https://pcmdi.llnl.gov/CMIP6/Guide/dataUsers.html>

Enter Text: Display 10 results per page [\[More Search Options \]](#)

Show All Replicas Show All Versions Search Local Node Only (Including All Replicas)

Search Constraints: CMIP | 1pctCO2

Total Number of Results: 30577

-1- 2 3 4 5 6 Next >>

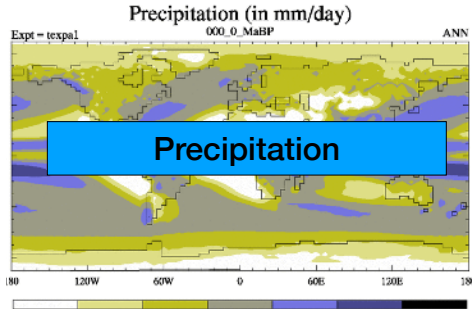
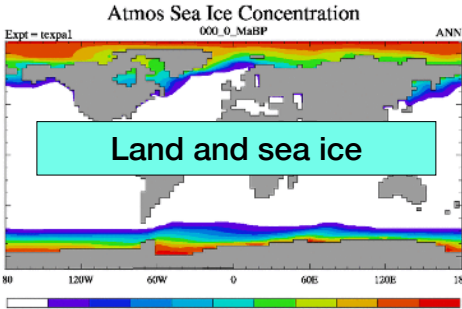
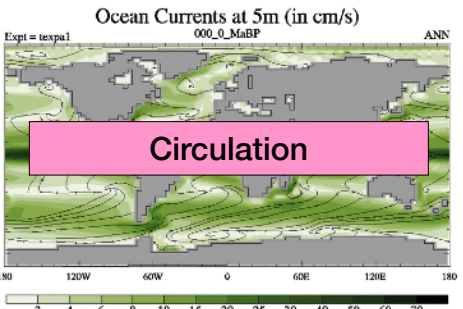
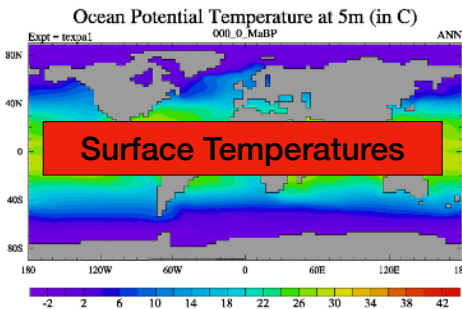
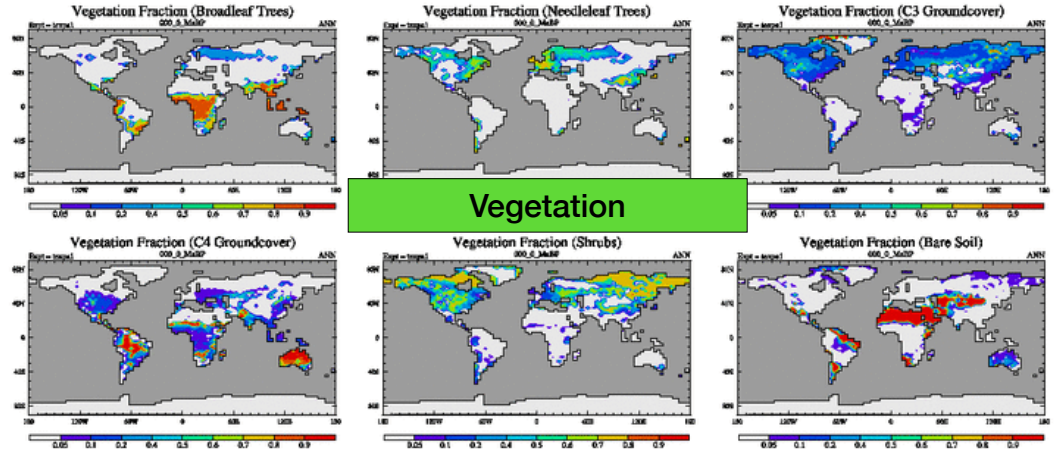
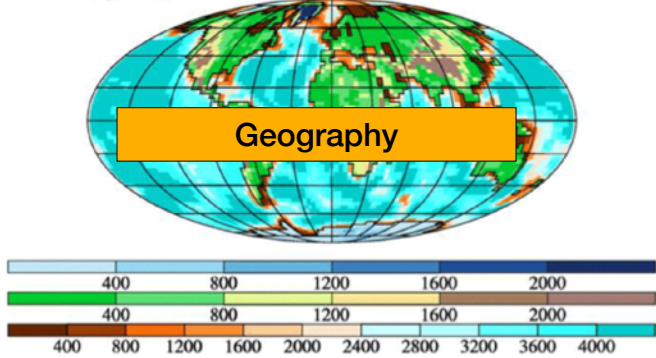
Please login to add search results to your Data Cart

