A look at Pleiades 1-B and SPOT data
Outline

- Data Overview
  - Pleiades 1-B
  - SPOT 6
- Geometric Assessment
  - Results
    - Pleiades 1-A
    - SPOT 6
- Qualitative radiometric and MTF assessments
- Summary
Pleiades 1-B overview

- **Data from Pleiades 1-B**
  - Sioux Falls – Ortho (Produced using SRTM DEM)
  - Pueblo – Ortho (Produced using 10m NED)

- **Four spectral bands**
  - Blue, Green, Red, Near Infrared

- **Ground sampling distance**: 0.5 m (PAN), 2 m (MSS)

- **Data for analysis in WGS UTM Zone 13N (Pueblo) and 14N (Sioux Falls)**

- **Reference data**: Orthoimagery, Ground Control Points
SPOT 6 Data overview

- Data from SPOT 6
  - Sioux Falls
  - Pueblo

- Four spectral bands
  - Blue, Green, Red, Near Infrared

- Ground sampling distance: 1.5 m (PAN), 6 m (MSS)

- Data for analysis in WGS UTM Zone 13N (Pueblo) and 14N (Sioux Falls)

- Reference data: Orthoimagery
Geometric Accuracy Assessment

- **Performed using the Landsat Image Assessment System (IAS)**
  - Developed for Radiometric and Geometric Characterization and Calibration for Landsat data.

- **Band to Band (B2B) assessment**
  - B2B is performed to test band alignment of the image data
  - It is typically done by registering each band against every other band

- **Image to Image (I2I) registration assessment tool**
  - I2I is usually performed to compare the relative accuracy between two images
  - Performed against an image of higher accuracy (reference data)
  - The results provide an insight to the relative accuracy of the search image with respect to the reference image
  - When the correlated points are plotted in the image, it also helps to detect any systematic bias in the image
A point $P$, where alignment is tested. Moving search template that determines cross correlation matching measure. Reference image: $P$'s estimated location in search image. Search image: $P$'s actual location in search band determined from Image matching. Error in Search image: Moving search template that determines cross correlation matching measure. A 3D surface is generated on the correlation values. The maxima of the surface is taken as the location of offset.
Pleiades 1-B Data Analysis
Pleiades 1-B Data Analysis

- Ground Control Points based analysis for 0.5 m PAN data
- I2I matching using Orthoimagery as control data for MSS data
- Coordinate System: WGS 84 UTM Zone 13N for Pueblo and Zone 14 N for Sioux Falls data
Pleiades 1-B Geometric results

Summary statistics for Pleiades 1-B GCP analysis for imagery: Sioux Falls

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sioux Falls</td>
<td>-2.10</td>
<td>-2.90</td>
</tr>
<tr>
<td>GCP analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAN Band</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>0.70</td>
<td>0.40</td>
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<tr>
<td>StDev</td>
<td>2.18</td>
<td>2.96</td>
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<tr>
<td>RMSE</td>
<td>3.67 m (7.3 pixels)</td>
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<tr>
<td>Total RMSE</td>
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</tbody>
</table>

Summary statistics for Pleiades 1-B GCP analysis for imagery: Pueblo

<table>
<thead>
<tr>
<th></th>
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<th>Y</th>
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<tbody>
<tr>
<td>Pueblo</td>
<td>1.96</td>
<td>1.10</td>
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<tr>
<td>GCP analysis</td>
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</tr>
<tr>
<td>PAN Band</td>
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</tr>
<tr>
<td>Mean</td>
<td>0.60</td>
<td>1.30</td>
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<tr>
<td>StDev</td>
<td>2.10</td>
<td>1.70</td>
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<tr>
<td>RMSE</td>
<td>2.7 (5.4 pixels)</td>
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<td>Total RMSE</td>
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Pleiades MSS data are well registered (0.3 pixels) with PAN data.
- So they have the same magnitude of errors.
MSS bands are registered to within 0.2 pixels of each other.
SPOT 6 Data Analysis
SPOT 6 Data Analysis

- I2I matching using Orthoimagery as control data for MSS and PAN data
- Coordinate System: WGS 84 UTM Zone 13N for Pueblo and Zone 14 N for Sioux Falls data
SPOT 6 Geometric results

Summary statistics for SPOT 6 PAN band analysis: Sioux Falls

<table>
<thead>
<tr>
<th>Sioux Falls I2I analysis PAN Band</th>
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<tr>
<td></td>
<td>Meters</td>
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<tr>
<td>Mean</td>
<td>-11.57</td>
<td>-1.97</td>
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<tr>
<td>StDev</td>
<td>0.65</td>
<td>0.65</td>
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<tr>
<td>RMSE</td>
<td>12.85</td>
<td>3.28</td>
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<td>Total RMSE</td>
<td>13.25 m (8.8 pixels)</td>
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Summary statistics for SPOT 6 PAN band analysis: Pueblo

<table>
<thead>
<tr>
<th>Pueblo I2I analysis PAN Band</th>
<th>X</th>
<th>Y</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Meters</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>-3.60</td>
<td>-0.95</td>
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<tr>
<td>StDev</td>
<td>0.31</td>
<td>0.38</td>
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<tr>
<td>RMSE</td>
<td>3.61</td>
<td>1.02</td>
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<tr>
<td>Total RMSE</td>
<td>3.75 (2.54 pixels)</td>
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SPOT MSS data are well registered with PAN data
- So they have the same magnitude of errors
MSS bands are registered to within 0.39 pixels of each other
• Image data for Quality Checking
• Quality
  ✓ #17, Ringing
  ✓ #12/#13, Compression noise (artifacts)
Ringing may be after MTFC in PAN.
Ringing may be after MTFC in PAN SPOT6 has it. PHR-1B has a little.
Ringing (SPOT6, PAN)

- There is Ringing after MTFC
Ringing (PHR1B, PAN)
Compression noise (artifacts) - PAN
Compression noise (artifacts) - MS
Compression noise (artifacts)

- The compression noise may have a side effect on the image data;
  - (Smoothing) a shape of water seething
  - (Changing) A small object (1~3 pixels) with low DN value on the image data may be determined to a noise,
    - and then smoothed
  - (Changing) There is possibility that the edge (boundary) may be changed(smoothed); shape & location.
- More Research required
Summary

- **Pleiades 1-B and SPOT 6 Characterizations performed**
  - Following on from Pleiades 1-A in 2013

- **Future Analysis:**
  - Continued data assessments for Medium resolution datasets..
  - Elevation data characterizations
    - Working on Pleiades Stereo pair data
    - Working on World DEM- More about that later in JACIE 2014
  - More data are welcome
  - More collaborations welcome