Surface Temperature
Investigation of Untilled and Conservation-Tilled Farm Fields

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Big Question

• Do Changes to the Land Made by People Affect the Earth’s Temperature?
Which is warmer?

Untilled (No-Till) Field
The plant debris from last year’s harvest remains in the field.

Conservation-Tilled Field
The ground is broken up, but some plant debris remains.

or
How Did We Determine Which is Hotter?


2. Used Student GLOBE Surface Temperature Observations to Correct the Satellite Estimated Ground Temperature for Atmospheric Effects.

Step 1: Find our Fields on a Map and Validate Their Location
Validation: (Making sure we have the right field)
The April 4, 2005 Landsat 7 Satellite Image of Cedar Falls, IA was Clear.
Using the GLOBE One fields as samples, we can use mathematics to determine if the fields are untilled or conservation-tilled fields.

We called this technique a *supervised classification*. 
Classification Results

Black – Not a field (urban, water, road, etc.)

Gray – Prairie or forest

Green – No-Till Field

Brown – Conservation-Tilled Field
Surface Temperature Spring 2005 Field Campaign

• GLOBE Schools in Iowa Measured Surface Temperature Using Infrared Thermometers

Orchard Hill Elementary School
Central Middle School
Immaculate Conception
Hoover Middle School
Kittrell Elementary School
St. Edwards School
Orange Elementary School

Thank You
GLOBE Iowa Student Observations

April 4 Satellite Image
Hoover Middle School Sites
The ‘Hot Spot’ in the center is the school.
Surface Temperature with the Landsat7 Thermal Image

L7=22.7°C  GLOBE=29.2°C
L7=23.3°C  GLOBE=30.3°C
L7=23.8°C  GLOBE=30.8°C
Because of Atmospheric Interference, the thermal radiation sensed by the satellite seems cooler than it truly is.
How much Does the Atmosphere Affect the Satellite Temperature?

<table>
<thead>
<tr>
<th>School Site</th>
<th>Landsat7 Temperature</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoover - Grass</td>
<td>22.7°C</td>
<td>7.6°C</td>
</tr>
<tr>
<td>Hoover - Prairie</td>
<td>23.8°C</td>
<td>7°C</td>
</tr>
<tr>
<td>Hoover - Concrete</td>
<td>23.3°C</td>
<td>5.9°C</td>
</tr>
<tr>
<td>Immaculate Conception - Concrete</td>
<td>20.4°C</td>
<td>8.6°C</td>
</tr>
<tr>
<td>Immaculate Conception - Grass</td>
<td>21°C</td>
<td>8°C</td>
</tr>
<tr>
<td>St. Edwards - Asphalt</td>
<td>23.3°C</td>
<td>6.3°C</td>
</tr>
</tbody>
</table>

Temperature Variation

- 16°C
- 18°C
- 20°C
- 22°C
- 24°C
- 26°C
- 28°C
- 30°C
- 32°C
- 34°C
- 36°C

Graph showing the relationship between School Data Temperature and Landsat7 Temperature.
Results of Atmospheric Correction

Before

ATM-07: Conservation
ATM-08: No-till
ATM-05: Conservation
ATM-10: Prairie

After

ATM-07: Conservation
ATM-08: No-till
ATM-05: Conservation
ATM-10: Prairie

Surface Temperature
°C
-2 - 15
15.1 - 16
16.1 - 17
17.1 - 18
18.1 - 19
19.1 - 20
20.1 - 21
21.1 - 22
22.1 - 23
23.1 - 24
24.1 - 25
25.1 - 26
26.1 - 27
27.1 - 28
28.1 - 29
29.1 - 30
30.1 - 31
31.1 - 32
32.1 - 33
33.1 - 70
Which is warmer?

Untilled (No-Till) Field

Conservation-Tilled Field

29.2° C

or

32.3° C
Thank You!