



## Engaging students in authentic science

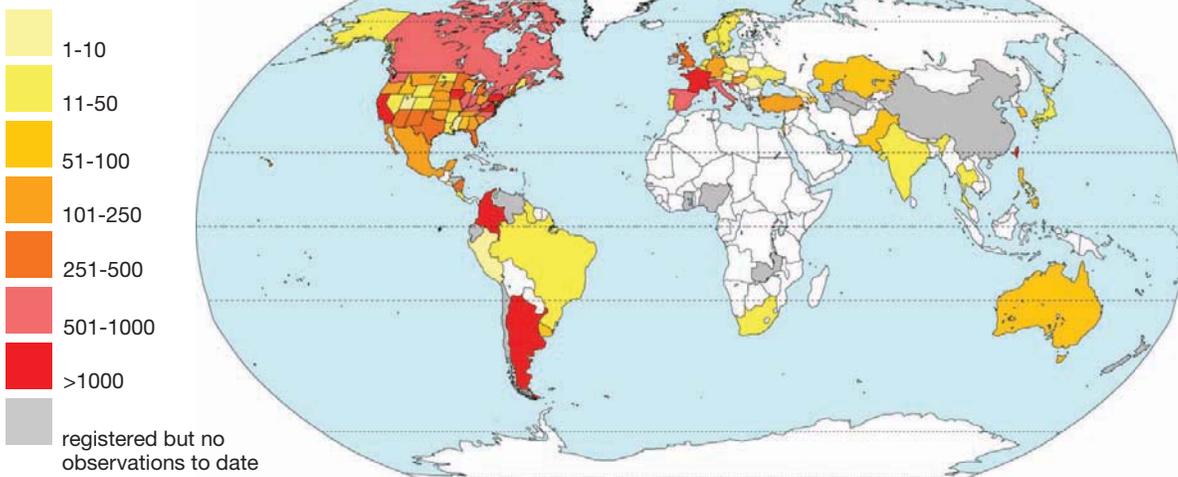
### Unique Educational Contributions

The S'COOL program provides a simple and effective means for educators to bring authentic science into their teaching practice. Observations require no expensive equipment or extensive training, yet make a meaningful contribution to our understanding of the planet and the role that clouds play in our climate. Since 1997, S'COOL has directly impacted more than 25,000 students and 1,800 teachers in all 50 states and more than 46 countries around the world. S'COOL provides teachers peer-reviewed Earth Science educational materials, with current science content. Students are highly motivated to provide observations for NASA. S'COOL data, available on the Internet, enable open-ended inquiry regarding the effects of clouds on weather and climate.

### Societal Benefits

S'COOL allows teachers to tap into the different learning styles and skills of diverse students. For example, teachers have reported good results with special education students. S'COOL has done extensive outreach to Native American and Hispanic communities, as well as to rural communities in general, to obtain observations from a wide geographical area. The program works with these communities through existing organizations such as the Society for the Advancement of Chicanos and Native Americans in Science, American Indian Science and Engineering Society, National Association of Bilingual Educators, and ongoing NASA outreach efforts serving Puerto Rico. S'COOL also welcomes the participation of home school groups.

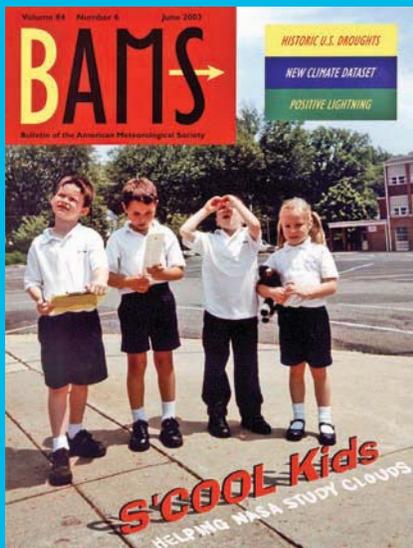
### Student Observations



S'COOL - students' cloud observations on-line

# S'COOL

K-12 students around the world are involved in authentic, hands-on science through NASA's S'COOL program. As part of the validation effort for cloud retrievals from the Clouds and the Earth's Radiant Energy System (CERES) instruments, these students observe and report cloud conditions when NASA's Earth Observing System satellites pass over their location. S'COOL is managed by a NASA/contractor team, through funding from NASA's Science Mission Directorate.



“This program provides the skills that they will need for a very long time to be successful. The students who have been active have learned valuable information and problem solving skills that they will be able to use forever.”

Eileen Poling, Teacher at Tucker Valley Elementary and Middle School, Hambleton, WV

Engagement in authentic data collection and especially data analysis has been shown to improve science test scores (National Assessment of Educational Progress, 2000). S'COOL provides both, with a database of over 41,000 ground observations available via the Internet. Anecdotally, at least one young woman is reported to be studying atmospheric and oceanic science in college as a result of her participation in S'COOL.

## Outgrowths

S'COOL has been used in museums, science centers, science camps, science clubs, and scouting groups; not just K-12 classrooms. In order to obtain observations from around the world, S'COOL materials have been produced in French, Spanish, German and Italian. This enables foreign language teachers in the US to use S'COOL for real world language exercises for their students. A paper describing lessons learned from S'COOL was published in the Bulletin of the American Meteorological Society (Chambers et al., 2003). This paper attracted interest from people beginning development of outreach projects as well as existing outreach projects such as the GLOBE program. S'COOL has joined forces with GLOBE to begin a contrail observation protocol. Together, they are the ONLY source of surface observations of contrails in the world, a very important complement to studies using satellite data.

## Findings

Satellite data corresponding to over 9,000 student observations have so far been processed to obtain remotely sensed cloud information. These data are available to students via the Internet. Scientific analysis reveals that about half the cases show complete agreement between the satellite data and the surface observation. However, the cases where the two reports disagree are more interesting. They have allowed us to confirm and quantify the extent to which the satellite misses thin, high clouds. Effects of cloud layering, snow covered surfaces, etc, continue to be examined.

For more information, visit <http://scool.larc.nasa.gov> or <http://asd-www.larc.nasa.gov/GLOBE/>. You can email S'COOL at [scool@lists.nasa.gov](mailto:scool@lists.nasa.gov).

S'COOL - students' cloud observations on-line