

FIU Passive Microwave Intensity Estimation (PMW-IE) Model for Tropical Cyclones in North Atlantic (AL), East Pacific (EP), and Central Pacific (CP) Basins

NOAA JHT FY17 Project: 2019 Hurricane Season Real-Time Demonstration

Prepared by

Haiyan Jiang (haiyan.jiang@fiu.edu); Florida International Univ.

11200 SW. 8th Street, AHC5 Rm371, Miami FL 33199

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The Passive Microwave Intensity Estimation (PMW-IE) model is designed to estimate the current intensity of TCs using a set of 85-91 GHz (85 GHz hereafter) and rain related variables (total 12 variables) from the Global Precipitation Mission (GPM) 1C-constellation and 2A-GPROF-constellation near-real-time (NRT) products, respectively. The GPM constellation sensors to be used in real-time include GPM Microwave Imager (GMI), Special Sensor Microwave Imager/Sounder (SSMIS), and Advanced Microwave Scanning Radiometer 2 (AMSR-2). The 85 GHz variables are derived from the 85 GHz Polarization Corrected Brightness Temperatures (PCTs) from the GPM 1C-constellation NRT product, while the rain variables are calculated from the GPM 2A-GPROF-constellation NRT product.

To test how well the 85 GHz variables are able to estimate TC intensity compared with both rain & 85 GHz variables, there are two models running in parallel: 1) One is the **85 GHz model** using 85 GHz only variables; 2) The other is the **rain+85GHz model**, which uses both 85 GHz and rain variables (all 12 variables). Both models were trained with 1998-2013 TRMM TMI data and 2014-2018 GPM 1C-constellation and 2A-GPROF-constellation data for AL and EP/CP TCs for high-resolution sensors (TMI, GMI, and AMSR2) and low-resolution sensor (SSMIS), separately. Both are able to estimate the current (Vmax) and 6-h future TC intensity (Vmax_6). The models continuously run in real-time at each satellite observation time, which is called **the satellite-centered run**.

Currently, the model is running for the AL and EP/CP basins for the 2019 hurricane season. The online output includes both satellite-centered text files and figure files for each storm declared by NHC A-deck data. Under the http://tcpf.fiu.edu/JHT/Intensity_Estimates_Text/ folder, text output files are stored under two basin folders (/AL2019/ folder for AL TCs and /EP2019/ folder for EP/CP TCs). There are separate folders for each TC (named by storm ID number, for example, AL01) under each basin folder. An example is: http://tcpf.fiu.edu/JHT/Intensity_Estimates_Text/AL2019/AL01/1905210847AL0119.SSMIS-F16.INTENSITY_ETA.DAT

The text file format is as follow and self-explanatory:

Basin Name PMW-IE TC Intensity Estimate

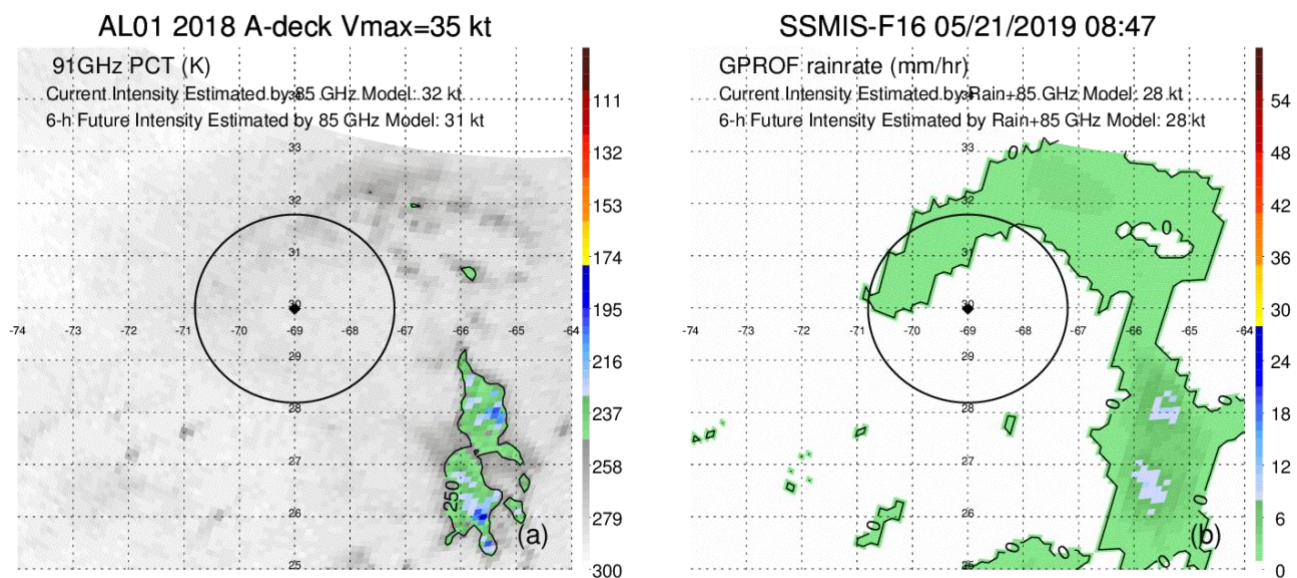
Satellite Sensor Name Storm Name Storm ID MM/DD/YY HHMM UTC

```
==Current Intensity Estimated by Rain+85GHz Model:    ??? kt
==Future 6-hr Intensity Estimated by Rain+85GHz Model:  ??? kt
==Current Intensity Estimated by 85 GHz Model:         ??? kt
==Future 6-hr Intensity Estimated by 85 GHz Model:     ??? kt
=====
==NHC Current Intensity at MM/DD/YY HHMM UTC from A-deck):  ??? kt
```

The image folder (http://tcpf.fiu.edu/JHT/Intensity_Estimates_Images/) contain the 85-91 GHz PCT and GPROF retrieved rain rate images for each satellite overpass that captured at least 200 km radius from an A-deck TC center. The current and 6-h future TC intensity estimates from the 85 GHz model and the rain+85GHz model are also indicated on each panel, respectively. Under the http://tcpf.fiu.edu/JHT/Intensity_Estimates_Images/ folder, image output files are stored under two basin folders (/AL2019/ folder for AL TCs and /EP2019/ folder for EP/CP TCs). There are separate folders for each TC (named by storm ID number, for example, AL01) under each basin folder.

One example of the images is:

http://tcpf.fiu.edu/JHT/Intensity_Estimates_Images/AL2019/AL01/1905210847ATL_01_2A.F16.SSMIS.GPROF2017v1.20190521-S083429-E100958.V05B.RT-H5.jpeg



This README file is located at:

http://tcpf.fiu.edu/JHT/FIU_JHTFY17_PMW_IE_model_RealTime_ReadMe_2019.pdf

References:

- Jiang, H., C. Tao, and Y. Pei, 2019: Estimation of Tropical Cyclone Intensity in the North Atlantic and North Eastern Pacific Basins Using TRMM Satellite Passive Microwave Observations. *J. Appl. Meteor. Climatol.*, **58**, 185–197.
- Jiang, H., Y. Pei, and X. Wang, 2019: Estimation of Tropical Cyclone Intensity Using Satellite Passive Microwave Observations: Year 2 Update, *73rd Interdepartmental Hurricane Conference/2019 Tropical Cyclone Research Forum*, Miami, Florida, Mar 12-14, 2019.

Contact information:

Dr. Haiyan Jiang: haiyan.jiang@fiu.edu