Technology Review

Ihsan Kahveci, Jacqueline Nugent, Lauren Snyder, Sami Turbeville, and Claire Zarakas

The problem: Climate models and uncertainty in climate projections can be challenging to understand for people who are not familiar with climate science and/or not comfortable coding

Our solution: A simplified tool for users without a technical background to interact with climate model output and visualize uncertainty for a specific location

Data sources:

- Climate model output available from the Climate Model Intercomparison Project phase 6
- Real historical observations from Berkeley Earth Surface Temperature dataset

Use Case - Visualizing climate data

Objective: The user wants to create a climate dashboard for her city to understand climate models and uncertainty

Expected Interactions:

- *User*: inputs latitude and longitude or city of their chosen location
- *User*: selects variables, i.e. temperature and annual mean
- *Tool*: graphs and map update for selections
- *User*: selects scenario
- *Tool*: graphs update for scenario selection

User chooses latitude and longitude

* List of cities (drop down or autofill)

* Click on map

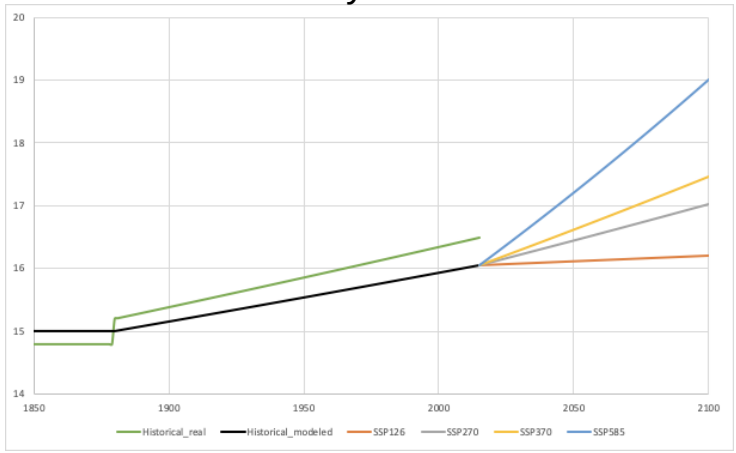
* Custom input (sliders or textbox)

User chooses options for what they can look at

* Variable (drop down): Minimum, maximum, & average temperature

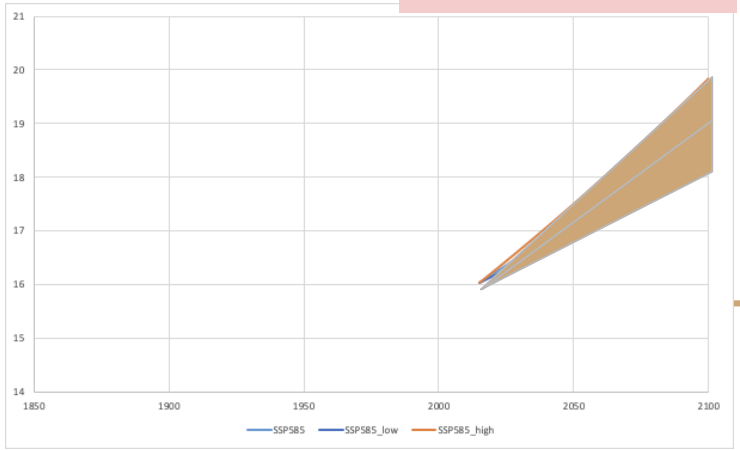
* Time (drop down): Annual mean, January mean, February mean, etc.

Scenario Uncertainty



Model Uncertainty

*** Select scenario**



Some text with more information about what the plots are showing

* Describe the scenario

* Describe the variables

* Brief model description

Global map of difference between scenario and historical data (model average)

