

# Supplementing data with WorldClim

Seascape Genomics of North Pacific Forage Fishes RCN Group

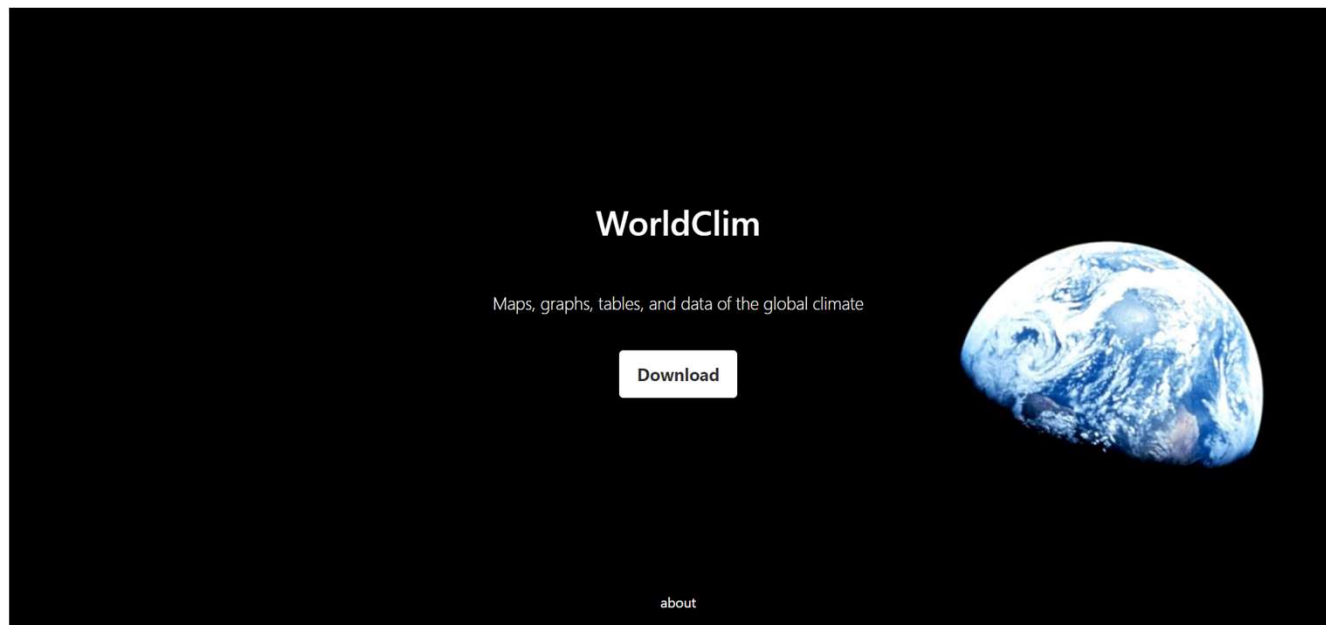
Timm LE, Tucker N, Rix A, LaBua S

# Data you have in hand

- Collection site coordinates are preferred, general localities are usable
- Collection dates are preferred, seasons are usable
- Depth is optional

