GPM-ETC

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Created by Catherine Naud, July 2017.

For more information on the dataset and for citation purposes, refer to:
Naud, C.M., J.F. Booth, M. Lebsock, and M. Grecu, 2018: Observational constraint for precipitation in extratropical cyclones: Sensitivity to data sources. *J. Appl. Meteorol. Climatol.*, **57**, no. 4, 991-1009, doi:10.1175/JAMC-D-17-0289.1.

For each 6-hourly cyclone detection, we selected segments of GPM (Hou et al., 2003) combined 'CMB' version 5 product (Grecu et al., 2016) orbits that were found within $\pm$ 3 hours and in a 2500 km radius region centered on the low pressure center. The GPM-CMB files contain retrievals performed with the Ku band radar and GMI radiometer (NS) or Ku and Ka band radars with GMI (MS). This database provides the Ka+Ku+GMI precipitation rates, type (large scale vs. convective) and fraction of liquid precipitation information in 120 km wide swath at 5 km resolution. The files provided here include information on the cyclone and its track, along with the GPM-CMB file names (so with access to the GPM database the Ku+GMI products can be obtained), and the aforementioned precipitation products for each segment. The database contains all files acquired from March 2014 to December 2016.

Each tar directory contains a year of matched cyclones/GPM-CMB netcdf files, arranged in subdirectories per month.

The cyclones are detected and tracked using MCMS (Bauer et al., 2016) applied to 6-hourly ERA-interim SLPs. Each file corresponds to one of these 6-hourly detections, however the files also contain information on the overall track that the instantaneous cyclone snapshot belongs to.

For each of these cyclone locations, we searched the CMB database for orbits that were found within a circular region centered on the low of about 25° radius, within $\pm$3 hours. Then we extract portions of these orbits that are included in the cyclonic zone and save them in the ncdf files.

Filename convention:
GPM-ETC _yyyymmdd_tt_lat_long_surfacetype_trackID.ncdf
Where

- yyyymmdd is the date of the storm detection
- tt is the UT time of the detection (it can be 00, 06, 12, or 18)
- lat: is the latitude of the center of the storm (i.e. the location of the minimum SLP)
- long: is the longitude of the center
- surfacetype is either ocean or land and obtained by setting a 50% threshold on the MERRA2 land fraction file

- trackID is the unique identifier of the track this particular storm occurrence belongs to

The files contain the following:

- storminfo: a vector that contains some of the storm specific information, such as the longitude, the latitude, the SLP at the center, the land fraction and the SLP of the closed contour furthest from the center. This last parameter is used to evaluate the strength of the storm: based on the work of Polly and Rossow (2016), the difference in SLP between the outermost closed contour and the center is a good measure of the storm intensity (the largest the more powerful the storm).
- Trackinfo: this array contains the same information as above but for each instance along the track this storm is part of.
- gpmfileslist: the list of CMB files that match the conditions highlighted above for proximity in time and space to the cyclone. The dimension is nbgpmfiles.

We preselected some of the data fields in the files, for the Ka+Ku+GMI combination ('MS'), i.e. precipitation rate, type, liquid fraction and surface type. These were extracted and saved in arrays of dimension nbgpmfiles x nblong x nblatmax (= each swath has a fixed number of cross-track pixels (5 km in 120 km swaths) but the candidate orbit portions are of different length depending on how close the orbit is to the center of the storm. So nblatmax is the number of along track pixels (also 5 km) from the longest orbit portion amongst the candidate files included in GPMfileslist (-999. Is used to fill in the gaps):

- gpmlatitude: latitudes of GPM-Ka data (-999. Is used to fill in the orbit chunks smaller that nblatmax)
- gpmlongitude: longitudes of GPM-Ka data
- gpmprecrate: surface precipitation rate from Ka+Ku+GMI
- gpmliqfrac: liquid fraction of precipitation
- gpmprectype: other (=3), convective(=2) or stratiform(=1) rain type
- gpmsurftype: surface type extracted from the files. 0=ocean, 100-322=land

Further Reading and Resources:

Bauer, M.P., G. Tselioudis, and W.B. Rossow, 2016: A new climatology for investigating storm influences in and on the extratropics. *J. Appl. Meteorol. Climatol.*, **55**, 1287-1303.

Grecu M., W. S. Olson, S. J. Munchak, S. Ringerud, L. Liao, Z. Haddad, B. L. Kelley and S. F. McLaughlin, 2016: The GPM combined algorithm. *J. Atmos. Ocean. Technol.*, **33**, 2225-2245, doi:10.1175/JTECH-D-16-0019.1.

Hou, A. Y., R. K. Kakar, S. Neeck, A. A. Azarbarzin, C. D. Kummerow, M. Kojima, R. Oki, K. Nakamura and T. Iguchi, 2014: The Global Precipitation Measurement Mission, *Bull. Am. Meteorol. Soc.*, 95, 701-722, doi: 10.1175/BAMS-D-13-00164.1.

If you want to learn more about or download GPM-CMB data:
https://pmm.nasa.gov/data-access/downloads/gpm

MCMS tracking software: https://gcss-dime.giss.nasa.gov/mcms/