Expert Users: you may display the search URL and return results as XML or return results as JSON

1.	CMIP6.CMIP.NCAR.CESM2.1pctCO2.r1i1p1f1.Amon.co2.gn Data Node: esgf-data.ucar.edu Version: 20191105 Total Number of Files (for all variables): 3 Full Dataset Services: [Show Metadata] [Hide Files] [WGET Script] [Show Citation] [PID] [Globus Download] [Further Info]																														
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Climate Model Data - Bristol

(a) Topography, Bathymetry and Ice sheets
Expt = texfa Pre-Ind (000.0 MaBP)



Existing Solutions

- virtual globes provide intuitive user interface to access geospatial data, e.g.:
 - Google Earth
 - earth.nullschool.net
- potential to help interdisciplinary research, education and public outreach

About  [cambecc / earth](#)

a project to visualize global weather conditions

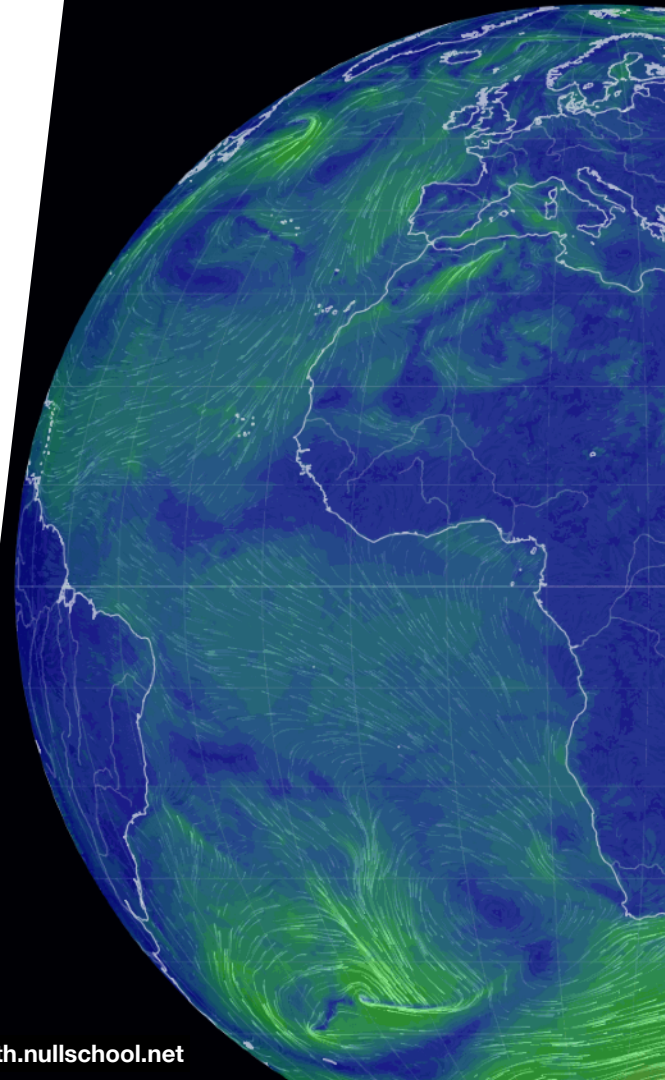
 [earth.nullschool.net](#)