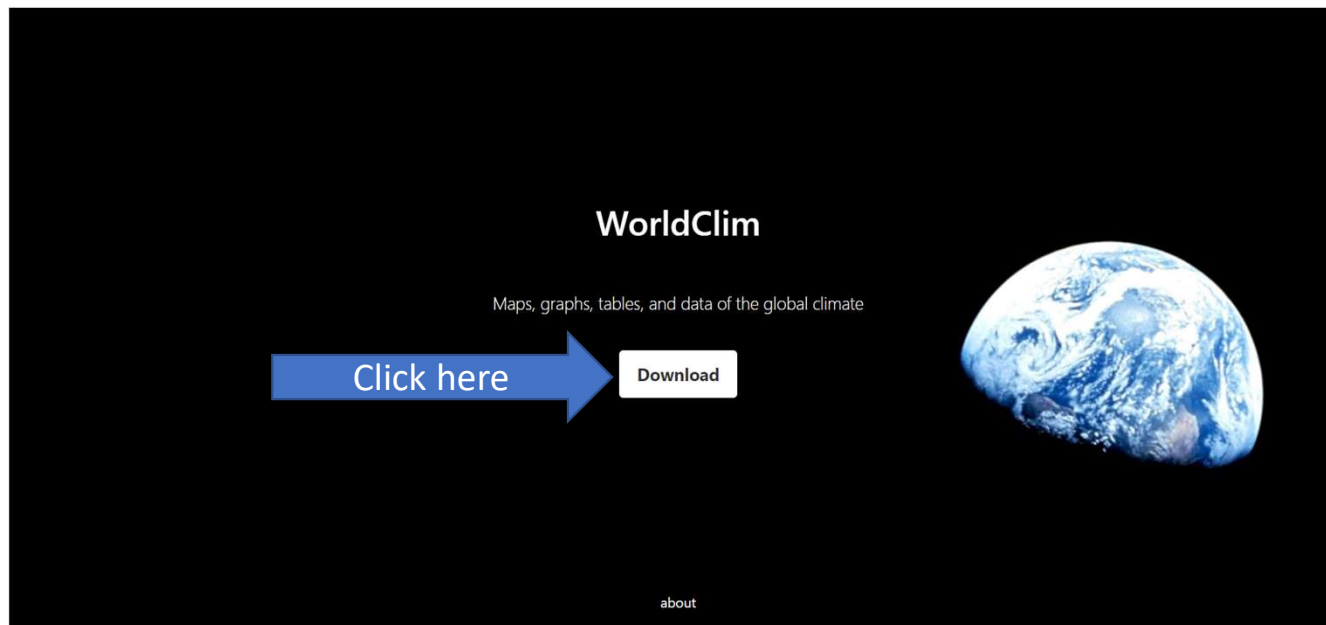
# How to supplement climatic variables

Navigate to the WorldClim Database (<https://worldclim.org/>)

