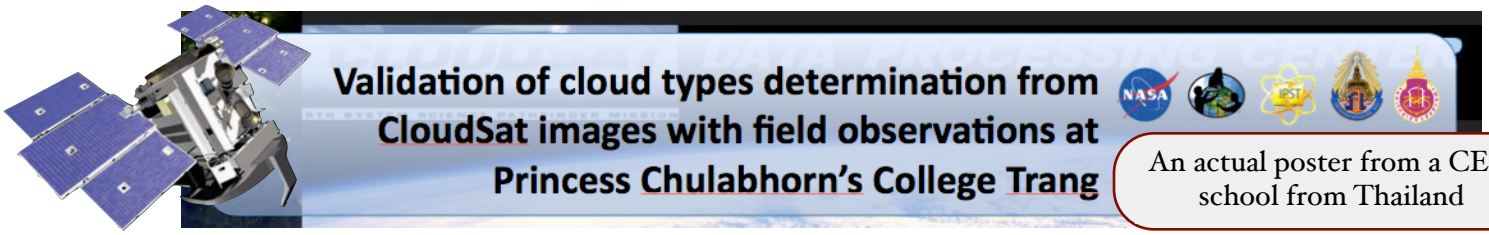
The CloudSat Downlink

Thailand: Partnering Students at All Levels with CloudSat



An actual poster from a CEN school from Thailand

At Walailak University in Thailand, CloudSat and the CEN have allowed for a very unique and exciting partnership. Graduate students, under direction of Dr. Krisanadej Jaroensutasinee, mentor and work alongside K-12 students and teachers to design and implement research projects using CEN data.

Dara Academy students checking the quadrants for cloud types

At the invitation of the Thiland GLOBE/CloudSat team, two CEN outreach members, Ms. Deanna TeBockhorst and Dr. Matt Rogers, attended the second annual GLOBE & CloudSat Student Conference on 3-7 November in Bangkok. It featured 10 different schools presenting their research from all over Thailand. Each presentation was delivered in English to better help the students master that language. All of them were quite impressive and really showed off just how exciting it can be to form a partnership with local scientists (even young scientists still in school). Afterwards, we met with country coordinators and CloudSat facilitators in Thailand to envision how we might develop an Asia/Pacific network with other schools in the region,.

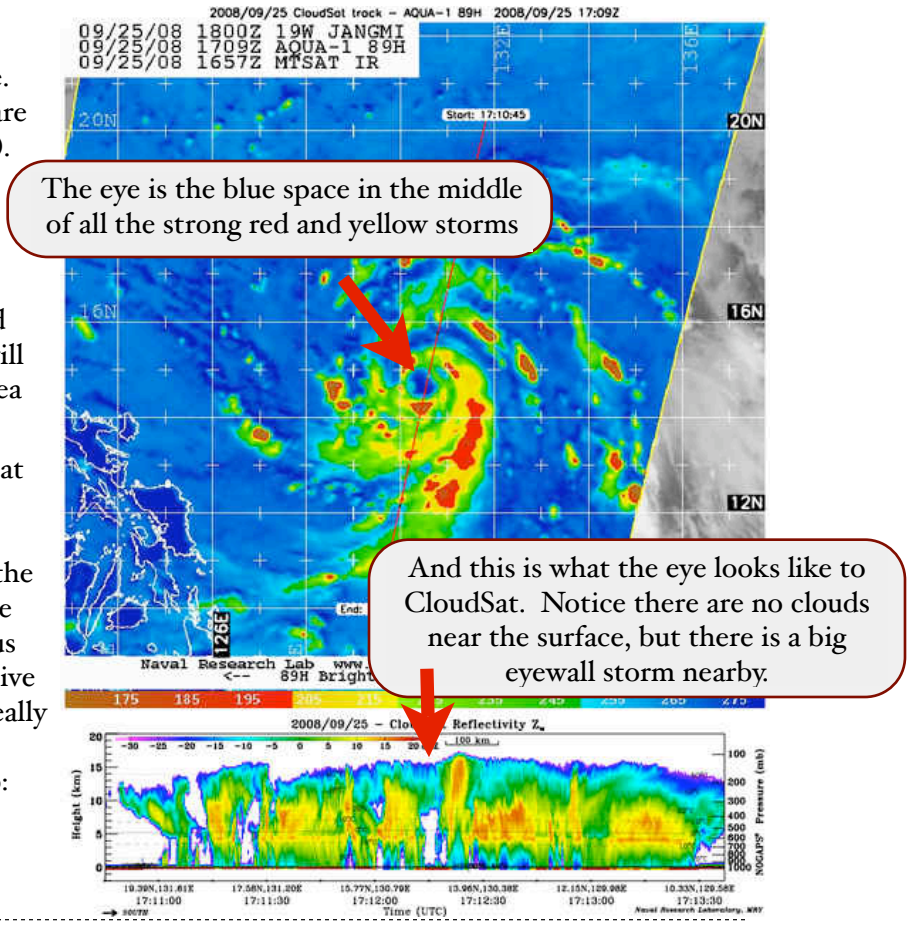
This leads us at the *Downlink* to wonder what other partnerships are out there, ripe for tapping into. Maybe it's a partnership with the local college or university like our friends in Thailand. Maybe it's a partnership with another CEN school in a different parts of the world. It could even be a partnership with a local company or government who is interested in how much it rains or how often it is cloudy.