 [Readme](#)

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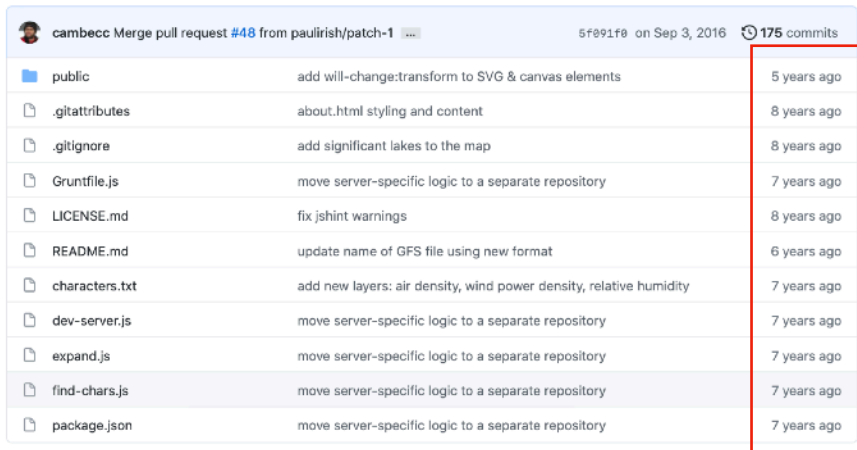
[bristol.ac.uk](#)

[earth.nullschool.net](#)



JGI Seed Corn Funding

- problem: we are scientists, not software developers (at least most of us)
- seed corn funding enabled support from a professional software developer (Tessa Alexander) from the start
- UoB Research IT provides this on a consultancy basis



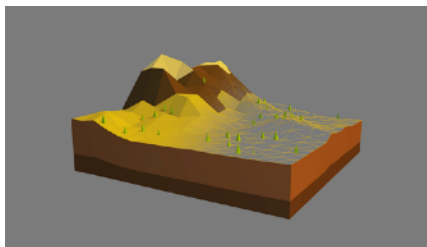
File	Description	Age
public	add will-change:transform to SVG & canvas elements	5 years ago
.gitattributes	about.html styling and content	8 years ago
.gitignore	add significant lakes to the map	8 years ago
Gruntfile.js	move server-specific logic to a separate repository	7 years ago
LICENSE.md	fix jshint warnings	8 years ago
README.md	update name of GFS file using new format	6 years ago
characters.txt	add new layers: air density, wind power density, relative humidity	7 years ago
dev-server.js	move server-specific logic to a separate repository	7 years ago
expand.js	move server-specific logic to a separate repository	7 years ago
find-chars.js	move server-specific logic to a separate repository	7 years ago
package.json	move server-specific logic to a separate repository	7 years ago