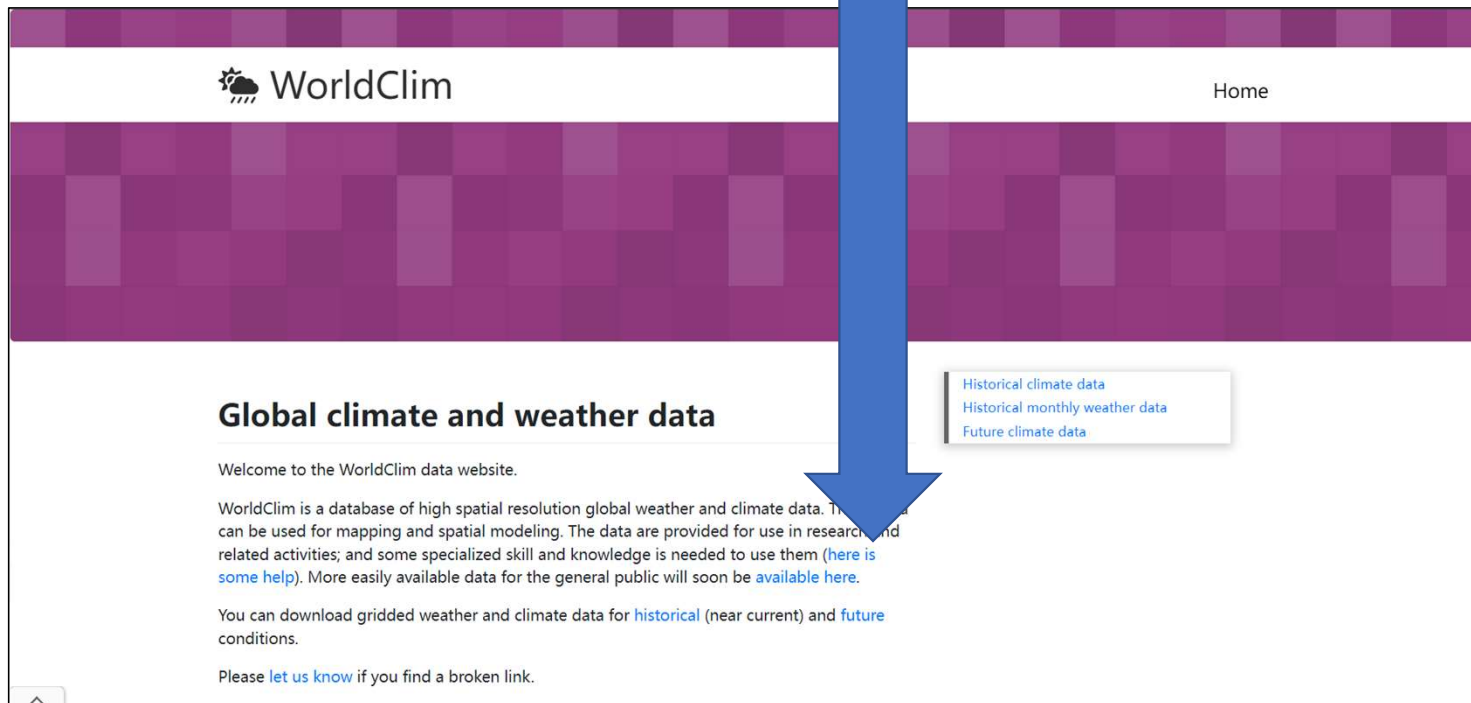


# How to supplement historical climatic variables

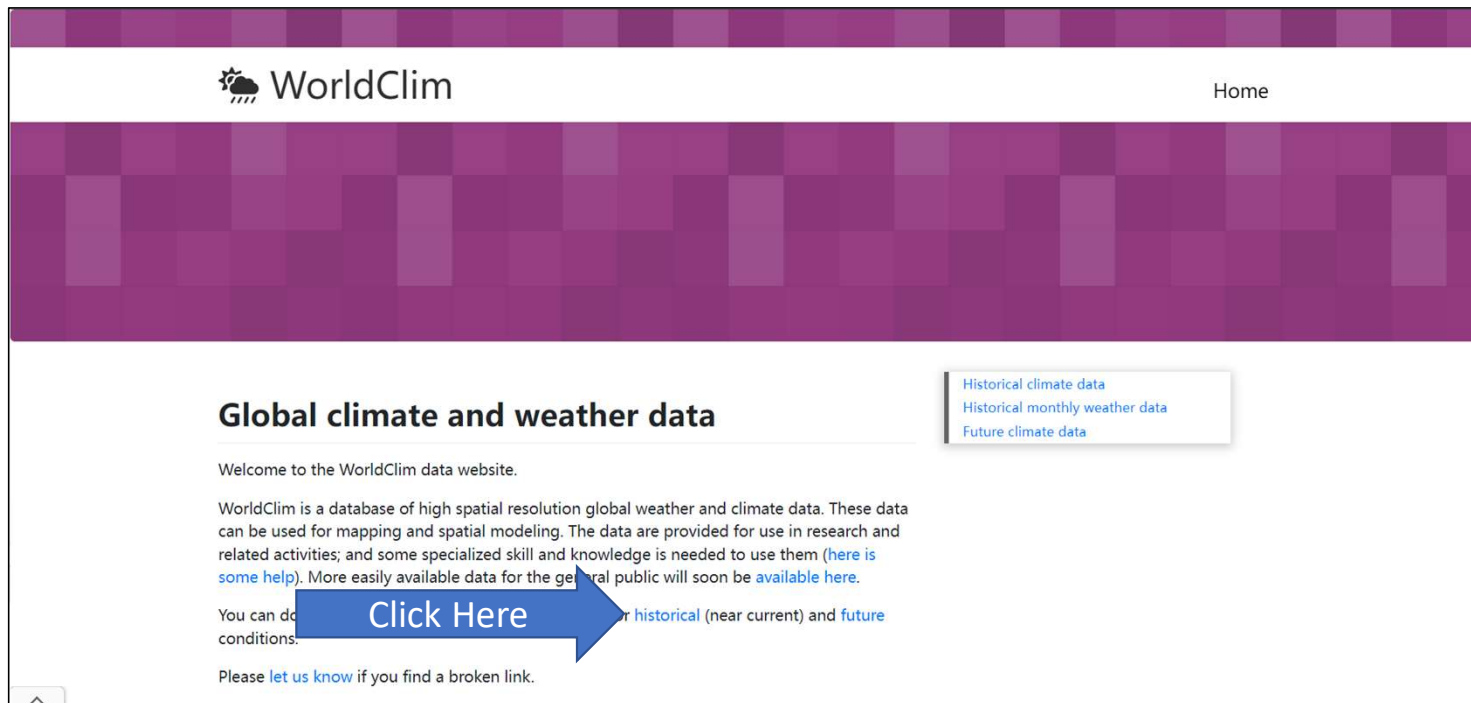
Navigate to the WorldClim Database (<https://worldclim.org/>)