We at the *Downlink* love the idea of teaching students how to ask good questions and form testable hypotheses. And remember, we're here to help you do just that. Just send us an email at cloudsatoutreach@atmos.colostate.edu and we'll help you think about partnerships and research questions of your own!

CLOUDSAT OBSERVES THE STRUCTURE OF TROPICAL CYCLONES AROUND THE WORLD

One of the most exciting phenomena that CloudSat has been able to observe since it was launched in 2006 has been the tropical cyclone. They go by many names (in the Atlantic, they are known as Hurricanes, in the Pacific, Typhoons). And for the first time, we can see inside these powerful storms to learn more about how they form and how they get stronger or weaker. Scientists are even using CloudSat data to help them make forecasts for tropical cyclones - and knowing where it will land and how strong it will be is important for everyone who lives in an area where these storms can hit.

The image to the right is an example of what CloudSat can see. The top image is a standard infrared satellite image - it measures energy emitted from a cloud and can tell us how cold the top of the cloud is (from which we can calculate the strength of the storm). But CloudSat lets us see inside the storm, including the area of relative calm in the center known as the eye, and the really strong storms that surround the eye (called the eyewall). To see more pictures like these, go to: http://reef.atmos.colostate.edu/~natalie/tc/casestudies.html



A SIMPLE CLOUD IN A BOTTLE EXPERIMENT

One of our favorite activities features how clouds form? (After all, we at the CloudSat mission do have a thing for clouds.) This experiment is a variation on a well known demonstration that allows you to make a cloud in a plastic soda container.

What you need:

•a 2-liter plastic bottle

•a Fizz-keeper (available for US$2-3 online)

•a couple of matches

•a thermometer to fit inside the bottle (one that can measure small changes (1°C scale is best)

•10 mL of water

What to do:

Add the water to the bottom of your (clean) bottle and put the thermometer in the bottle. Then light a match, let it burn for a second and then blow it out and drop it into the bottle (so smoke gets into the bottle) and put the Fizz-keeper on.

Note the temperature inside the bottle. Now pump up the bottle. Along the way the temperature should increase, which demonstrates the Ideal Gas Law - that in a fixed volume, if the pressure of the air goes up, the temperature will too. Continue to pump up the pressure until you've pumped 100 times. Now, holding the bottle in front of a dark background, unscrew the top. The temperature will drop and a cloud will form instantly! The match provides condensation nuclei - a place for water to condense when the air inside the bottle cools. Just like in a cloud!

I like to do experiments where first I omit the match. When you open the top, no cloud will form. This shows the importance of cloud condensation nuclei. I also like to have students form their own hypotheses and explain why they were wrong if the experiment didn't do what they thought. If you have any questions or suggestions, just email us at cloudsatoutreach@atmos.colostate.edu. *-Todd Ellis*

CEN RESOURCES: ASK A SCIENTIST

With this issue of the *Downlink*, we're introducing a new feature to the newsletter: the Ask-A-Scientist column. Each issue, we will select a question from our inbox and post the question asked by one of you and an answer from one of our CloudSat scientists.

