

Documentation for Jupyter notebooks processing and analyzing Project Loon balloon data

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February 12, 2024

These Jupyter notebooks process Project Loon data (Rhodes and Candido, 2021) and analyze it, as described in Green et al. (2024). The focus of Green et al. (2024) is estimating and analyzing the vertical flux of horizontal momentum by atmospheric internal gravity waves (GWs), commonly referred to as the GW momentum flux, observed by the Project Loon balloons. The GW momentum flux dataset output by the analysis is available at:
<https://doi.org/10.25740/zh044ts5443>.

The COSMIC-1 and COSMIC-2 data analyzed in 3a_cosmic_read.ipynb and 3b_segments_cosmic.feather are available at:
<https://doi.org/10.5065/ZD80-KD74> and
<https://doi.org/10.5065/t353-c093>.

Notes on the notebooks

The notebooks in the “processing” folder begin with the Loon data of Rhodes and Candido (2021) and should be run in numerical order, starting with 1_combine.ipynb, then 2_data_gaps.ipynb, and so on.

Depending on the available computational resources, the volume of data sometimes requires it to be processed in pieces between 2_data_gaps.ipynb and 3b_cosmic_calc_backgroundT.ipynb before recombining the data into a single file and proceeding to 4a_GPS_spikes.ipynb.

The processed data ready for GW momentum flux estimation and analysis are produced by 5_interptime_processing.ipynb.

In the “analysis” folder, calculate_segment_fluxes.ipynb estimates the GW momentum fluxes; this is the dataset with the DOI mentioned above.

The other analysis notebooks produce the results presented in Green et al. (2024).

Balloon depressurizations are handled by these analysis notebooks, not the processing notebooks or calculate_segment_fluxes.ipynb, so there are some momentum fluxes in the dataset that are unrealistic and not due to GWs. Code to remove the depressurizations is included in both the analysis notebooks and the dataset’s readme file.

The wavelet's cone of influence results in momentum fluxes in the first and last two hours of each segment that are unreliable. Code to delete these data is included in both the analysis notebooks and the dataset's readme file.

References

Green, B., Sheshadri, S., Alexander, M.A., Bramberger, M., & Lott, F. (2024). Gravity wave momentum fluxes estimated from Project Loon balloon data. *Journal of Geophysical Research: Atmospheres*. *In press*

Rhodes, B. & Candido, S. (2021). Loon stratospheric sensor data (Version 3) [Dataset]. Zenodo. <https://doi.org/10.5281/zenodo.5119968>