

# THE CERES S'COOL PROJECT

STUDENTS' CLOUD OBSERVATIONS ON-LINE

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SAIC



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CERES Science Team Meeting  
Exeter, UK  
October 2006

# What is S'COOL?

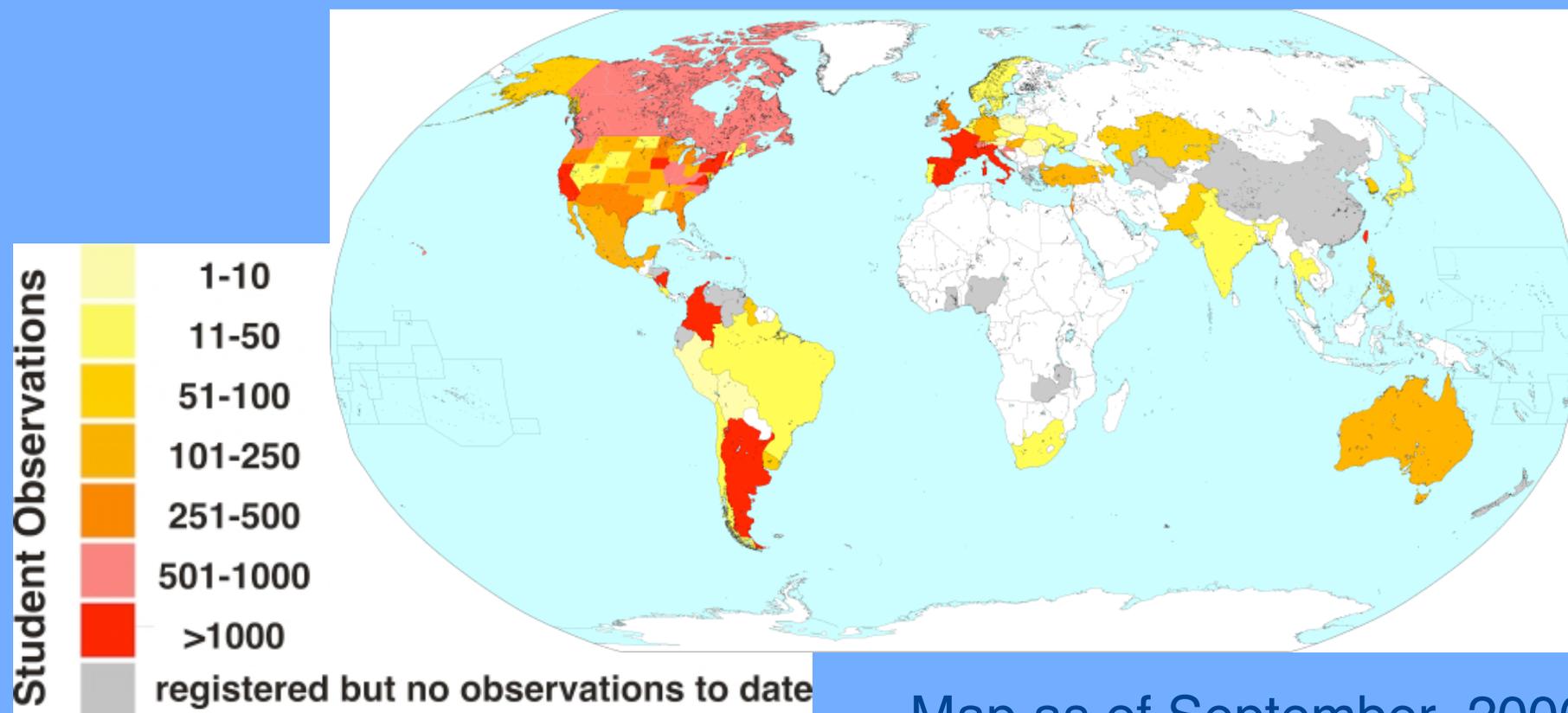
- Education and Public Outreach arm of CERES
- Backbone of Terra/Aqua formal education effort
- A simple way to involve K-12 students in authentic science
- A source of validation data for the CERES cloud retrievals