The website offers their own use guide to navigate the site



# Investigate the historical datasets



The screenshot shows the WorldClim website homepage. The header features the WorldClim logo and a 'Home' link. A large purple banner is positioned below the header. The main content area is titled 'Global climate and weather data'. It includes a welcome message, a paragraph about the database, and a list of data types: 'Historical climate data', 'Historical monthly weather data', and 'Future climate data'. A blue arrow labeled 'Click Here' points to the word 'historical' in the text 'or historical (near current) and future'.

WorldClim

Home

## Global climate and weather data

Welcome to the WorldClim data website.

WorldClim is a database of high spatial resolution global weather and climate data. These data can be used for mapping and spatial modeling. The data are provided for use in research and related activities; and some specialized skill and knowledge is needed to use them ([here is some help](#)). More easily available data for the general public will soon be [available here](#).

You can download data for [historical](#) (near current) and [future](#) conditions.

Please [let us know](#) if you find a broken link.

[Historical climate data](#)  
[Historical monthly weather data](#)  
[Future climate data](#)

Click Here

# Investigate the historical datasets



[Home](#)

## Historical climate data

This is WorldClim version 2.1 climate data for **1970-2000**. This version was released in January 2020.

There are monthly climate data for minimum, mean, and maximum temperature, precipitation, solar radiation, wind speed, water vapor pressure, and for total precipitation. There are also 19 "bioclimatic" variables.

The data is available at the four spatial resolutions, between 30 seconds (~1 km<sup>2</sup>) to 10 minutes (~340 km<sup>2</sup>). Each download is a "zip" file containing 12 GeoTiff (.tif) files, one for each month of the year (January is 1; December is 12).

variable	10 minutes	5 minutes	2.5 minutes	30 seconds
minimum temperature (°C)	<a href="#">tmin 10m</a>	<a href="#">tmin 5m</a>	<a href="#">tmin 2.5m</a>	<a href="#">tmin 30s</a>
maximum temperature (°C)	<a href="#">tmax 10m</a>	<a href="#">tmax 5m</a>	<a href="#">tmax 2.5m</a>	<a href="#">tmax 30s</a>
average temperature (°C)	<a href="#">tavg 10m</a>	<a href="#">tavg 5m</a>	<a href="#">tavg 2.5m</a>	<a href="#">tavg 30s</a>
precipitation (mm)	<a href="#">prec 10m</a>	<a href="#">prec 5m</a>	<a href="#">prec 2.5m</a>	<a href="#">prec 30s</a>
solar radiation (kJ m <sup>-2</sup> day <sup>-1</sup> )	<a href="#">srad 10m</a>	<a href="#">srad 5m</a>	<a href="#">srad 2.5m</a>	<a href="#">srad 30s</a>
wind speed (m s <sup>-1</sup> )	<a href="#">wind 10m</a>	<a href="#">wind 5m</a>	<a href="#">wind 2.5m</a>	<a href="#">wind 30s</a>
water vapor pressure (kPa)	<a href="#">vapr 10m</a>	<a href="#">vapr 5m</a>	<a href="#">vapr 2.5m</a>	<a href="#">vapr 30s</a>

[Historical climate data](#)  
[Historical monthly weather data](#)  
[Future climate data](#)

# An example with average temperature.

This is a 10 minute spatial resolution which will be downloaded as a .tif file



[Home](#)

