Accessing Global Precipitation Data and Analyzing Total Precipitation Trends over 40 years

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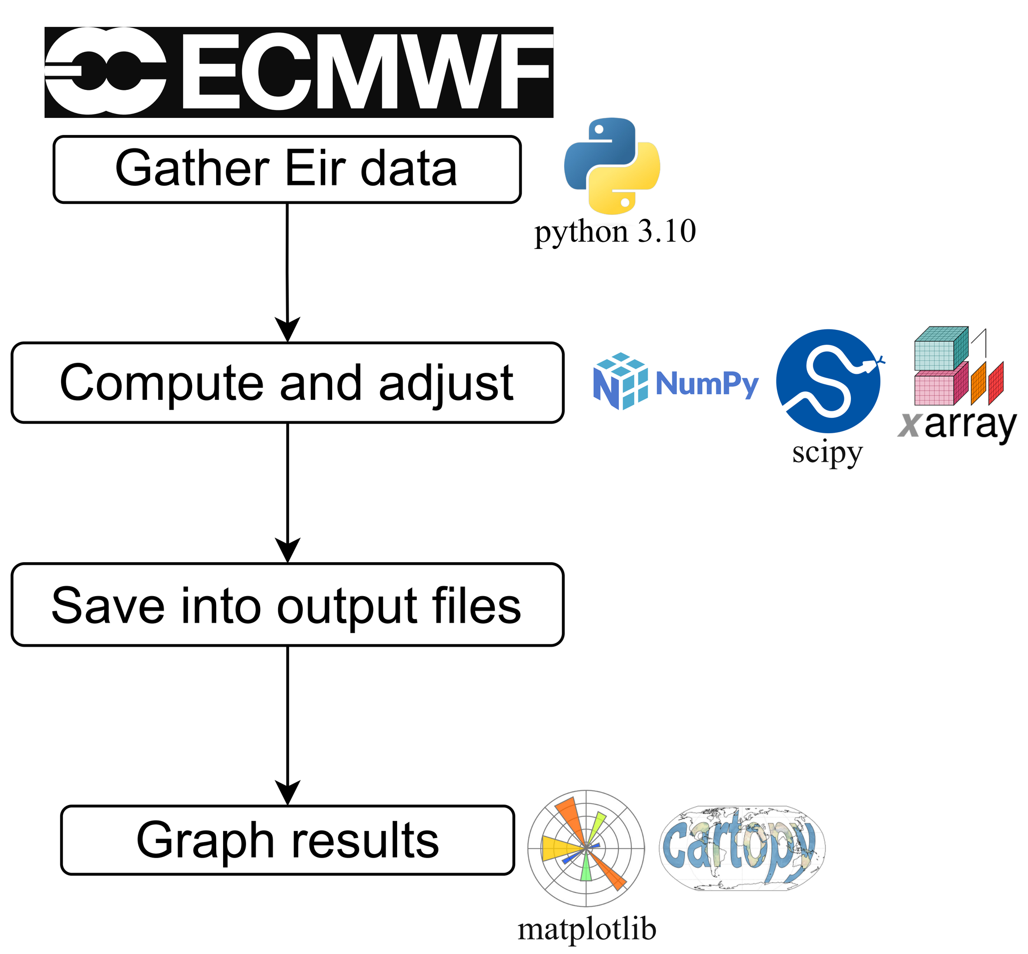
Wetter places wetter, dryer places dryer.

Abstract
Precipitation is an integral part of the worlds climate. A well trusted and extensive dataset is the Eir(ERA interim reanalysis). Some of the methods that can be used to analyze this dataset are linear regression, graphing, and cleaning the data.

Introduction
The Eir spans 40 years but only 1984-2017(34) were used for these graphs. Precipitation was measured every 3 hours. To analyze this data we can use netCDF files which is the standard for multidimensional data. We use ECMWF, which is a reanalysis model. Models have varying degrees of reliability and there is no conclusive "best" data set currently.

Methods
We use python since it has data analysis and graphing libraries. From python, matplotlib and cartopy are the libraries best suited for our purpose. We need xarray to handle reading and writing netCDF files. numpy is used for speeding up calculations. The last library we need is scipy for linear regression. Below is a flowchart showing how these libraries work together.



