RapidEye™

geo facts
turned into knowledge

RapidEye – Multi-Temporal Imagery A Key Resource In Agricultural Monitoring

MARS-Conference-2008
Session T1 / Ljubljana / 2008-12-03

Overview

- History and achievements to date
- RapidEye satellite system, imaging concepts and calibration
- RapidEye data products and ortho-rectification
- RapidEye service partnership
- Imagery

Who are We?

- RapidEye is a geo-spatial service and data provider
- Incorporated 1998, grown into a team of 100 experts from more than 20 countries
- Located close to Berlin, Germany

Who are We?

- **August 29, 2008**
  Launch
- Baikonur, Kazakhstan

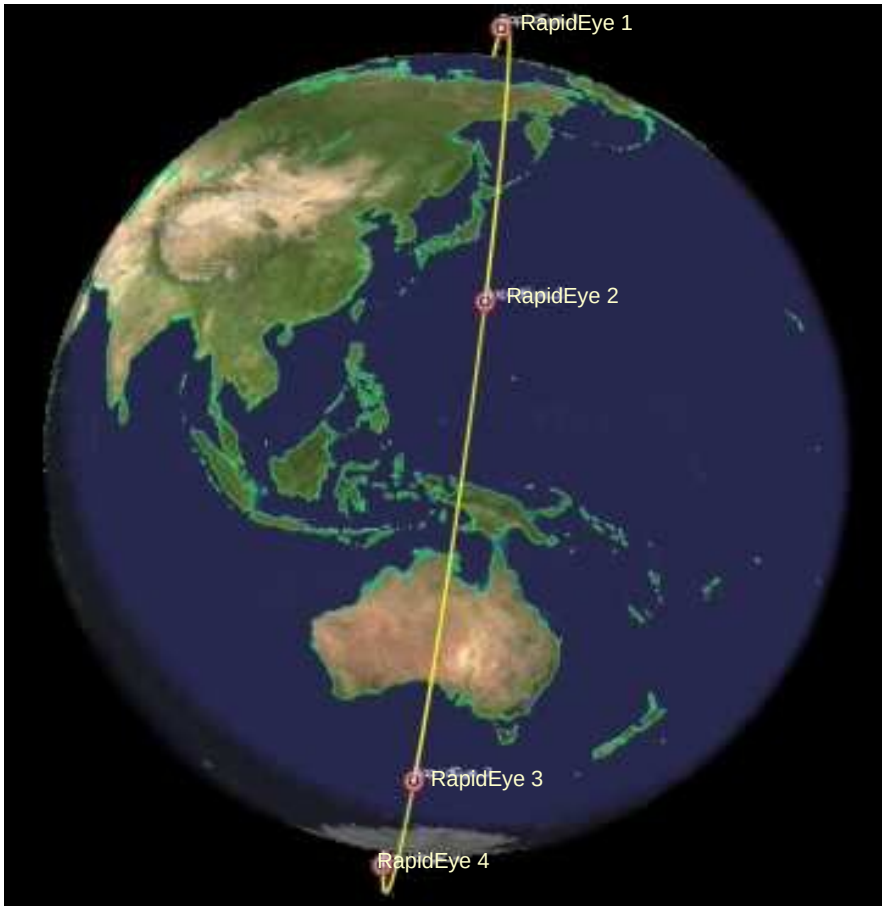
Who are We?

- Release of satellite #1 and #2

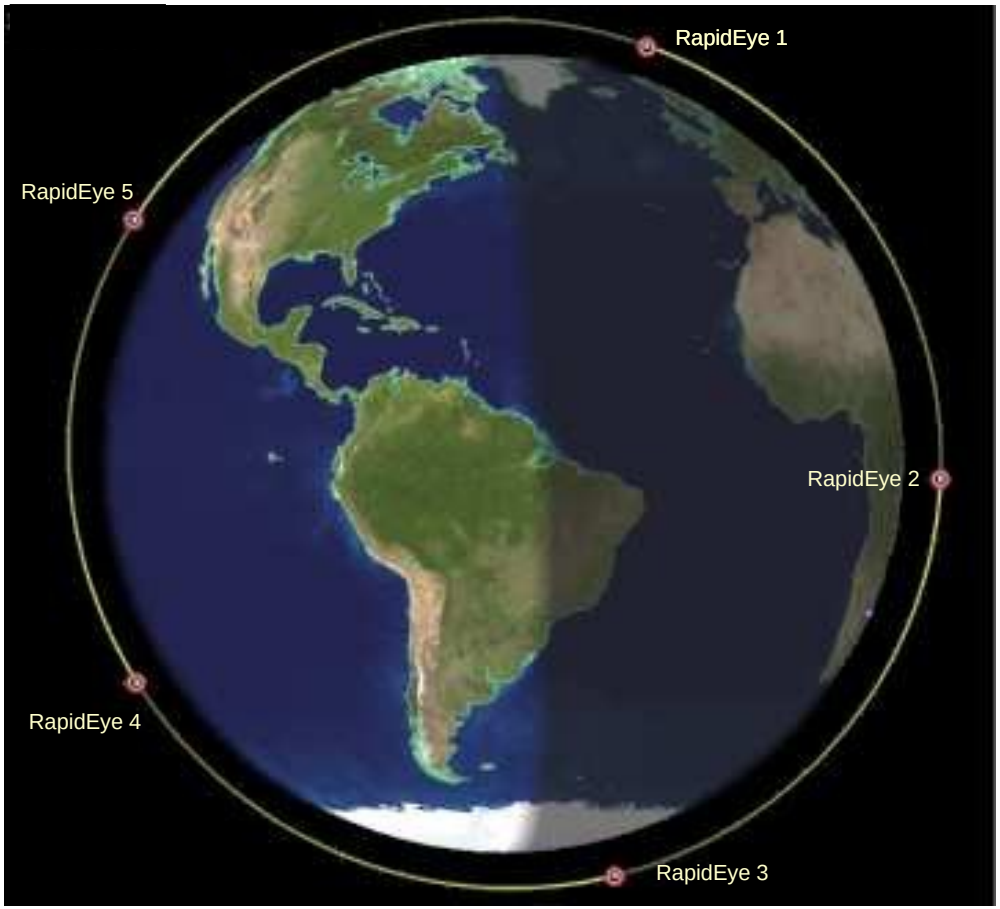
Who are We?