<http://scool.larc.nasa.gov>

# S'COOL Project

- > 55,500 observations from 49 countries and all 50 states
- 41 % from outside the US
- > 2,100 registered participants from 69 countries



Map as of September, 2006

# Impact Measures

- ~55 requests for S'COOL materials since May 2006 (a noticeable increase in the rate)

| States "Top Five" |     |
|-------------------|-----|
| ▪ PA ↑            | 21% |
| ▪ VA              | 10% |
| ▪ PR ↓            | 6%  |
| ▪ NH ↓            | 5%  |
| ▪ CA              | 5%  |

*Small  
Changes*

| Countries "Top Five" |       |
|----------------------|-------|
| ▪ US                 | 59% ↓ |
| ▪ Colombia           | 8% ↑  |
| ▪ France             | 8%    |
| ▪ Argentina          | 6% ↑  |
| ▪ Taiwan             | 3%    |

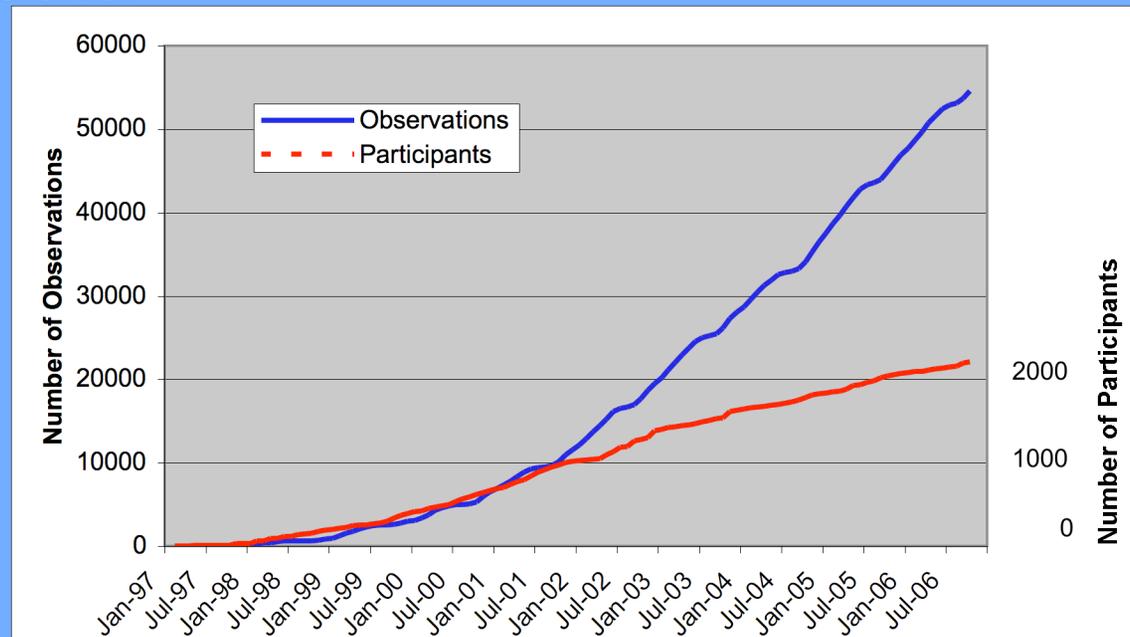
*Still  
No Change*

| States "Bottom Five" |   |
|----------------------|---|
| ▪ Virgin Islands     | 9 |
| ▪ Vermont            | 7 |
| ▪ Guam               | 6 |
| ▪ Delaware           | 3 |
| ▪ Northern Marianas  | 0 |

# Impact Measures (cont'd)

## Database of observations - as of Oct. 2006

- > 22,000 satellite correspondences
  - For 40% of ground observations
- 2,136 registered participants
  - 39% submitted data
- 69 countries
  - data from 49 countries (71%)



# S'COOL Evaluation

- Thanks to CERES support, a formal external evaluation was conducted this year
- Very positive results
- Good ideas for ways to continue to improve

