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User Manual for HAB Float Predictor Application

Overview

This Python application is designed to predict High-Altitude Balloon (HAB) float paths and generate Google Earth Pro Keyhole Markup Language (KML) files based on user-inputted parameters. This application is most accurate for Kaymont latex helium balloons and its usage is optimized for UMD Balloon Payload Program operations.

Requirements:

To utilize the HAB Float Predictor application, users need to ensure the installation of several essential libraries in their Python environment. The application relies on various libraries for its functionalities as described below:

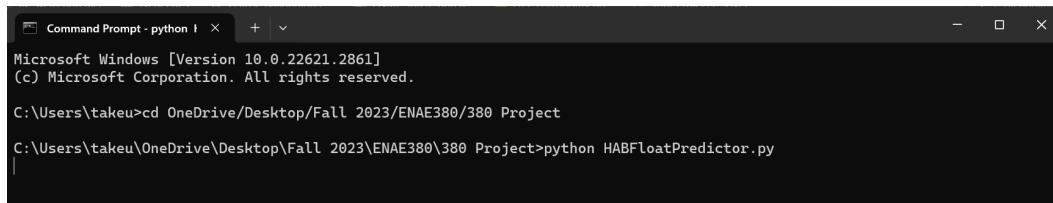
1. pandas - handles all data manipulation and analysis (pip install pandas)
2. datetime - handles manipulation and arithmetic of time formatting (pip install datetime)
3. simplekml - creates and manipulates KML files for visualization in Google Earth Pro (pip install simplekml)
4. os - file manipulation (pip install os)
5. PySimpleGUI - for creation of a graphical user interface (GUI) (pip install PySimpleGUI)

In order to take advantage of this application's full capability, download Google Earth Pro. Access the page below for download.

<https://www.google.com/earth/about/versions/>

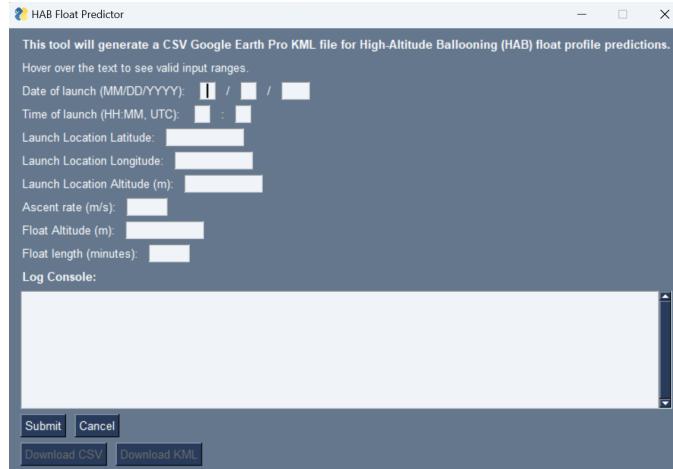
Getting Started

1. Launch the Application - Run the Python script (HABFloatPredictor.py) in any Python environment or command terminal.

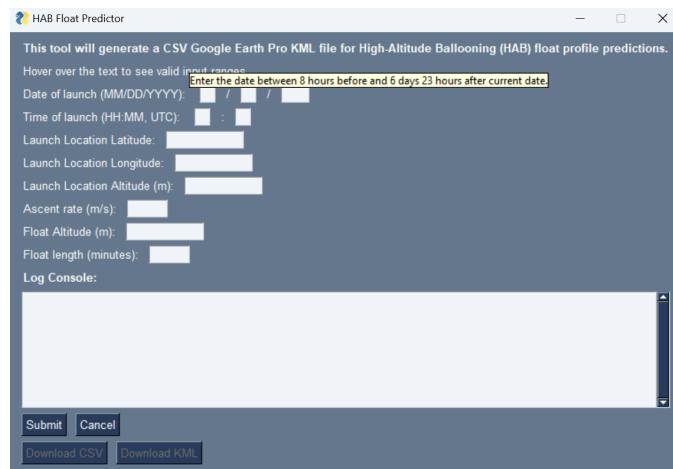


The screenshot shows a Windows Command Prompt window titled "Command Prompt - python 1". The window displays the following text:
Microsoft Windows [Version 10.0.22621.2861]
(c) Microsoft Corporation. All rights reserved.
C:\Users\takeu>cd OneDrive\Desktop\Fall 2023\ENAE380\380 Project
C:\Users\takeu\OneDrive\Desktop\Fall 2023\ENAE380\380 Project>python HABFloatPredictor.py

