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22 NOV 22

SUBJECT: THE CAPABILITIES AND ACHIEVEMENTS OF FNMOC'S CSV TO KML TOOL (C2K-TOOL)

1. Abstract. C2K-Tool is introduced as a script used to convert climatology products from .csv format to .kml format. C2K-Tool is designed to work with the outputs of Modernized Analysis of the Trends and Tendencies of Climate and Forensics (MATTCAF) for simple, standard .kml climate products. C2K-Tool enables FNMOC's climatology team to generate .kml climate products for the Navy and DoD in an information assured process.

2. Introduction. The climatology team at Fleet Numerical Meteorology and Oceanography Center (FNMOC) periodically receives requests from the Navy and Department of Defense (DoD) for climate data in .kml format. While there exist many conversion ways to convert data types into .kml format using commercial means, maintaining information assurance often times limits the resources available for use. FNMOC developed an easy tool to make conversions of climate data from .csv files to a simplistic .kml file to produce an information assured and standard climate product. This tool is called the CSV to KML Tool (C2V Tool) and was written in python3. C2V-Tool allows easy conversion from Modernized Analysis of the Trends and Tendencies of Climate and Forensics (MATTCAF) .csv output to a .kml output. MATTCAF is discussed in detail in another technical report.

The source code is maintained in-house at FNMOC as it has been designed, tested, built, and run on FNMOC systems using FNMOC archives. For this reason, it will not be made publically available. This project was conducted independently with no funding from outside sources.

3. Capabilities. C2K-Tool requires just 2 inputs to run: .csv file name and .csv model resolution. Once these inputs are placed in the source code, and the .csv file is saved in the same directory as the C2K-Tool script, the script can be run to produce a .kml file containing all data in the .csv file. The output file name is the same as the .csv's file name with the only difference being the .csv file extension replaced with a .kml extension. The color map can be customized if the user desires but is initially set as a default to mirror the 'jet' format in python. It is worth noting C2K-Tool cannot include direction-based features such as vectors or wind barbs at this time. For example, only magnitudes such as wave height, wind speed, or temperature will be displayed even if the u and v components are included in the .csv from MATTCAF. C2K-Tool plots a colormesh of the data with the title specified in the .csv. A legend is included on the eastern side of the data to identify the range of values defined by the colors.

4. Example Output. An example output from C2K-Tool is presented in Figure 1. MATTCAF was used to create a 2-m air temperature product covering the coast of central California using ERA5 at quarter degree resolution. A period of record (POR) from 2012 to 2021 was used to calculate the average temperature in January with csv selected as an output. C2K-Tool was used to convert this .csv to a .kml file, and the .kml file was loaded into Google Earth. Figure 1 depicts the final

product as seen in Google Earth. The title in the top left was pulled from the .csv file, and the legend's range is automatically selected from the maximum and minimum values of the .csv file.

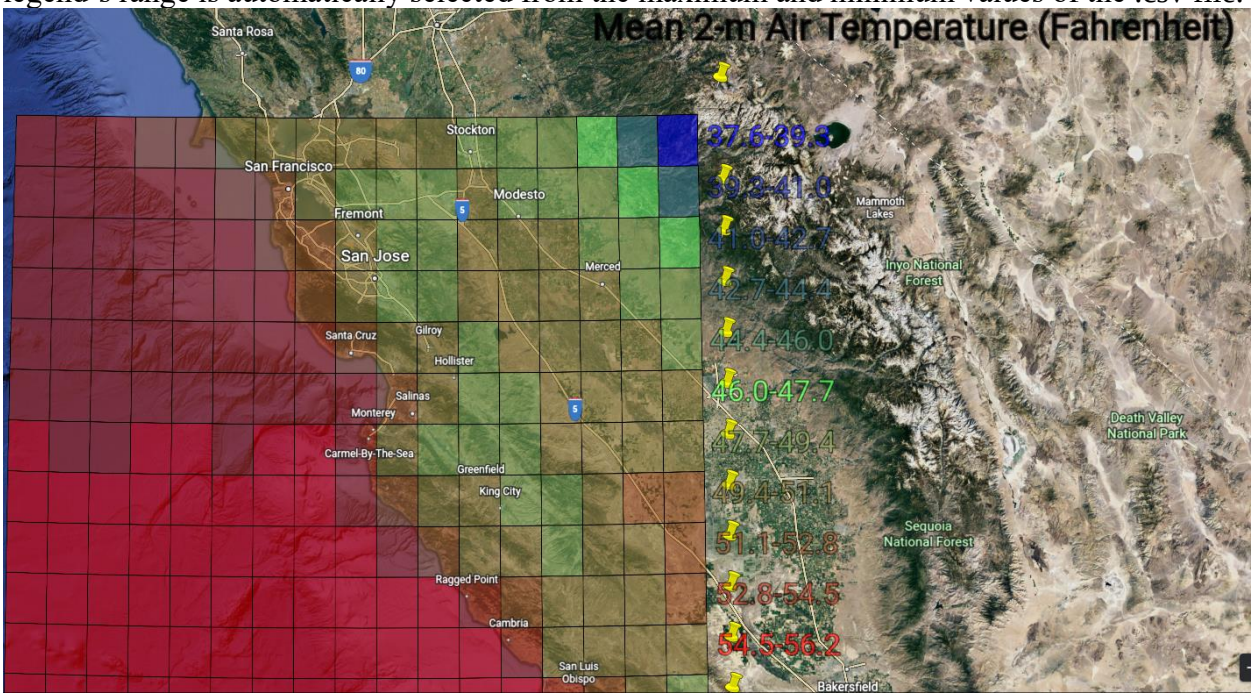

Figure 1. Mean 2-m Air Temperature product made from a .csv file generated by MATTCAF and converted to .kml through C2K-Tool.

5. <u>Conclusion.</u> FNMOC periodically receives requests from the Navy and Department of Defense (DoD) for climate data in .kml format. To maintain information assurance, C2K-Tool was built to convert climate data in .csv format to .kml format. While other methods exist to make this conversion, C2K-Tool allows this conversion to remain information assured at FNMOC by avoiding the use of commercial means.

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