EVALUATION *of the*  
**CERES**  
**S'COOL**  
**PROJECT**



# S'COOL Data

- A unique dataset matched to satellite
  - 15 minute temporal match
  - 1 degree spatial match
  - 0.4 degree spatial match (SSF) being done offline
- More than 22,000 correspondences available
- QA applied to weed out obvious errors
- Most recent: Oct. 10, 2006 (from FLASHFlux)
- Data available via the Internet for analysis:

[asd-www.larc.nasa.gov/SCOOL/usedata.html](http://asd-www.larc.nasa.gov/SCOOL/usedata.html)

| School Name                             | Latitude | Longitude | City     | State    | Country   |
|---|----------|-----------|----------|----------|-----------|
| Club de Ciencias Tantanakuy Informatica | -29.35   | -66.50    | La Rioja | La Rioja | Argentina |

| Surface Information      |                      |                          | Satellite Information<br>1001945 |                             |                     |                          |                 |
|--------------------------|----------------------|--------------------------|----------------------------------|-----------------------------|---------------------|--------------------------|-----------------|
| Date: 2006-10-10         | Local Time:<br>11:49 | Universal Time:<br>14:49 | Date: 2006-10-10                 | Universal Time:<br>14:49:00 |                     |                          |                 |
| Satellite: Terra         |                      |                          | Satellite: Terra                 |                             |                     |                          |                 |
| Opacity                  | Cloud Cover          | Type                     | Visualization                    | Altitude                    | Opacity             | Cloud Cover              | Phase Temp (C)  |
|                          |                      |                          | High                             |                             |                     |                          |                 |
|                          |                      |                          | Mid                              |                             |                     |                          |                 |
|                          |                      |                          | Low                              | 0.65                        | Translucent<br>3.89 | (0%<br>to<br>5%)<br>0.64 | water<br>315.82 |
|                          |                      |                          |                                  |                             |                     |                          |                 |
| Persistent Contrails: 00 |                      |                          | Short-Lived Contrails: 00        |                             |                     |                          |                 |

# S'COOL Interaction

New feature enabled by  
FLASHFlux:  
Auto-email notification  
when satellite data  
match a ground report.

Date: Wed, 18 Oct 2006 07:30:14 -0400

Dear Harding Middle School students,

The link(s) below will display one or more of your S'COOL observation reports that has been matched to a satellite observation. Remember that matches may not always be perfect. The satellite can easily tell the difference between 48 % and 52 % cloud cover and puts those in different classes. A human observer has to make a judgement call. Similarly, the satellite assigns opacity and height classes to definite levels, while a human observer looks at the whole picture to give the best description of what is seen.

[October 10, 2006](#)  
[October 10, 2006](#)

When you have time, please look at the information for these dates in comparison to your report form. Do you have any comments on this comparison? Do you remember anything about the conditions on this day which would help to explain the comparison? You may wish to refer to the [SCOOOL Data Analysis tutorial](#).

As always, we welcome your comments and feedback.

Lin

Dr. Lin Chambers - Director

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The CERES S'COOL Project - Students' Cloud Observations On-Line

<http://asd-www.larc.nasa.gov/SCOOOL/> scool.nasa.gov

Tel.: (757) 864-4371 Fax.: (757) 864-7996

The CERES S'COOL Project, MS 420, NASA Langley Research Center,

Hampton, VA 23681-2199

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## S'COOL Ground Observation & Satellite Results

| Latitude | Longitude | City         | State | Country |
|----------|-----------|--------------|-------|---------|
| 41.95    | -91.68    | Cedar Rapids | IA    | USA     |