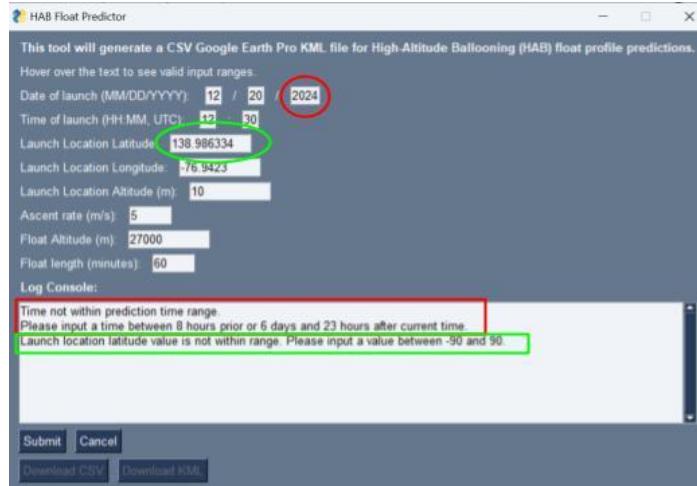
2. Upon launching, a GUI window will appear.



3. Hover over the text to see input ranges. Enter your preferred data into fields as specified:
 - a. Launch Date (MM/DD/YYYY): This application only has the capability to go 8 hours into the past and 6 days and 23 hours into the future
 - b. Launch Time (HH:MM): Launch Time is in UTC (5 hours ahead of standard EST)
 - c. Launch location latitude (decimal): Accepts values between -90 and 90
 - d. Launch location longitude (decimal): Accepts values between -180 and 180
 - e. Launch location altitude: Accepts values between -430 m (the dead sea) to 8848 m (peak of Mount Everest)
 - f. Ascent rate (m/s): Initial ascent rate of the balloon upon launch (typical values: 4 m/s to 7 m/s)
 - g. Float altitude (m): Altitude of balloon to maintain neutral buoyancy (typical values: 20000 m to 30000 m)
 - h. Float length (minutes): Duration of balloon to remain at neutral buoyancy (typical values: 30 minutes to 3 hours)



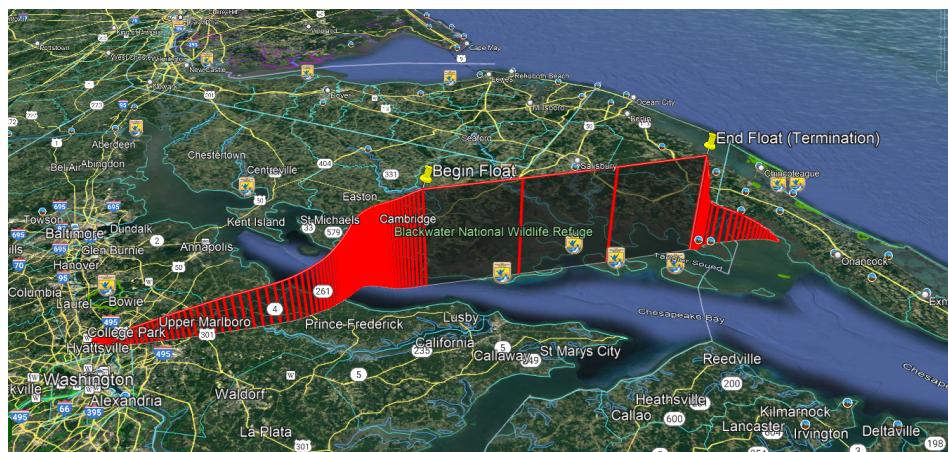
4. Click submit to generate predictions. If any inputs are invalid or there is an issue retrieving data from the API, then respective error messages will appear in the error log.



5. Download CSV/KML: After successful prediction generation, the "Download CSV" and "Download KML" buttons become active. Select a folder to save respective files.



6. View the KML File in Google Earth Pro by clicking the file in your files or importing the file:



7. Continue generating predictions (each will be downloaded with a unique name in a folder that is user-specified for windows users) and view all of them simultaneously.

Name	Date modified	Type	Size
flight_predict_path1	12/18/2023 4:59 PM	KML	181 KB
flight_predict_path2	12/18/2023 5:11 PM	KML	160 KB
flight_predict_path3	12/18/2023 5:11 PM	KML	363 KB
HABFloatPredictor	12/18/2023 4:40 PM	Python Source File	26 KB



8. Close out the application by clicking the “Cancel” or close (X) button.

Notes on the generated CSV file and KML files:

CSV File: Contains all the data points for the float predict. This is very useful for getting specific values of the float and timestamps for balloon position.

KML File: Open in Google Earth Pro to visualize the float flight profile in 3D. This allows us to see the physical landmarks the balloon will pass over such as roads, terrain, and cities. Tools on Google Earth (such as elevation profile) are also critical for visualization.