**10/16/20**

The PISTON and SPURS-2 directories of ODM disdrometer code, datasets, and plots for processing of Nw, D0, mu. These "level\_2" files were created with programs: ODM\_gamma.m and ODM\_save\_nc\_level\_2.m . All the info in the prior files is included in these, but only for times when "good" Nw, D0, and mu retrievals are possible. Therefore, the level 2 files have fewer data points (times).

Also, Kyla tested things with Christian's fortran code and confirmed my suspicion that the fortran code (and therefore OceanRain) undercounts drops. This undercounting is not replicated or done in my code because it's not explained in Christian's papers, since we see no need to do it physically, and the in-situ rain gauge data do not indicate it should be done either. We suspect the fortran code's few lines that reduce the drop count by some geometry relation/comparison/reason was intended to be a calibration fix in some situations experienced in the early testing of the device with Christian and the manufacturer. However in these tropical rain events, it seems to work in the opposite direction as needed. ODM already misses drops if smaller than 0.4 mm, and this artificial drop reduction in the fortran code (not my code) reduces the drop counts further (see materials in prior email for details. It's not a huge amount of undercounting, but it does affect rain rate. Might be important if you inspect the OceanRain dataset further.

**7/17/20**

I have processed and completed numerous tests of the ODM 470 disdrometer data from:

SPURS-2 2016-2017 using Kyla's unit located on O2 deck in 2016 and on bow foremast in 2017.

ftp://ftp1.esrl.noaa.gov/psd3/cruises/SPURS2\_2016\_2017/

(contains ODM DSD data as well as ship met/sea/flux/navigation data)

PISTON 2018 using Kyla's unit located on top of the pilot house.

ftp://ftp1.esrl.noaa.gov/psd3/cruises/PISTON\_MISOBOB\_2018/TGT/DSD/

ship met/sea/flux/navigation data from this cruise are separate here: ftp://ftp1.esrl.noaa.gov/psd3/cruises/PISTON\_MISOBOB\_2018/TGT/scientific\_analysis/updated\_July\_2020/

TGT 2017-2018 using Christian's unit located on top of the pilot house.

ftp://ftp1.esrl.noaa.gov/psd3/cruises/TGT\_2017\_2018/DSD/

This folder contains processing code used for all cruises and the attached summary powerpoint presentation (in /synthesis/). My matlab code is in a folder labeled as ET. It was used to produce the data files above. Kyla's fortran code is from Christian originally. It is in German and is included for reference.

ftp://ftp1.esrl.noaa.gov/psd3/cruises/DSD\_ODM\_code/

FTP instructions: I suggest using Filezilla or Chrome. Safari will mount into Finder, which can be useful but is sometimes tricky. It will prompt you for username/password. Use the guest/anonymous option without a password.

The data folders include:

- ODM level 1 data: drop counts, densities, and derived rain quantities in raw, processed, and final form: the .nc and .mat files in /final/ are the ones you want. The files in /final/ and the plots in /analysis/ are version controlled: currently v3. If updates are made, they'll be v4. Please let me know if you have any questions or find something amiss with the data. The netcdf file has attributes that should fill the role of a readme. I can make changes if needed or if something is currently inconvenient.

- Plots are in the /analysis/ folder. They compare the different data fields and different methods for processing (see below)

- Ship meteorological, seawater, navigation, and flux data... An optical rain gauge was used in both SPURS-2 experiments and the PISTON experiments. Same make/model, same location on the bow foremast of the ship. These are the best rain gauges around for ships. I have compared the ODM output to the rain gauge in plots contained in /analysis/

We don't currently have the meteorological ship data from TGT prior to PISTON. This is okay because the TGT ODM data do not look right, not just before PISTON but for the entire time period. I include the latest versions of ship met, seawater, flux, and navigation data for SPURS-2 and PISTON 2018. The SPURS-2 data are the most recent version from Carol Anne Clayson and Jim Edson (WHOI) on PODAAC. The PISTON 2018 data were produced by me this week from our last round of processing in April 2019. We found a small bug in our code for wind and fluxes, so these data will be reprocessed and re-released soon. I'll let you know when they are ready, and will update these folders accordingly.

I summarized findings I find most important for data users in this attached powerpoint. Since the ODM doesn't capture drops with diameter < 0.44 mm, it's understandable that the rain rates do not agree 100% to the ship gauge. The other purpose of the tests I completed was to determine the source of small disagreement between output from my matlab code using equations in Christian's paper, vs. the fortran code Christian gave Kyla a long time ago. I saved Pfortran in the data files -- this is the rain rate calculated from Christian/Kyla's fortran code that doesn't quite make sense. It is lower than the rain rate I calculate by up to 10% at higher diameters. I trust my code more at this point (see notes and plots in powerpoint). My code matches Christian's paper and theory, and my output rain rate agrees a bit more to the optical gauge measurements. There is a mysterious extra term in the fortran code that I don't understand. It reduces drop counts and therefore rain rates, which is consistent with the disagreement that I found. I asked Christian about it today. I bring this potential issue up because this discrepancy I found in Christian's code vs. mine vs. published papers may extend to the OceanRain datasets too. Hopefully Christian can confirm this soon, and hopefully he can take a look at these data to let us know for sure.

I have code written and successfully working to calculate Nw, D0, and mu from these DSD data. I call these the level 2 files. I will send them very soon. This past spring, I embarked on a feasibility study to understand whether these calculations are trustworthy because of the ODM's insensitivity to drops with D < 0.44 mm. Missing the small drops sort of matters. Chris and I think a workaround solution might be possible. One could use the more complete Manus Island 2DVD data to parameterize what the 0.2-0.4 mm size bin data should be from PISTON 2018. It could also work for SPURS-2 since it is a similar rain regime. I haven't attempted a parameterization fix of Nw an D0, but I have written a draft of the issues and results from processing ODM data. I'll share this along with my ODM Nw, Do, mu code and output files very soon. Chris Fairall and I are interested in pursuing this mainly because PISTON 2018 is the first time that DSD data were collected alongside our W-band radar. Scattering simulations of these data might be interesting and useful for improving our W-band radar processing procedures.

I will write up a more complete document with equations used to produce the level 1 files very soon. For now, here is the level 1 data! Please let me know how it goes, and if I can help with anything else with these data. I look forward to hearing about your research results with these data. I hope the data are useful, and that my data checking exercises will enable a smoother interpretation of these data.