* Dot for the user's location

* Show grid spacing to see the area it was averaged over

Tech option 1 - Panel

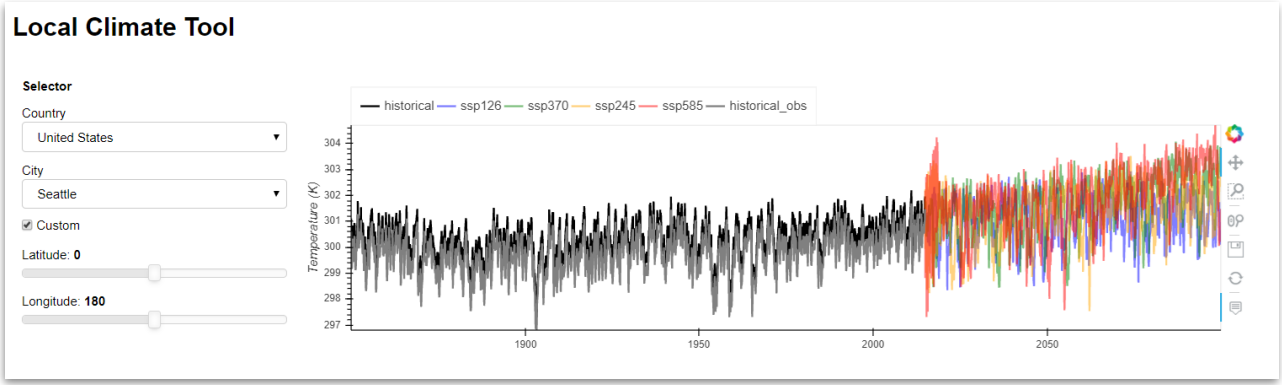
Pros:

- Compatible with jupyter notebook, xarray
- Control panels and widgets to interact with the inputs
- Reactive plotting
- Uses Geoviews to show gridded and geospatial data, popular with geoscientists

Cons:

- Dash is better at dealing with multiple users

Example:



Tech option 2 - Dash

Pros:

- Horizontally scalable (can handle lots of data and lots of users on the web using it simultaneously)
- Been around a while & lots of support, documentation
- Highly customizable but easy to get started

Cons:

- Can’t get super fancy using jupyter notebooks (but is fine for basic dashboard)
- Does not suitable Xarray indexes

Example: https://dash-gallery.plotly.host/dash-oil-and-gas/

Local Climate Tool App

A web application for everyone to analyze climate change! Data from CMIP6 (historical and projections) and Berkeley Earth Surface Temperature (BEST).

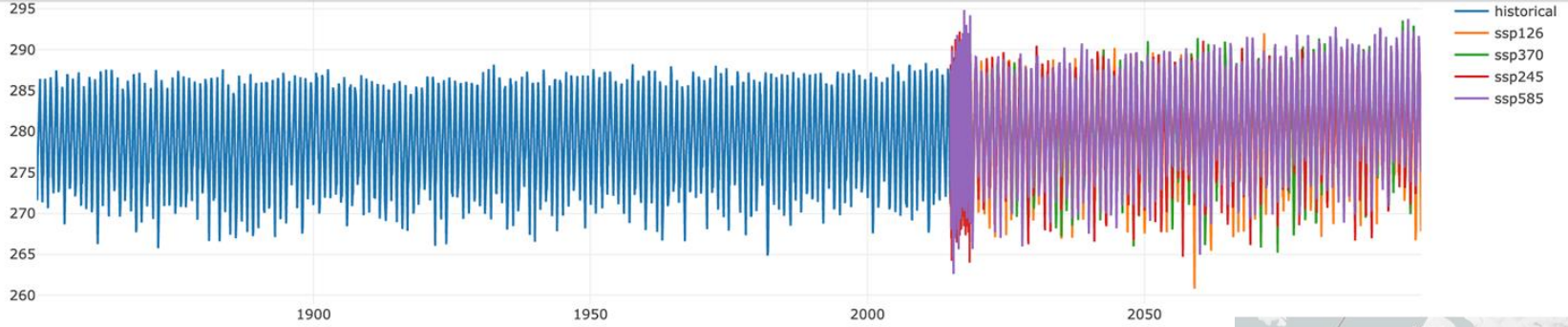
Dropdown

Seattle

Seattle

Olympia

Tacoma



Side by side comparison

	Panel	Dash	Winner
Compatibility with Jupyter	Yes	No	Panel
Ease of using geospatial data and Xarrays	Easy	Possible	Panel
Developer experience	2 team members already have used	No experience	Panel
Compatibility with climate science community	Preferred by ocean.pangeo.io	Less commonly used	Panel
Quantity of simultaneous users technology can support	Limited	Thousands	Dash

➡ **we choose Panel!**