THE USE OF LONG TERM EARTH OBSERVATION DATA ARCHIVES TO IDENTIFY POTENTIAL VICARIOUS CALIBRATION TARGETS IN AUSTRALIA

Cindy Ong*, Mike Caccetta*, Ian Lau*, Tim Malthus+ and Nadika Thapur+.
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*Spectral Sensing Team, Mineral Resource Flagship, +Ocean and Atmosphere Flagship
Aim

To build a vicarious calibration site specifically for imaging spectroscopy missions underpinned by instrumentations at least meeting (and aiming for beyond) those of current CEOS endorsed vicarious calibration sites.
Vicarious Site Identification

- Problem: How to systematically identify site(s) suitable for calibration of moderate spatial resolution sensors (~30m) across 450-2500nm?
- Strategy: Analysis of Landsat archive.
  - Operating since 1970’s;
  - 30m pixel, 120x120km swath;
  - 6 bands covering VNIR SWIR;
  - 16 day revisit therefore extensive archive.
- Site selection search criteria:
  - Spatially >100x100m, at least 3x3 30m pixels, preferably larger;
  - High reflectance (VNIR > 30, SWIR > 40) and preferably lambertian;
  - Spatial, spectral and temporal uniformity (CofVar < 0.15);
  - Consistently bare ground (BG Class > 0.75);
  - Low relief to flat (Slope < 2%);
  - Favourable climatic conditions.
Method – Project Workflow/Algorithm

NCI Raijin & AGDC

TM 5 2003-2010

Tile 1

Tile 824

40-60 images

“dry” scenes

Core 1

Core N

.. 1 2 1 2

.. 1 2

GDAL mosaic

AGDC API “Stacker”, Python code & scripts

Spectral Indices

* NDVI
* MNDWI etc

PQA

Cover Classification

*Bare ground* Vegetation *Surface water* Low albedo *Cloud

Temporal stats

*Class occurrence
* Normalised class occurrence
* Observations

“Bare ground” temporal stats

• Band \( \mu \) & \( \sigma \)
• Coefficient of variation
• *VNIR Albedo \( \mu \) & \( \sigma \)
• SWIR Albedo \( \mu \) & \( \sigma \)

ENVI

* Data visualisation
* Integration
* Interrogation

IGARSS 2015 | ISIS TC Session: Calibration And Validation, Inter-Calibration And Coming To Terms With Terminology
Results

Image Search criteria

\[(\text{Obs}_\text{tot} > 40) \cap (\text{Norm}_{-\text{Class}_{-\text{Occur}}}[\text{Bare\_ground}] > 0.75) \cap (\text{Alb}_\text{VNIR} > 0.3) \cap (\text{Alb}_\text{SWIR} > 0.4) \cap (\text{CofVar} < 0.15)\]
First Cut

- Green vectors show high rainfall zone > 600 mm pa
- Red circles show radius of 400 km (half day’s drive) from major airport
- Image is VNIR-SWIR temporal means
Converging On Central Desert Search Area

(VNIR Moran I Index > positive) ∩ (SWIR Moran I Index > positive) ∩ (Slope < 2%)
Dunes North Of Lake Eyre

ASTER DEM 90m Slope <2%  VNIR Clusters  SWIR Clusters
Sand Plains Between Lake Eyre North And Lake Eyre South

ASTER DEM 90m Slope <2%  VNIR Clusters  SWIR Clusters
Spectral And Temporal Characteristics

Albedo

VNIR temporal variation

SWIR temporal variation
Composition

ASTER silica

ASTER ferric oxide

ASTER AIOH

ASTER MgOH
**Logistics**

Access
- ~ 700 km N of Adelaide
- Nearest airport Olympic Dam, ~ 150 km away
- Nearest town Maree, ~ 100 km away
- Nearest accommodation Muloorina Station, ~50 km
- Sealed roads from Adelaide to Lyndhurst (~600km N), good unsealed road to Marree (~80km N), good unsealed road to Muloorina Station (~80km N), unsealed tracked to site (~ 50-80km E).

Communications
- Likely to be satellite phone only

Permissions
- Site is on BHPBilliton lease area, permissions required from BHPBilliton, protocol similar to Lake Lefroy

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**Centre of search area**

29°7'15.6"S; 137°27’11.7”E

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<table>
<thead>
<tr>
<th></th>
<th>January</th>
<th>February</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>October</th>
<th>November</th>
<th>December</th>
<th>Annual</th>
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<tbody>
<tr>
<td>Mean max temp (°C)</td>
<td>38</td>
<td>36.8</td>
<td>33.9</td>
<td>28.5</td>
<td>23.2</td>
<td>19.6</td>
<td>19.1</td>
<td>21.5</td>
<td>25.8</td>
<td>29.6</td>
<td>33.3</td>
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<td>Highest max temp (°C)</td>
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<td>46.1</td>
<td>40.1</td>
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<td>17.2</td>
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<td>Mean rainfall (mm)</td>
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<td>14.3</td>
<td>11</td>
<td>13.3</td>
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<td>9.9</td>
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<td>75.9</td>
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<td>39.3</td>
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<td>Mean number of cloudy days</td>
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<td>Mean 9am relative humidity (%)</td>
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Work Plan For The Near Future

- Field campaign for site characterisation, sample collection, field spectral measurements (VNIR-SWIR and TIR (TBD)) and possibly some limited BRDF measurements;
- Field trial of dual FOV spectral instrument in collaboration with NERC FSF, University of Edinburgh;
- Laboratory characterisation of samples (XRD, size fractions, etc.);
- Hyperspectral and high spatial resolution temporal characterisation of selected site where possible;
- BRDF characterisation (DSTO, UCL);

Instrumentation To Be Installed

- CIMEL (on Aeronet);
- Weather station linked to CIMEL;
- COSMIC Ray Probe (on national and international network);
- Automated acquisition of complete VNIR-SWIR spectral measurements feeding into systems which are spectral equivalent of aeronet or future radcalnet and/or receiving/processing hubs;
Thank you

Questions?

Contingency Plan