Global Forest Change
Published by Hansen, Potapov, Moore, Hancher et al.

http://earthenginepartners.appspot.com/science-2013-global-forest

Rapideye

Not just another high resolution satellite sensor ...

5 satellites – RapidEye constellation

5 million km² – daily collection capacity

Global revisit: 1 day
(off-nadir, nadir = 5.5 days)

Price: $1.40 / sq km  ($2.50 rectified)

http://www.youtube.com/watch?feature=player_embedded&v=ovPULctoQGs
5 spectral bands - multispectral imagery - includes the ‘Red Edge’ (RE)

<table>
<thead>
<tr>
<th></th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue</td>
<td>440 – 510 nm</td>
</tr>
<tr>
<td>Green</td>
<td>520 – 590 nm</td>
</tr>
<tr>
<td>Red</td>
<td>630 – 685 nm</td>
</tr>
<tr>
<td>Red Edge</td>
<td>690 – 730 nm</td>
</tr>
<tr>
<td>Near-Infrared</td>
<td>760 – 850 nm</td>
</tr>
</tbody>
</table>

Table 1: RapidEye’s Spectral Bands

- Designed/launched 2008 by Rapideye AG Munich/Berlin, Germany
- Implemented by MacDonald Dettwiler (MDA) Richmond, BC
- Satellites built by Surrey Satellite Technology Ltd (UK)
  World leader in building small satellites (ex-U. Surrey) - 1 cubic metre (150kg)
- Data downloaded to receiving stations, Svalbard, Norway
- Rapideye AG acquired 2011 by Iunctus -> Blackbridge, LA
  (Lethbridge, AB)
Sept 5 2011: Iunctus Geomatics Corp. of Lethbridge, Alberta, whose current business includes being Canada’s exclusive distributor of French Spot optical satellite data, purchased Brandenburg, Germany-based RapidEye for ~13 million euros ($19 million) – includes 5 satellites [http://www.rapideye.de/gallery/index.htm](http://www.rapideye.de/gallery/index.htm)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orbit Altitude</td>
<td>630 km in Sun-synchronous orbit</td>
</tr>
<tr>
<td>Equator Crossing Time</td>
<td>11:00 am (approximately)</td>
</tr>
<tr>
<td>Sensor Type</td>
<td>Multi-spectral push broom imager</td>
</tr>
<tr>
<td>Camera Dynamic Range</td>
<td>12 bit</td>
</tr>
<tr>
<td>Ground sampling distance (nadir):</td>
<td>6.5 m</td>
</tr>
<tr>
<td>Pixel size (orthorectified):</td>
<td>5 m</td>
</tr>
<tr>
<td>Swath Width:</td>
<td>77 km</td>
</tr>
</tbody>
</table>
RapidEye 1-5 (Germany)

- Resolution: 5 m
- Bands:
  - Blue (440-510 nm)
  - Green (520-590 nm)
  - Red (630-685 nm)
  - Red Edge (690-730 nm)
  - Near IR (760-850 nm)
- Altitude: 630 km
- Push Broom
- Revisit time:
  - Off-nadir – 1 day
  - Nadir – 5.5 days
- Swath width of 77 km
- Launched August 29, 2008
- Images at 11:00am local

- 5 identical satellites:
  - Tachys (rapid),
  - Mati (eye),
  - Choma (earth),
  - Choros (space),
  - Trochia (orbit)

- First commercial satellites to image the Red-edge band (measures variances in vegetation)

- Products:
  - Two types:
    - Level 1A – radiometric and sensor correction
    - Level 3A – radiometric, sensor, and geometric correction
The red portion is where chlorophyll strongly absorbs light and the NIR is where the leaf cell structure produces a strong reflection (green line in Fig. 1). Variations in both the chlorophyll content and the leaf structure are often reflected in the Red Edge band.

Studies have suggested that this band is able to provide additional information to identify plant types, nutrition and health status, and characterize plant cover and abundance, among other features.
Agriculture and Vegetation: red edge provides extra contrast.

Figure 2: Example for a Relative Chlorophyll Map

Red and NIR alone show slim difference between grassland and crops.

Figure 3: (a, b, c) Scatterplots of different combinations of two RapidEye bands including the representation of selected land cover classes. a:
Increased separation of vegetation types, e.g. grassland versus crops

Special Applications


Available Off-The-Shelf Mosaics

Price: $1.40 / sq km
Rapideye data at UNBC

- Prince George (unrectified) - next week’s lab
- Mt. Revelstoke National Park
- Mt. Robson Provincial Park (Berg Lake)
- Andrei Icefield, Coast Mountains
- Lyngen, Norway (70 degrees north)
Rapideye – Mt. Revelstoke Nat. Park

Andrei Icefield
TM 2010
Rapideye Data possibilities

Potential to fuse Landsat 8 with Rapideye

- Multispectral OLI - including Mid-IR)
- Higher-res. Rapideye - including Red Edge / NIR
- Use of Principal Components Analysis to merge multiple datasets

Low examination to date using:

- The Red Edge and
- 5-satellite / low cost coverage