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[Historical climate data](#)  
[Historical monthly weather data](#)  
[Future climate data](#)

variable	10 minutes	5 minutes	2.5 minutes	30 seconds
minimum temperature (°C)	<a href="#">tmin 10m</a>	<a href="#">tmin 5m</a>	<a href="#">tmin 2.5m</a>	<a href="#">tmin 30s</a>
maximum temperature (°C)	<a href="#">tmax 10m</a>	<a href="#">tmax 5m</a>	<a href="#">tmax 2.5m</a>	<a href="#">tmax 30s</a>
precipitation (mm)	<a href="#">prec 10m</a>	<a href="#">prec 5m</a>	<a href="#">prec 2.5m</a>	<a href="#">prec 30s</a>
solar radiation (kJ m <sup>-2</sup> day <sup>-1</sup> )	<a href="#">srad 10m</a>	<a href="#">srad 5m</a>	<a href="#">srad 2.5m</a>	<a href="#">srad 30s</a>
wind speed (m s <sup>-1</sup> )	<a href="#">wind 10m</a>	<a href="#">wind 5m</a>	<a href="#">wind 2.5m</a>	<a href="#">wind 30s</a>
water vapor pressure (kPa)	<a href="#">vapr 10m</a>	<a href="#">vapr 5m</a>	<a href="#">vapr 2.5m</a>	<a href="#">vapr 30s</a>

Click Here



# An example with average temperature.

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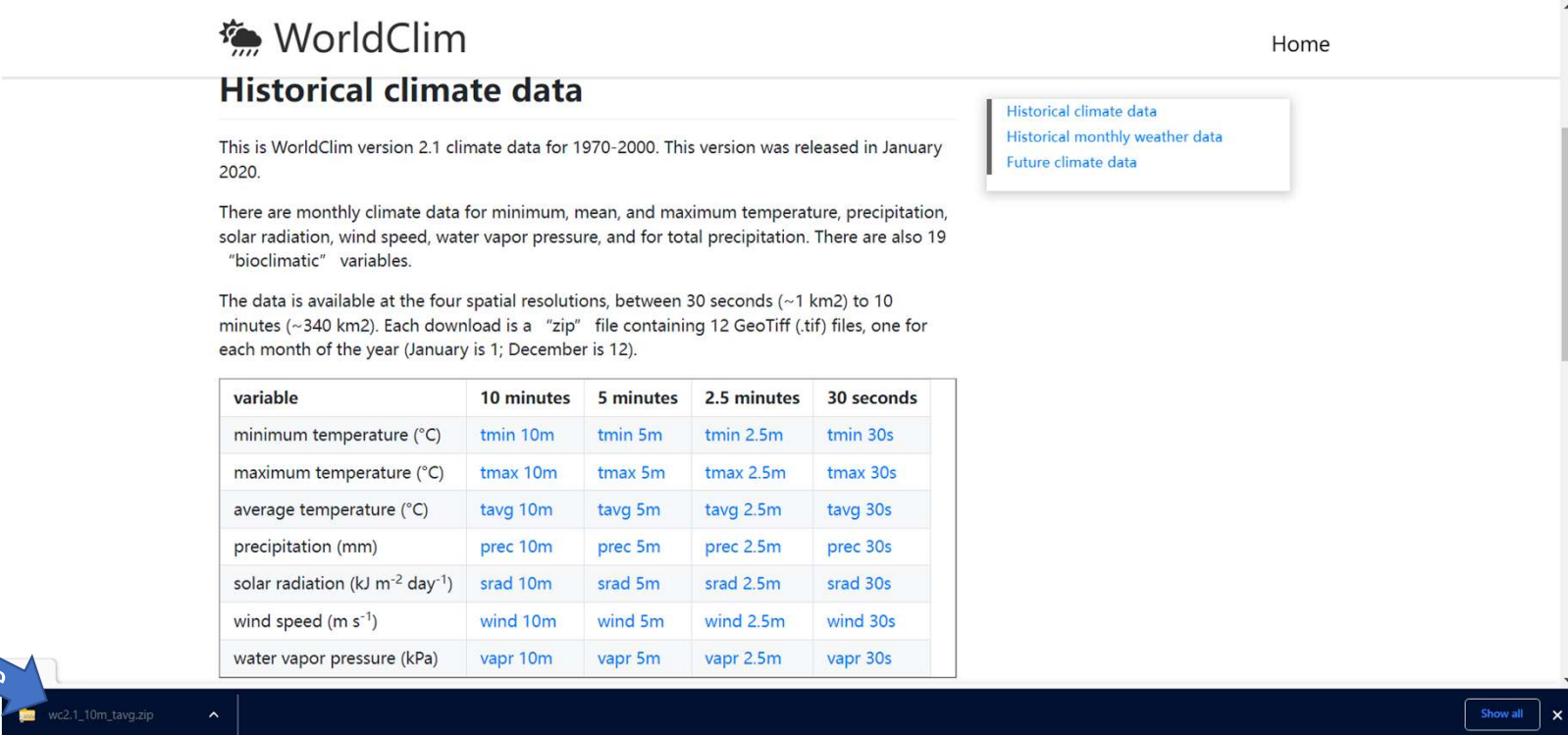
The screenshot shows a web browser window with a 'Home' button and a list of data categories: 'Historical climate data', 'Historical monthly weather data', and 'Future climate data'. A 'Save As' dialog box is open, showing the file path 'Nicholas Tucker > OneDrive - Florida International University (1) > Desktop > RCN'. The file name is 'wc2.1\_10m\_tavg' and the save type is 'Compressed (zipped) Folder'. A blue arrow points to the 'Save' button with the text 'Click Here'.

