



2013-08-15 update

A newsletter for non-scientists (and scientists) interested in MAGIC

MAGIC is a field program funded and operated by the Atmospheric Radiation Measurement (ARM) Climate Research Facility of the U.S. Department of Energy. The ARM MAGIC webpage is <http://www.arm.gov/sites/amf/mag>.

All previous updates and other MAGIC information can be found at <http://www.bnl.gov/envsci/ARM/MAGIC/>.

The *Spirit* arrived at the Port of Los Angeles this morning, completing MAGIC Leg16B. It is scheduled to depart this Saturday morning, starting Leg17A. In addition to Brett Bersche and Mark Smith, the two technicians who keep everything working so well, there will be two science riders on this leg: Mike Jensen and Yuan Gao. Mike is a meteorologist here at Brookhaven National Laboratory, and as he is interested in working on MAGIC data in the future, it was easy to entice him to observe firsthand what the clouds look like on MAGIC. This is his first time on a research ship. Yuan, from Rutgers University nearby in New Jersey, is an atmospheric chemist with a strong interest in aerosols. She's been on ships numerous times collecting samples. We installed her aerosol sampling system on the *Spirit* in May of this year just before Leg11. This system collects aerosol particles on filters, which can be analyzed later for chemical composition and morphology of the particles. I was working on aerosols when I became involved with MAGIC, and I had worked on aerosols in the marine environment for some time previous to that, so as needless to say, I'm very interested in the outcome of these analyses.



Yuan Gao



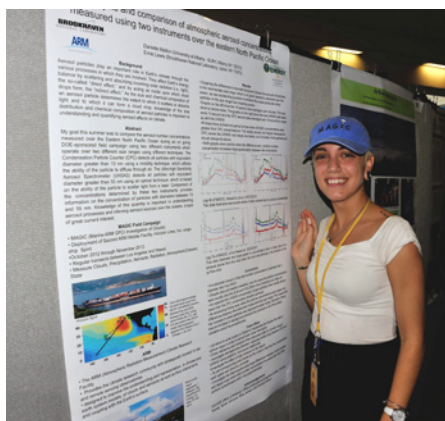
Mike Jensen

My brother emailed me two weeks ago and asked if Tropical Storm Flossie was causing us any problems. As I hadn't watched the news for a while, this was the first I had heard of any storms and I was initially worried. However, Flossie never made it to hurricane status, but it did hit Hawaii on July 30 and caused extensive flooding. The *Spirit* was nearly back to Los Angeles at that time. I called Pat Dowell, the

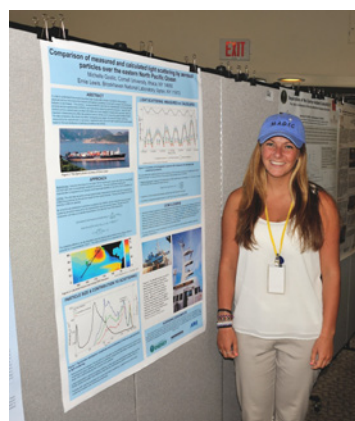
lead MAGIC technician, when he got to LA a few days later, and he said the voyage was calm and that they didn't experience any strong seas. Hurricane Henriette, a Category 2 hurricane with sustained winds reaching 100 mph, was in the Eastern Pacific about a week later, but by the time it passed ~500 miles south of Hawaii on August 11 it already diminished to below hurricane force, and the *Spirit* was part of the way back to Los Angeles. I just talked to Brett, who just arrived back in Los Angeles with the ship today, and he said that it was smooth sailing all the way back, so Henriette didn't affect us either.

Hurricanes thrive on the temperature difference between the sea surface and the upper atmosphere, but they are not common in Hawaii because the nearby waters are generally not sufficiently warm to supply the energy required to form and maintain them (as opposed to the waters in the Caribbean, for instance). However, Hawaii has experienced roughly half a dozen hurricanes in the last fifty years or so (since reliable records have been kept), including the Category 4 Hurricane Iniki in 1992 which killed several people and caused major damage. A hurricane is a tropical cyclone with sustained winds of 74 mph or higher, and a tropical cyclone (according to the National Hurricane Center), is a "rotating, organized system of clouds and thunderstorms that originates over tropical or subtropical waters and has a closed, low-level circulation." Hurricanes are called typhoons in the western North Pacific (i.e., west of 180° longitude; Honolulu is at 158°W); similar storms in the Indian Ocean and South Pacific Ocean are called cyclones. According to the National Hurricane Center, "There are no tropical cyclones in the Eastern Pacific at this time." That's good news.

The two undergraduate students who were working with me this summer, Danielle Mallon and Michelle Gostic, left at the end of last week. The pictures below show them with their MAGIC posters. I discussed them and their projects in the 2013-06-14 MAGIC update, and Michelle wrote part of the 2013-07-02 MAGIC update. Danielle volunteered to write something for this one, which I have included below.