| Ground Observation - 57996                     |                              |  |                                |                     | Terra Satellite             |   |                  |  |
|--|------------------------------|--|--------------------------------|---------------------|-----------------------------|---|------------------|--|
| Date:<br>2006-10-10                            |                              | Local<br>Time:<br>11:09:00   | Universal<br>Time:<br>16:09:00 | Date:<br>2006-10-10 | Universal Time:<br>16:09:00 |   |                  |  |
| Opacity  | Cloud<br>Cover               | Type   | Visualization                  | Altitude<br>(km)    | Opacity                     | Cloud Cover                               | Phase<br>Temp(K) |  |
|  |                              |  |                                | 10.43               | Opaque<br>15.63             | Mostly<br>Cloudy<br>(50% to 95%)<br>60.00 | ice<br>222.98    |  |
|  |                              |  |                                | 7.33                | Translucent<br>5.67         | Partly Cloudy<br>(5% to 50%)<br>40.00     | mixed<br>247.58  |  |
| Opaque   | Overcast<br>(95% to<br>100%) | Stratus  |                                |                     |                             |   |                  |  |
| Persistent Contrails: 00                       |                              | Short-Lived Contrails: 00  |                                |                     |                             |   |                  |  |
| Surface<br>Observations:                       |                              | Snow/Ice: No<br>Standing Water: No<br>Muddy: No<br>Dry Ground: Yes<br>Leaves on Trees: Yes |                                |                     |                             |   |                  |  |
| Temperature: 13.33 C                           |                              | Barometric Pressure: 1030.00 hPa   |                                |                     |                             |   |                  |  |
| Relative Humidity: 65.00                       |                              |  |                                |                     |                             |   |                  |  |
| Comments: No comments provided by participant. |                              |  |                                |                     |                             |   |                  |  |

Ground and satellite  
provide  
complementary views

Please help to classify how your ground observation compares to the Terra satellite's observation.  
Select one of the below categories to describe how well the two match.

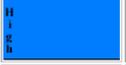
| Class<br>Number | Name   | Description   | Developed<br>By |
|-----------------|--|---|-----------------|
| 1               | <input type="radio"/> Perfect match with<br>Terra      | Cloud cover and opacity match perfectly at all 3 levels   | S'COOL<br>Team  |
| 2               | <input type="radio"/> Cloud cover match                | Cloud cover matches at all three levels   | S'COOL<br>Team  |
| 3               | <input type="radio"/> Overcast or mostly<br>cloudy low | Overcast or mostly cloudy low cloud corresponds to satellite; other levels not observable from the ground | S'COOL<br>Team  |
| 4               | <input checked="" type="radio"/> Overcast high or mid  | Overcast high or mid-level cloud; other levels not observable from satellite                              | S'COOL<br>Team  |
| 5               | <input type="radio"/> Fuzzy match                      | Cloud cover differs by at most one category at all levels   | S'COOL<br>Team  |
| 6               | <input type="radio"/> Sparse cloud                     | Ground or satellite reports 0-5% cloud only at a single level; the other sees nothing                     | S'COOL<br>Team  |

# Impact of FLASHFlux

- Began processing FLASHFlux data Oct. 1, 2004
- Provides satellite correspondence within a week for many S'COOL observations
- Sending auto email since mid-September 2006
  - Over 600 correspondences per month
  - About 40% have been classified by students
  - About 14% provide comments back to team by auto-email
  - We respond to 90% of these comments

| Class | Name                          |
|-------|-------------------------------|
| 1     | Perfect match                 |
| 2     | Cloud Cover match             |
| 3     | Overcast or mostly cloudy low |
| 4     | Overcast high or mid          |
| 5     | Fuzzy match                   |
| 6     | Sparse cloud                  |
| 7     | None of the above             |

| Latitude | Longitude | City       | State | Country |
|----------|-----------|------------|-------|---------|
| 39.76    | -77.56    | Waynesboro | PA    | USA     |