average temperature (°C)	<a href="#">tavg 10m</a>	<a href="#">tavg 5m</a>	<a href="#">tavg 2.5m</a>	<a href="#">tavg 30s</a>
precipitation (mm)	<a href="#">prec 10m</a>	<a href="#">prec 5m</a>	<a href="#">prec 2.5m</a>	<a href="#">prec 30s</a>
solar radiation (kJ m <sup>-2</sup> day <sup>-1</sup> )	<a href="#">srad 10m</a>	<a href="#">srad 5m</a>	<a href="#">srad 2.5m</a>	<a href="#">srad 30s</a>
wind speed (m s <sup>-1</sup> )	<a href="#">wind 10m</a>	<a href="#">wind 5m</a>	<a href="#">wind 2.5m</a>	<a href="#">wind 30s</a>
water vapor pressure (kPa)	<a href="#">vapr 10m</a>	<a href="#">vapr 5m</a>	<a href="#">vapr 2.5m</a>	<a href="#">vapr 30s</a>

Below you can download the standard (19) WorldClim [Bioclimatic variables](#) for WorldClim

# An example with average temperature.

This is a 10 minute spatial resolution which will be downloaded as a .tif file



The screenshot shows the WorldClim website interface. At the top left is the WorldClim logo. To the right is a 'Home' link. Below the logo is the heading 'Historical climate data'. A paragraph explains that this is WorldClim version 2.1 data for 1970-2000, released in January 2020. Another paragraph lists the variables available: minimum, mean, and maximum temperature, precipitation, solar radiation, wind speed, water vapor pressure, and 19 bioclimatic variables. A third paragraph states that data is available at four spatial resolutions: 30 seconds (~1 km²), 2.5 minutes (~340 km²), 5 minutes (~340 km²), and 10 minutes (~340 km²). Each download is a 'zip' file containing 12 GeoTiff (.tif) files, one for each month of the year (January is 1; December is 12).

On the right side, there is a dropdown menu with three options: 'Historical climate data' (selected), 'Historical monthly weather data', and 'Future climate data'.