Methodology
First, we make a result array organized by year, longitude, latitude. For each year, we get all of the files in the year and then open them as one dataset. We then unpack the values with xarray. We compute the sum of each year and then set the corresponding value in the result array. Next, we create a slope and intercept array organized by longitude and latitude. For each longitude and latitude, we take the 34 years, linearly regress them and store them in their respective output arrays.

These graphs exclude values!

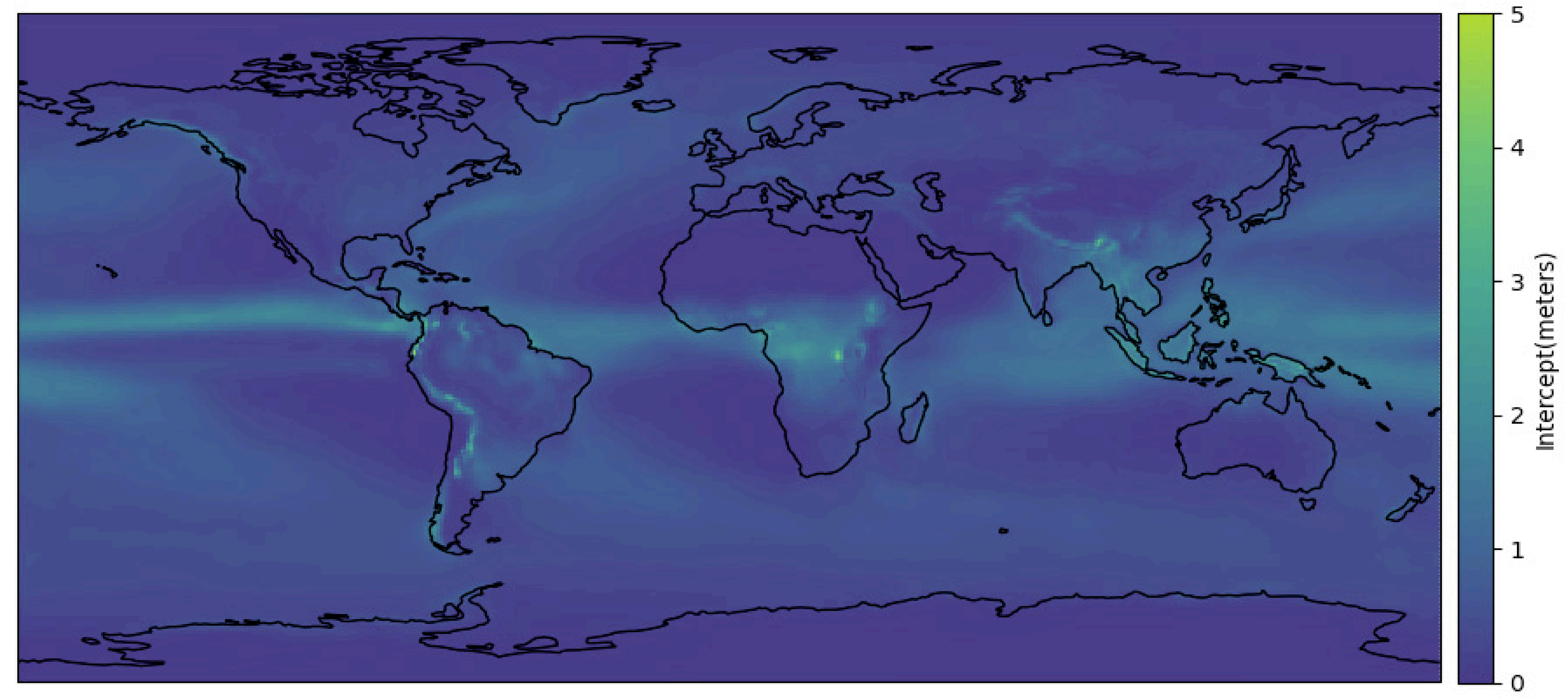


Figure 1. *Value of intercept from linear regression over 40 years*

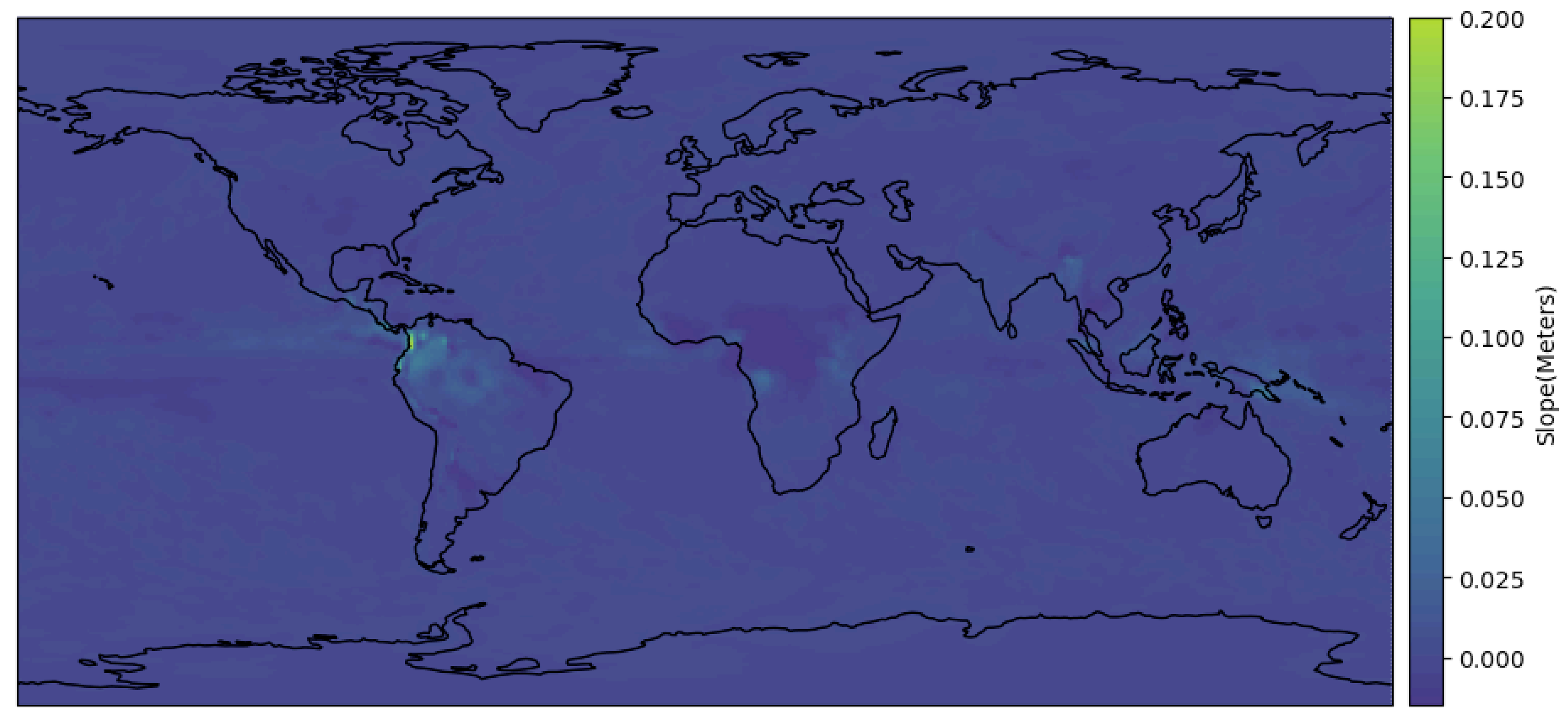