| Ground Observation - 58197   |                           |  |   |   | Terra Satellite |                             |                       |               |  |
|--|---------------------------|--|---|---|-----------------|-----------------------------|-----------------------|---------------|--|
| Date:<br>2006-10-10  |                           | Local Time:<br>12:09:00  | Universal Time:<br>16:09:00   | Date:<br>2006-10-10   |                 | Universal Time:<br>16:09:00 |                       |               |  |
| Opacity  | Cloud Cover               | Type   | Visualization   |  | Altitude (km)   | Opacity                     | Cloud Cover           | Phase Temp(K) |  |
| Transparent  | Partly Cloudy (5% to 50%) | Cirrus   |  |  |                 |                             |                       |               |  |
|  |                           |  |  |  | 8.13            | Transparent 0.52            | Clear (0% to 5%) 0.48 | ice 244.71    |  |
| Translucent  | Clear (0% to 5%)          | Stratus  |  |  | 0.58            | Translucent 4.38            | Clear (0% to 5%) 0.29 | water 287.59  |  |
|  |                           |  |  |   |                 |                             |                       |               |  |
| Persistent Contrails: 06   |                           |  | Short-Lived Contrails: 00   |   |                 |                             |                       |               |  |
| Surface Observations:  |                           | Snow/Ice: No<br>Standing Water: No<br>Muddy: No<br>Dry Ground: Yes<br>Leaves on Trees: Yes |   |   |                 |                             |                       |               |  |
| Temperature: 20.00 C<br>Barometric Pressure: 1016.82 hPa<br>Relative Humidity: 70.00 |                           |  |   |   |                 |                             |                       |               |  |
| Comments: hazy!  |                           |  |   |   |                 |                             |                       |               |  |

# S'COOL Presentations

## Since May 2006

- **Exhibit at the Virginia Air and Space Center Open House**
- **Presentations at local science teachers conference**
- **Presentations at National Institute of Aerospace and NASA Explorer Schools educator workshops**
- **Presentation to student teachers (CNU science methods class)**
- **AGU Joint Assembly, Baltimore: *Authentic K-12 Science Projects at the NASA Langley Research Center***

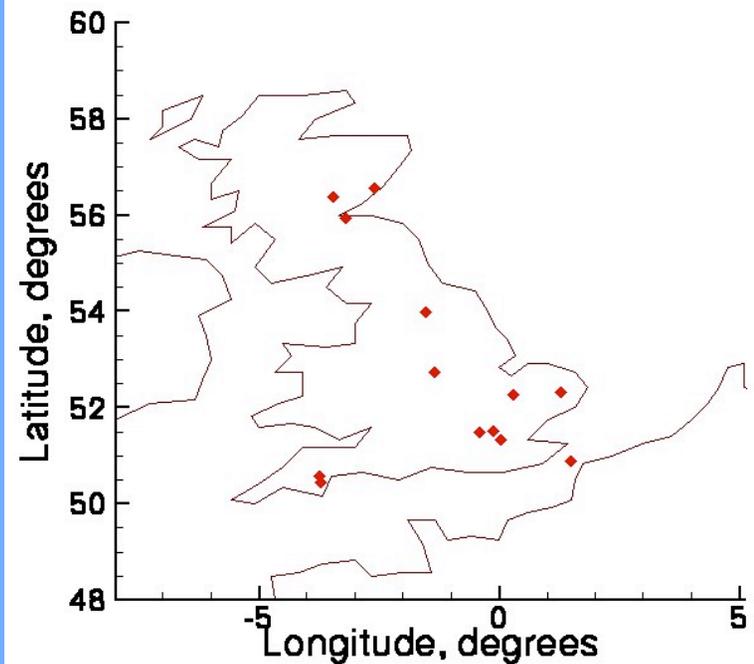
# S'COOL in Taiwan

- Ambassador: Dr. Shi-Keng Yang, NOAA/CERES
- Invited to Taiwan for 2 S'COOL workshops.
  - Sept. 19, 2006, Taipei, Taiwan, ROC
    - 140+ students from 7 schools
    - Many already familiar with S'COOL from older students
    - Two of teachers' sons studying Atmos. Sci. at top univ. in Taiwan
  - Sept. 22, 2006, Tainan, Taiwan, ROC
    - 100 students from 5 schools; New to S'COOL
    - Lots of interesting questions asked



# S'COOL in the UK

- 14 registered schools; 6 have observed (1 in Bermuda)
- 383 observation reports
- 94 satellite matches
- NO double matches (Aqua & Terra) yet
- Cloudiness:
  - 50% reports of overcast
  - 25% reports of mostly cloudy



