The CERES S’COOL Project

Lin Chambers and David Young
NASA LaRC, Hampton, VA

Carolyn J. Green, Doug B. Stoddard, & Roberto Sepulveda
SAIC

Amanda Falcone
Trinity University

23rd CERES Science Team Meeting
Williamsburg, Virginia
January 23-2225, 2001

NASA Langley Research Center / Atmospheric Sciences
S’COOL Accomplishments Since September 2000 CERES Science Team Meeting

• Reached the 694 Participant Milestone (Added 44 Schools)
• Over 12 Presentations at Conferences and Schools
• Sent the Latest Newsletter to over 750 Subscribers
• Held Intensive Observation Period During October 2000 (Over 600 Observations)
• Announcement of July 16-20, 2001 S’COOL Teacher Workshop. Open to all 50 states.
Comparing Student and Satellite Cloud Observations

- What We Compare
- How to Match Observations
- Examples
- Understanding the Results
What We Compare

- Cloud Amount
  - Clear
  - Partly Cloudy
  - Mostly Cloudy
  - Overcast

- Cloud Height
  - Low
  - Mid
  - High

- Number of Cloud Layers

- Cloud Visual Opacity
How to Match Observations

- Satellite and Student Observations Are Entered Into the S’COOL Database

- S’COOL Site Must Be Within Satellite Area (1° x 1° grid)

- Satellite and Student Observation Times Must Be Within 15 Minutes
The Difficulty of Satellite Detection of Clouds

Visible

Infrared

Clouds

Snow

Germany

France

Italy
Clear Day Comparison
October 20, 1997  17:45 GMT
**Comparison Results**  
October 20, 1997 17:45 GMT

<table>
<thead>
<tr>
<th></th>
<th>Poquoson Student Observations</th>
<th>Newport News Student Observations</th>
<th>CERES Cloud Measurements</th>
<th>Do They Agree?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cloud Type</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>Yes</td>
</tr>
<tr>
<td>Cloud Fraction</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>Yes</td>
</tr>
<tr>
<td>Cloud Height</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Visual Opacity</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Comment: Comparisons of Clear-Sky Observations Are Very Important!
Cloudy Day Comparison
October 22, 1997 17:45 GMT
Comparison Results  
October 22, 1997  17:45 GMT

<table>
<thead>
<tr>
<th></th>
<th>Poquoson Student Observations</th>
<th>Newport News Student Observations</th>
<th>CERES Cloud Measurements</th>
<th>Do They Agree?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cloud Type</td>
<td>Cumulus</td>
<td>Alto cumulus + Cirrus</td>
<td>Low water clouds</td>
<td>Poq: Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NN: No</td>
</tr>
<tr>
<td>Cloud Fraction</td>
<td>0 - 5% (Clear)</td>
<td>5 - 50% (Partly Cloudy)</td>
<td>7%</td>
<td>Close</td>
</tr>
<tr>
<td>Cloud Height</td>
<td>Low</td>
<td>Mid / High</td>
<td>Low</td>
<td>Poq: Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NN: No</td>
</tr>
<tr>
<td>Visual Opacity</td>
<td>Translucent</td>
<td>Transparent</td>
<td>Translucent (optical depth = 6.6)</td>
<td>Poq: Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NN: No</td>
</tr>
</tbody>
</table>

Comment: Poquoson observed contrails - These may be what the Newport News students were reporting. There also was a mid-level layer cloud to the south.
Pre-CERES Cloud Amount Comparison
(CERES Algorithm with AVHRR Data)

<table>
<thead>
<tr>
<th>Satellite</th>
<th>S’COOL Students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Clear</td>
</tr>
<tr>
<td>Clear</td>
<td>13</td>
</tr>
<tr>
<td>Partly Cloudy</td>
<td>4</td>
</tr>
<tr>
<td>Mostly Cloudy</td>
<td>2</td>
</tr>
<tr>
<td>Overcast</td>
<td>0</td>
</tr>
</tbody>
</table>
Summary of Cloud Comparison

The Students and Satellite Observations:

<table>
<thead>
<tr>
<th>Agreement Level</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>34 Out of 45 Times</td>
<td>(76%)</td>
</tr>
<tr>
<td>Weakly Agree</td>
<td>7 Out of 45 Times</td>
<td>(15%)</td>
</tr>
<tr>
<td>Disagree</td>
<td>4 Out of 45 Times</td>
<td>(9%)</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>0 Out of 45 Times</td>
<td>(0%)</td>
</tr>
</tbody>
</table>
Comparison Update Project
by Amanda Falcone

Before CERES - 15 Minute Matching
- Percentages of cloudiness
  - 34 out of 45 agree totally
  - 75.6% total agreement
  - 0 third class errors
- Cloud level comparisons
  - 28 out of 45 agree totally
  - 62.2% total agreement
  - 1 second class error

With CERES - 15 Minute Matching
- Percentages of cloudiness
  - 60 out of 99 agree totally
  - 60.6% total agreement
  - 1 third class error
- Cloud level comparisons
  - 52 out of 99 agree totally
  - 52.5% total agreement
  - 3 second class errors

Major Discrepancy Observed was for Thin, Sparse Cirrus
### Updated Cloud Amount Comparison

(Observations within 15 minutes)

<table>
<thead>
<tr>
<th>Satellite</th>
<th>Clear</th>
<th>Partly Cloudy</th>
<th>Mostly Cloudy</th>
<th>Overcast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear</td>
<td>27</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Partly Cloudy</td>
<td>7</td>
<td>10</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Mostly Cloudy</td>
<td>5</td>
<td>3</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>Overcast</td>
<td>0</td>
<td>1</td>
<td>8</td>
<td>11</td>
</tr>
</tbody>
</table>
Number of Matched Observations

Number of Matches

Time Difference (minutes)

15 30 60 120 180 240 300

0 20 40 60 80 100 120 140

NASA Langley Research Center / Atmospheric Sciences
Effect of Mismatched Observation Times

Percent Agreement

Time Difference (minutes)

- 15
- 30
- 60
- 120
- 180
- 240
- 300
Percentage Agreements vs. Time

Percentage Agreement (%) vs. Time (minutes)

- Cloudiness Level
- Specific Levels of Clouds
- General Cloud Levels
- Linear (Cloudiness Level)
- Linear (Specific Level)

NASA Langley Research Center / Atmospheric Sciences
What’s Next?

- Automate Matching Procedure
  - Database growing quickly since launch of Terra
  - Waiting for CERES cloud parameters

- Compare Other Quantities
  - Cloud heights
  - Multi-level clouds
  - Cloud optical thickness

- Perform ERBE-like comparison