Danielle Mallon

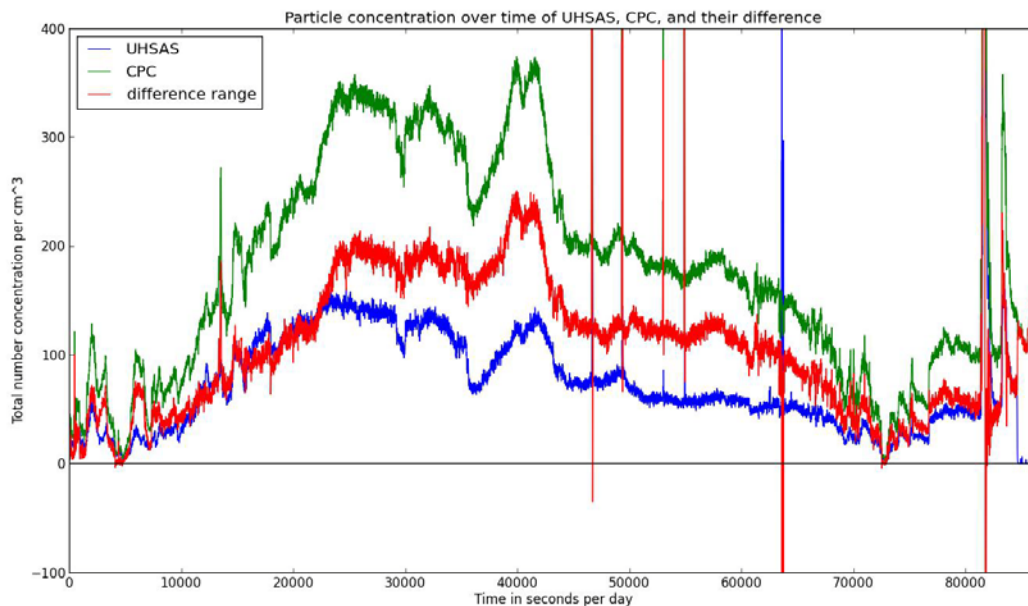


Michelle Gostic

As our internships at BNL come to a close, reflecting back on this summer, I have to say it has been MAGIC-al. This summer I was required to learn the programming language Python in order to plot and analyze MAGIC data. Having no prior programming experience, this was very challenging for me. At times I was very frustrated when scripts or commands didn't work as they were supposed to, but I kept the right attitude and worked through the road blocks. Once my programs worked properly, I had great feelings of being relieved and rewarded. I'm sure others who have had to do any programming can relate. That being said, this entire summer has been very rewarding. I can say that I have gained a new transferrable skill that will help me in the future as I continue in my academic career and in the research career field.

At the beginning of the summer I was apprehensive that I wouldn't complete the task Ernie assigned to me, which was writing and running scripts that would plot UHSAS and CPC data and the difference between them. But I was able to do this and I successfully contributed to MAGIC!

The Ultra High Sensitivity Aerosol Spectrometer (UHSAS) and the Condensation Particle Counter (CPC) are part of the suite of instruments aboard MAGIC. They measure aerosol concentration (the number of aerosol particles in a given volume), but they have different size ranges. I subtracted the UHSAS concentration, which included only particles with diameters greater than 55 nanometers (nm), from the CPC concentration, which included particles with diameters greater than 10 nm, to give the concentration of aerosol particles in the intermediate diameter range between 10 and 55 nm. Particles in this intermediate diameter range are often from anthropogenic sources. I did this for all the data from October to December 2012, on Leg03 through Leg07 (the UHSAS was on the ship only during this time period). Graphing these variables was important because it was unclear if there were any particles in this diameter region over the ocean, which is far removed from anthropogenic sources. The graph below shows these quantities for October 21, 2012, when the *Spirit* was a day out of Los Angeles on Leg04A.



Concentrations measured on October 21, 2012, when the *Spirit* was a day out of Los Angeles on Leg04A.

There are a few instances when the UHSAS concentration was greater than the CPC concentration. This should not occur, as the CPC covers the UHSAS's size range and also some below, so it should include more particles and thus give a greater concentration. However, this only occurred when spikes were seen in the data. These spikes were possibly caused when the

Spirit passed through the remnants of exhaust plumes from other ships, and differences in averaging time of the two instruments may have led to the negative values in the concentration difference. The drop in number concentration to near zero that occurred toward the end of the day is probably due to a rain event that removed most of the particles from the atmosphere. One interesting feature is that when the number concentrations from the two instruments increased, they did so disproportionately in that the concentration from the CPC increased more rapidly than did that from the UHSAS, resulting in the number concentration in the intermediate diameter range (10 nm to 55 nm) increasing as well. This means that the increase in number concentration of particles with diameter greater than 10 nm was due mostly to an increase in the concentration of particles in the intermediate diameter range (10 nm to 55 nm).

Overall I think this summer was successful and rewarding. I learned **a lot** and met some awesome and brilliant people. I got to see and experience how research is conducted professionally in the real world, see really cool facilities (like RHIC [*EL: a picture is shown in the 2013-07-02 MAGIC update*]), and speak with leaders in the atmospheric chemistry and aerosol science field. Doing this internship confirmed to me that this is in fact the field I would like to peruse in the future. I want to thank Ernie and everyone involved with ARM that helped me, I also wanted to thank Michelle (my fellow intern) for helping me write my codes when I would get stuck, especially in the beginning.

Thanks Danielle! For the record, the suggestion to learn Python was mine, and in hindsight it was a mistake. However, Danielle was fierce in her determination and never gave up. I'm sure with that determination she'll be successful in whatever she chooses. Good luck to both you and Michelle - it was great having you here this summer!

Ernie Lewis
2013-08-15

Please address any questions or comments to elewis@bnl.gov.