Figure 2. *Value of slope from linear regression over 40 years*

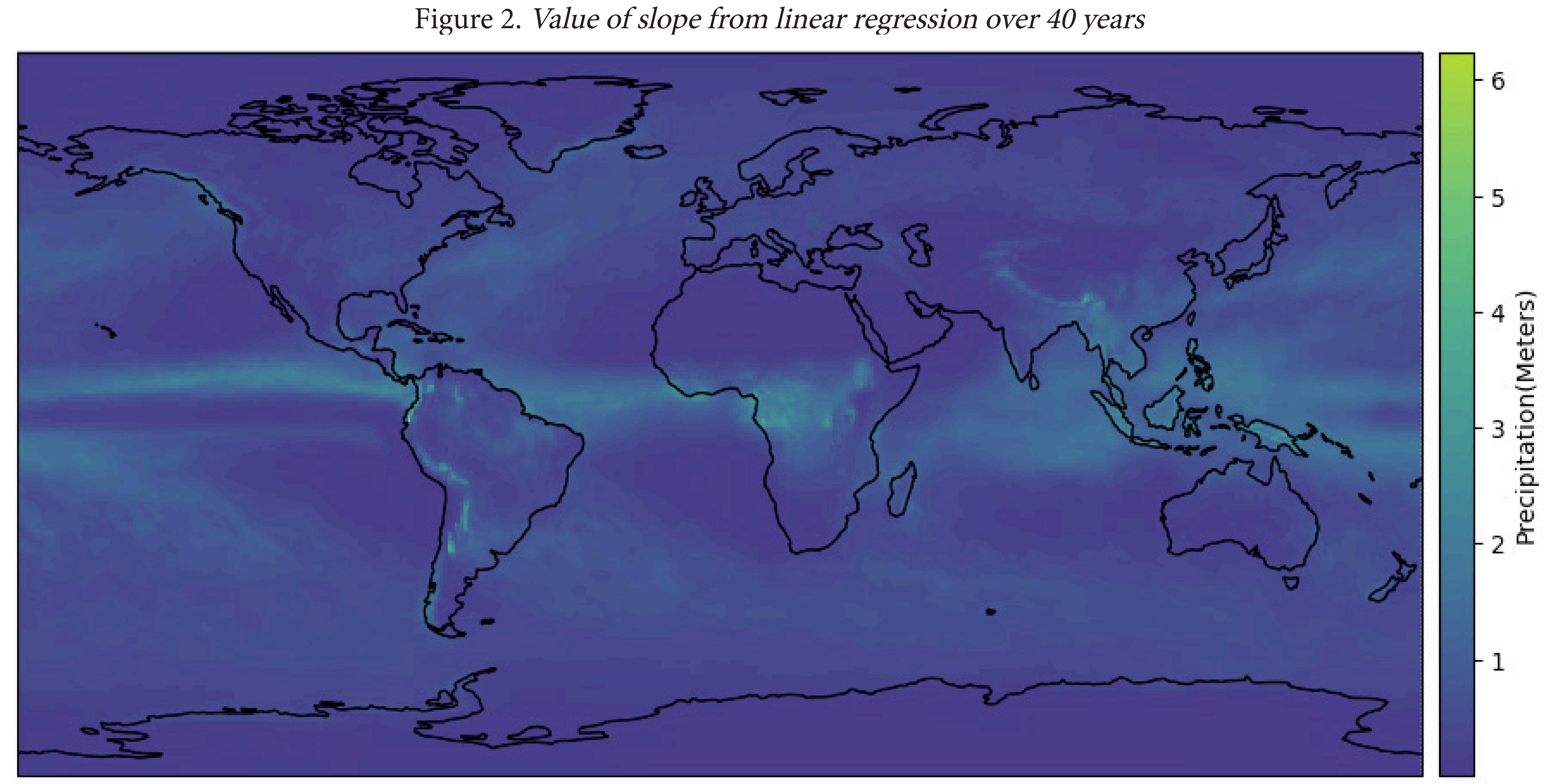


Figure 3. Total *Precipitation in 1984*

Full Charts & All Code

Discussion
In figure 1, we can see that areas near the equator have high intercept values. Therefore, the equator already has relatively high precipitation. Looking at figure 2 we see that the equator and seas are rising in precipitation. Sub tropical high pressure belts explain why areas below and above the equator don't get as much precipitation.

Conclusion
In figure 1, we see the locations that have precipitation lie near the equator and oceans. In figure 2, we see that the ocean and places with high intercepts have high slopes. In figure 3, we can see that 1984 matches this trend quite nicely. This affects climate, influencing global temperatures, climate change, and natural disasters.

Partially related works
The WMO leads much of the world from climate change to snowfall. Author 1 wrote 2 programs that retrieve the latest weather data from all capitals around the world. One is more technical while the other is more high level. They use wget and pandas to produce CSV output files. They're a great introduction to anybody looking to learn pandas and contain in depth explanations for every line of code.

Acknowledgements
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Poster download