How do you participate? That's easy. Just send an email with your name, your school, and your question to the following address:

ASKASCIENTIST@ATMOS.COLOSTATE.EDU

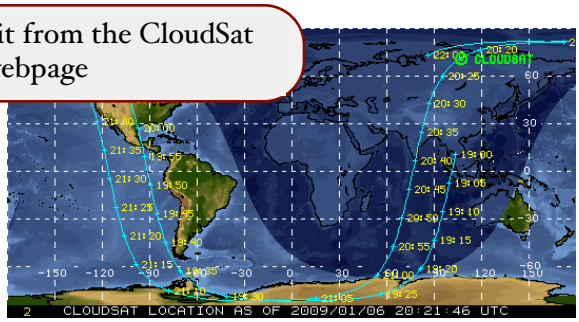
And to get us started, here's a question that we received from Lisa Bucci, from the University of Michigan in June:

I read that CloudSat has a repeat orbit of 16 days, but is that how long it takes the satellite to have complete global coverage? How long does it take to see the entire equator?

And the answer from scientist Dr. Matt Rogers:

Hi, Lisa - thanks for your question! You're correct that the 16-day figure is the time it takes to 'see' the entire equator, based on what is called the precession of CloudSat's orbit. It essentially works like this: the satellite crosses the equator on the sunlit side of Earth, moving from southeast to northwest. CloudSat's orbital period is approximately 88 minutes - this means that 88 minutes later, CloudSat will have gone completely around the Earth, and will be crossing the equator again, from the southeast to the northwest. During that 88 minutes, the Earth will have rotated on its axis

CloudSat's orbit from the CloudSat webpage



underneath CloudSat, moving from west to east from the point of view of the satellite. So when CloudSat is making it's second orbit over the equator, it's west of it's previous equator-crossing position, looking at a different part of the equator. Each successive orbit takes it further westward, until over a period of 16 days, CloudSat samples each longitude of the equator.

So, if you have questions about clouds or the CloudSat mission, please email us. And who knows, maybe your email will appear in this space in the next issue!

See you at the next GLOBE Annual Conference

2-7 August 2009

13th Annual GLOBE Conference in Calgary, Alberta, Canada

We're working on the activities we'll be presenting in Calgary next summer. Stay tuned for ways that you can get involved!

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WAGNER RANCH ELEMENTARY STUDENTS SHINE WITH SCIENCE KNOWLEDGE

By Todd Ellis

Recently Peter Falcon and I took a quick a trip to San Francisco, California, USA where we were attending the American Geophysical Union conference – a gathering of many of the worlds best earth scientists. While there, we couldn't resist the opportunity to visit another of our top-performing schools: Wagner Ranch Elementary School in Orinda, California.

Ms. Brucker's 5th grade class was a very bright group of students. We talked about what makes a cloud, and did some in class experiments to learn about how you can make a cloud in a plastic bottle (see earlier in this issue for some quick directions on how to do this on your own).

The students asked very good questions and kept me on my toes the whole time! They were very excited to learn more about clouds and CloudSat and were very well prepared for our visit. And since it was the day before the holiday break, we made sure to bring a few presents too! (OK, so we do that anytime we visit one of our schools...)

But remember, we love to visit our top performing schools, wherever in the world they are found. So keep up the good work with your observations, and we'll try to visit your school too!

Todd, Peter, and Ms. Brucker's Fifth Grade class at Wagner Ranch Elementary School in Orinda, California, USA

BOOK REVIEW: KEN LIBBRECHT'S FIELD GUIDE TO SNOWFLAKES

By Todd Ellis

Snow. Some of us live in places where snow is just a word, and flakes in the air but a dream. For others (including me), snow is that stuff that you measure in feet every winter. But no matter where you are, it is an amazing and beautiful part of our natural world.

Ken Libbrecht, a professor of physics at CalTech, is a world renowned expert in the science of snow. He is an expert in taking remarkable photographs of snowflakes, and in this book, he shares his expertise in both in a very easy to understand way.

In this book, you can learn about what kinds of temperatures and humidities are needed to make different kinds of snowflakes, and see up close all the different shapes they can make. You can also learn about how to catch snowflakes and take pictures of them!

This book is meant to be taken out into the snow, so you can catch snowflakes, identify them, and learn about the how they formed in the field. And if you don't have snow, the pictures are still worth the price!

The book is published by Voyageur Press, the ISBN is 978-0-7603-2645-9.