- decided to write a new software from scratch



Technical Implementation

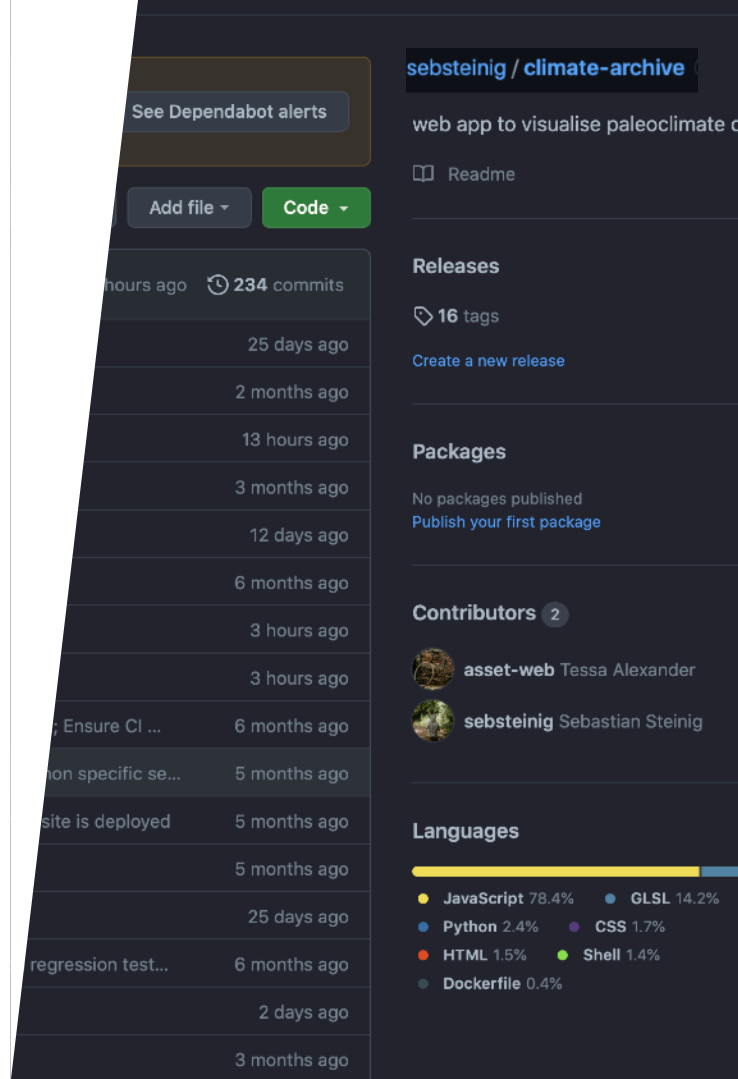
- a one-page website (application) running on any modern browser, including smartphones and tablets
- mainly 3D JavaScript library 'three.js'



humaan.com/blog/web-3d-graphics-using-three-js/



- uses WebGL (Web Graphics Library) real-time renderer
 - GPU-accelerated graphics power
 - more similar to a video game than a Python script