# S'COOL + SPHERE

- Served as advisor to a group of undergraduate students this summer
  - Students as Professionals Helping Educators Research the Earth
- 1 SPHERE student did analysis of S'COOL ground to satellite cloud mask data

| Value: | Corresponds to:  |
|--------|--|
| 0      | Both Ground and Satellite observations are recorded the same   |
| -1     | Satellite recorded cloud presence. Ground observation did not. |
| 1      | Ground recorded cloud presence. Satellite observation did not. |

- Hope to extend this study, as time permits



STATISTICAL RESULTS.txt - Notepad

File Edit Format View Help

Number of Observations Selected to Read: 21435  
 Total Number of Consistent Observations: 20642  
 Total Number of Inconsistent Observations: 793

| VECTOR:  | INSTANCES: | OCCURS: |
|----------|------------|---------|
| -1 -1 -1 | 340        | 1.65%   |
| -1 -1 0  | 1751       | 8.48%   |
| -1 -1 1  | 683        | 3.31%   |
| -1 0 -1  | 751        | 3.64%   |
| -1 0 0   | 1990       | 9.64%   |
| -1 0 1   | 549        | 2.66%   |
| -1 1 -1  | 8          | 0.04%   |
| -1 1 0   | 364        | 1.76%   |
| -1 1 1   | 44         | 0.21%   |
| 0 -1 -1  | 2371       | 11.49%  |
| 0 -1 0   | 4166       | 20.18%  |
| 0 -1 1   | 366        | 1.77%   |
| 0 0 -1   | 680        | 3.29%   |
| 0 0 0    | 3575       | 17.32%  |
| 0 0 1    | 910        | 4.41%   |
| 0 1 -1   | 28         | 0.14%   |
| 0 1 0    | 175        | 0.85%   |
| 0 1 1    | 157        | 0.76%   |
| 1 -1 -1  | 841        | 4.07%   |
| 1 -1 0   | 307        | 1.49%   |
| 1 -1 1   | 11         | 0.05%   |
| 1 0 -1   | 173        | 0.84%   |
| 1 0 0    | 314        | 1.52%   |
| 1 0 1    | 38         | 0.18%   |
| 1 1 -1   | 6          | 0.03%   |
| 1 1 0    | 27         | 0.13%   |
| 1 1 1    | 17         | 0.08%   |

Theory 1 Instances: 11810 Occurs: 57.21%  
 Theory 2 Instances: 6537 Occurs: 31.67%

Ln 1, Col 1

Perfect match

# S'COOL in the Field

- Teacher Ambassador presentations:
  - New Jersey Science Convention (B. Schaefer)
  - NSTA Midwestern Region Conference (L. Eppich)
  - Mississippi Science Teachers Association Conference (N. Heiselt)
  - Minnesota Department of Education Digital Content Conference (J. Minerich)
  - Minnesota Rural Education Association Conference (J. Minerich)

# S'COOL Publicity

- Article by Katie Lorentz on NASA Portal for Earth Science Week
- S'COOL on TV (Missouri)

## **NASA Picks A Heartland School For A Special Assignment**

By: Jason Lindsey

Cape Girardeau, MO - Kids at Saint Vincent De Paul Parish School take the classroom outside for an out of this world assignment.

Mrs. Karnes 2nd grade class is the only one in Cape Girardeau chosen by NASA to help with it's S'COOL Cloud Observation Project.

Each day around 1p.m. the students become cloud observers and report the cloud cover over Cape to NASA. Karnes says, "we are actually doing observations of the lower level clouds and looking for contrails that maybe airplanes or helicopters might be leaving.

The data they submit will help NASA determine how often satellites fail to detect certain clouds in specific area. "It gives the kids a sense of importance, they feel like they are some one special because they are working for a company like NASA," said Karnes.



 **NASA Picks A Heartland School For A Special Assignment**

# S'COOL Needs YOU!

- **Participants in every state and 69 countries**
  - Offer to serve as a **resource to a local teacher**
  - Arrange a **S'COOL visit when traveling**
  - [*Hint: nearest active school is Dartington School, Shinners Bridge near Totnes (on fall break this week)*]
  - Provide **S'COOL info to teachers you know**
- **Presentation materials available**, with script suggestions
- **Help with translation of materials**
- **Serve as resource for scientific content questions sent in by participants**