Workshop Instructions: Programming Weather & Climate Maps with Python

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## **Workshop Overview**

This 2-hour workshop introduces participants (ages 14+) to programming and data visualization using real-world **weather and climate data** from NOAA. Participants work with a **pre-written Python script in Google Colab** to create their own visualizations, with options to explore global temperature, wind, precipitation patterns and more.

No prior programming knowledge is required. Participants can either follow the script step-by-step or experiment freely, depending on their interest and skill level.

Your role as instructor is to:

* Guide participants through technical setup and the code walkthrough
* Support debugging and answer coding questions
* Provide scientific context for the visualizations (climate phenomena, patterns, meteorological events)

## **Target Audience**

* Age 14+, no programming background required
* Basic familiarity with using a computer and Google tools
* Interest in science, technology, or environmental topics is helpful

## **Required Materials**

### **For Participants**

* Laptop (own device or provided by organizer)
* Google account (required for Colab access)
* Internet access

### **For Workshop Setup**

* Projector/beamer
* Instructor laptop with access to Colab notebook
* Smartphone/camera (optional for documentation)
* Shared access to the prepared Google Colab notebook

## **About the Data Source: NOAA**

The **National Oceanic and Atmospheric Administration (NOAA)** is a US scientific agency that collects and distributes high-quality weather and climate data. The dataset used in this workshop is a so called Reanalysis from NOAA and typically includes various atmospheric variables.

The prepared notebook loads a small, preprocessed subset of NOAA’s publicly available datasets (in NetCDF format) and then creates an animation from it.

## **Workshop Timeline & Instructor Notes**

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| **Phase** | **Time** | **Instructor Goals** | **Actions & Notes** |
| --- | --- | --- | --- |
| **1. Welcome** | 0–10 min | Break the ice and set the tone | Greet participants, introduce yourself, briefly explain the workshop. Ask: Who has coded before? Who's into weather/climate? |
| **2. Context & Motivation** | 10–20 min | Explain the “why” behind the workshop | Discuss relevance of weather visualization and programming. |
| **3. Technical Setup** | 20–30 min | Get all devices ready, ensure everyone can run code | Assist with logging in, opening Colab, verifying the code loads and runs |
| **4. Code Walkthrough** | 30–70 min | Ensure understanding of how the script works | Go step-by-step through the notebook, explain structure and what each block does. Make the participants follow you on their on computers. Pause for questions, help with bugs |
| **5. Independent Work** | 70–100 min | Support creative exploration of the data | Participants choose data types to visualize and create their own maps. Encourage variation: wind fields, surface temperature, rainfall, etc. Provide interpretation help: point out interesting patterns (e.g., hurricanes, wind belts) |
| **6. Presentation & Reflection** | 100–115 min | Facilitate sharing and discussion | Ask for volunteers to present their results on the projector; initiate discussion on what they see.  Optional: Participants can take artistic photos in the projection. |
| **7. Wrap-up** | 115–120 min | Reflect, collect feedback, end on a positive note | Recap what was learned, invite feedback, and thank participants |

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### Programming Notes

The instructor should understand the code very well, especially the limits (e.g. only data for specific years are possible to download) so that he/she will be able to fix errors as fast as possible.

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### **Scientific Support**

You don’t need to be a meteorologist—but having a basic understanding of the following will help:

* **Jet streams**
* **Tropical storms / hurricanes**
* **Global wind belts (e.g. trade winds, westerlies)**
* **Precipitation patterns and the ITCZ (Intertropical Convergence Zone)**

Use visuals to highlight these phenomena and encourage curiosity.

### **Pedagogical Notes**

* Let participants move at their own pace: some will stick to the default script, others may try custom tweaks
* Encourage experimentation: changing colors, time ranges, or even combining datasets
* Provide positive feedback even for small achievements
* Allow breaks if needed—especially during the coding phase