Below the text is a table with columns for 'variable', '10 minutes', '5 minutes', '2.5 minutes', and '30 seconds'. The table lists various climate variables and their corresponding download links for each resolution.

variable	10 minutes	5 minutes	2.5 minutes	30 seconds
minimum temperature (°C)	<a href="#">tmin 10m</a>	<a href="#">tmin 5m</a>	<a href="#">tmin 2.5m</a>	<a href="#">tmin 30s</a>
maximum temperature (°C)	<a href="#">tmax 10m</a>	<a href="#">tmax 5m</a>	<a href="#">tmax 2.5m</a>	<a href="#">tmax 30s</a>
average temperature (°C)	<a href="#">tavg 10m</a>	<a href="#">tavg 5m</a>	<a href="#">tavg 2.5m</a>	<a href="#">tavg 30s</a>
precipitation (mm)	<a href="#">prec 10m</a>	<a href="#">prec 5m</a>	<a href="#">prec 2.5m</a>	<a href="#">prec 30s</a>
solar radiation (kJ m <sup>-2</sup> day <sup>-1</sup> )	<a href="#">srad 10m</a>	<a href="#">srad 5m</a>	<a href="#">srad 2.5m</a>	<a href="#">srad 30s</a>
wind speed (m s <sup>-1</sup> )	<a href="#">wind 10m</a>	<a href="#">wind 5m</a>	<a href="#">wind 2.5m</a>	<a href="#">wind 30s</a>
water vapor pressure (kPa)	<a href="#">vapr 10m</a>	<a href="#">vapr 5m</a>	<a href="#">vapr 2.5m</a>	<a href="#">vapr 30s</a>

A blue arrow labeled 'Click Here' points to the 'tavg 10m' link in the table. Below the table, a file download bar shows 'wc2.1\_10m\_tavg.zip' with a 'Show all' button and a close icon.

# An example with average temperature.

This is a 10 minute spatial resolution which will be downloaded as a .tif file

January



December

📁 > Nicholas Tucker > OneDrive - Florida International University (1) > Desktop > RCN > wc2.1_10m_tavg							
Name	Type	Compressed size	Password...	Size	Ratio	Date modified	
📄 wc2.1_10m_tavg_01	TIF File	3,052 KB	No	3,253 KB	7%	2/18/2019 3:37 PM	
📄 wc2.1_10m_tavg_02	TIF File	3,061 KB	No	3,262 KB	7%	2/18/2019 3:56 PM	
📄 wc2.1_10m_tavg_03	TIF File	3,055 KB	No	3,255 KB	7%	2/18/2019 4:16 PM	
📄 wc2.1_10m_tavg_04	TIF File	3,046 KB	No	3,244 KB	7%	2/18/2019 4:36 PM	
📄 wc2.1_10m_tavg_05	TIF File	3,045 KB	No	3,244 KB	7%	2/18/2019 4:56 PM	
📄 wc2.1_10m_tavg_06	TIF File	3,037 KB	No	3,237 KB	7%	2/18/2019 5:16 PM	
📄 wc2.1_10m_tavg_07	TIF File	3,032 KB	No	3,230 KB	7%	2/18/2019 5:36 PM	
📄 wc2.1_10m_tavg_08	TIF File	3,009 KB	No	3,206 KB	7%	2/18/2019 5:55 PM	
📄 wc2.1_10m_tavg_09	TIF File	3,025 KB	No	3,223 KB	7%	2/18/2019 10:19 PM	
📄 wc2.1_10m_tavg_10	TIF File	3,036 KB	No	3,239 KB	7%	2/18/2019 9:59 PM	
📄 wc2.1_10m_tavg_11	TIF File	3,051 KB	No	3,253 KB	7%	2/18/2019 9:38 PM	
📄 wc2.1_10m_tavg_12	TIF File	3,044 KB	No	3,245 KB	7%	2/18/2019 9:19 PM	

# Next Steps...

In order to use these data you will need to export them from the zipped folder that they are downloaded in.

You can do this using an unzip program on your computer or just drag and drop your folders into an unzipped folder.

Then depending on your application, you can begin processing directly using your .tif file or convert it to a format more compatible with your intended program.

# Caveats

These are climatic variables and therefore *may not* be well linked to the distribution or movement patterns of marine organisms.

“Filling in” data can be useful and informative, but always remember this process inherently introduces error. Keep this in mind when interpreting results, especially when the climatic variables are derived or inferred from elevation.

The site authors request to be cited as:

Fick, S.E. and R.J. Hijmans, 2017. WorldClim 2: new 1km spatial resolution climate surfaces for global land areas. [International Journal of Climatology 37 \(12\): 4302-4315](#).

If you try this guide, let us know!