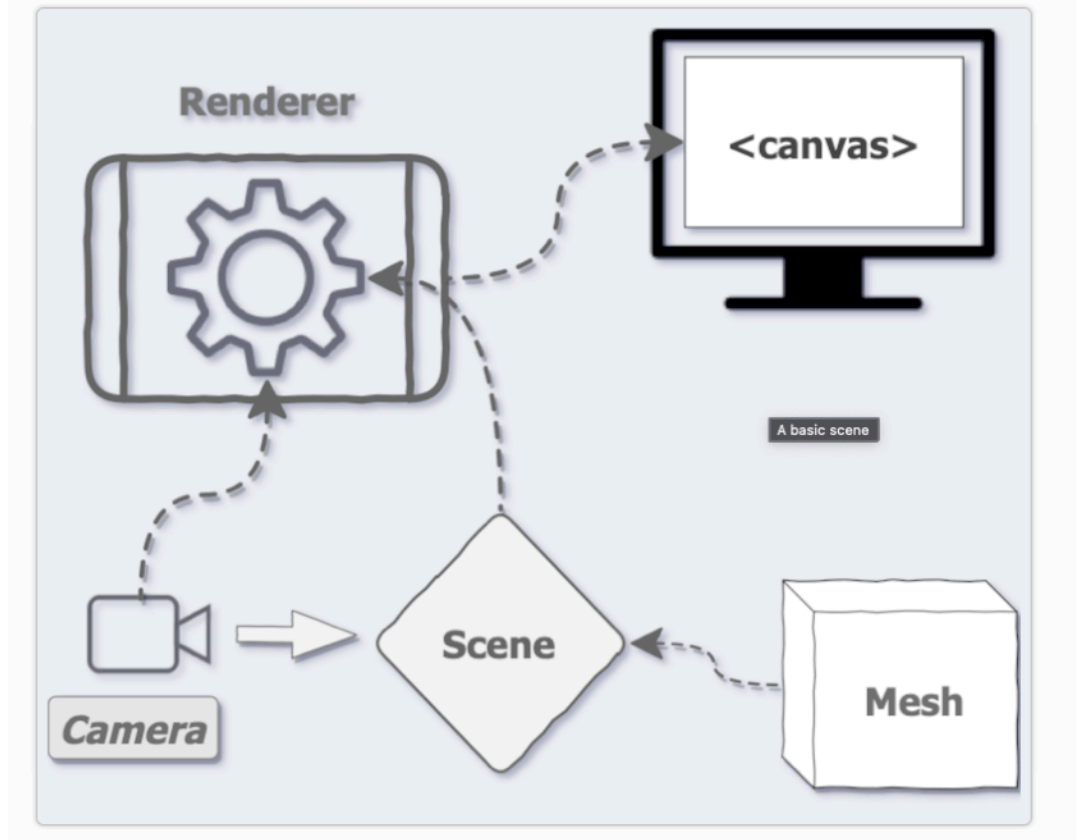


The screenshot shows the GitHub repository page for 'sebsteinig / climate-archive'. The repository is a web application to visualize paleoclimate data. It has 234 commits and 16 tags. The repository is primarily composed of JavaScript (78.4%), followed by GLSL (14.2%), Python (2.4%), CSS (1.7%), HTML (1.5%), Shell (1.4%), and Dockerfile (0.4%).


Language	Percentage
JavaScript	78.4%
GLSL	14.2%
Python	2.4%
CSS	1.7%
HTML	1.5%
Shell	1.4%
Dockerfile	0.4%

Real-Time 3D App

- two main app components:
 1. set up the scene
 2. render the scene
- renderer draws objects on the screen
- real-time: ~60 frames per second
- GPU support in browser via WebGL



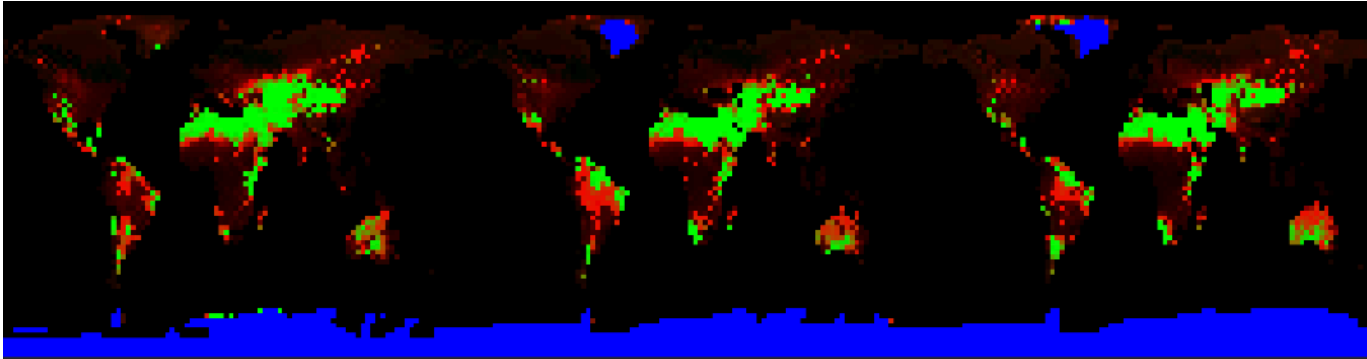
Encoding data in PNG images

- GPUs work with textures/images
- preprocessing: transcode climate model data from NetCDF to PNG images
- each colour channel can store 8 bits of data (0-255) 
- PNG: easy to handle in browsers and lossless compression

10 million years ago

5 million years ago

present day



Demo:
climatearchive.org