- Release of satellites #3, #4, #5
- Launch successful, excellent injection into orbit

Our Own Satellite System
Orbit Characteristics

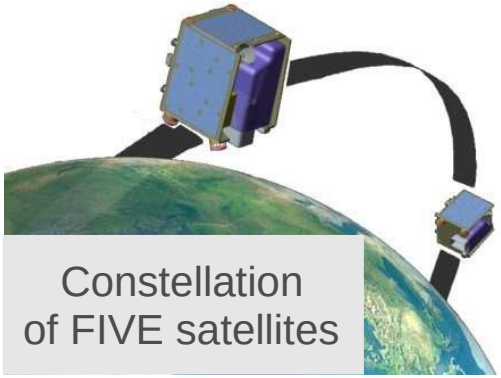


sun – synchronous orbit



equally spaced in one orbital plane

Our Own Satellite System

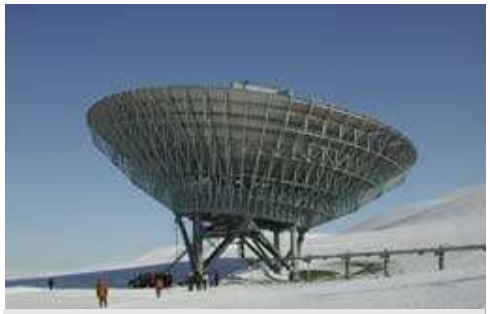


Constellation
of FIVE satellites

3

4

S-band antenna



X-band antenna

data download: Svalbard, Norway

Customer
Products
or Services

Request

1

6

Delivery

2

5

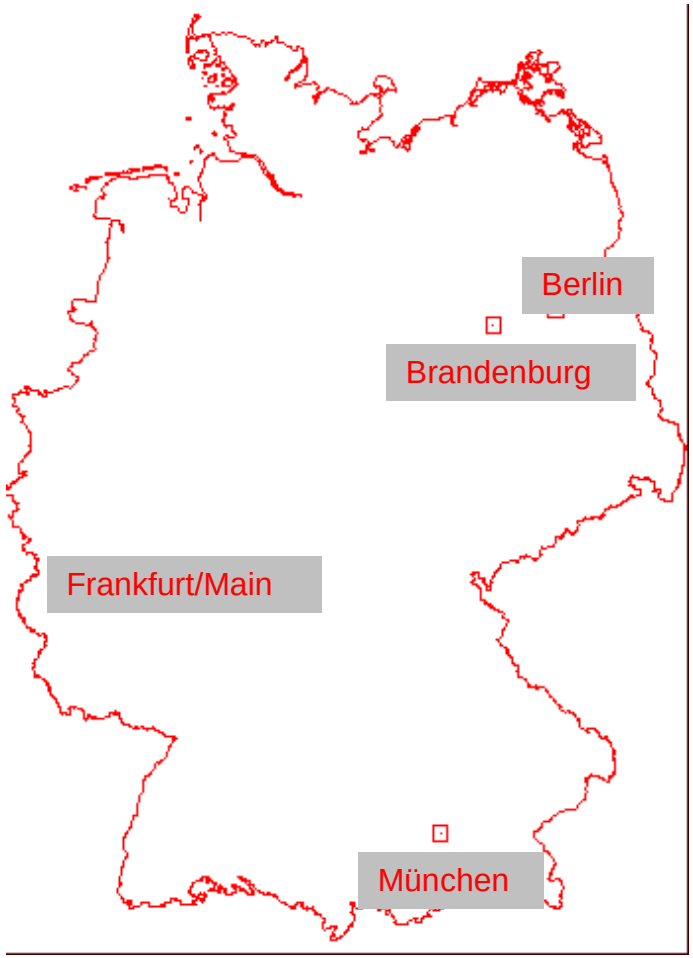
RapidEye Headquarters -
Brandenburg, Germany

production (data processing),
archive & control of satellites

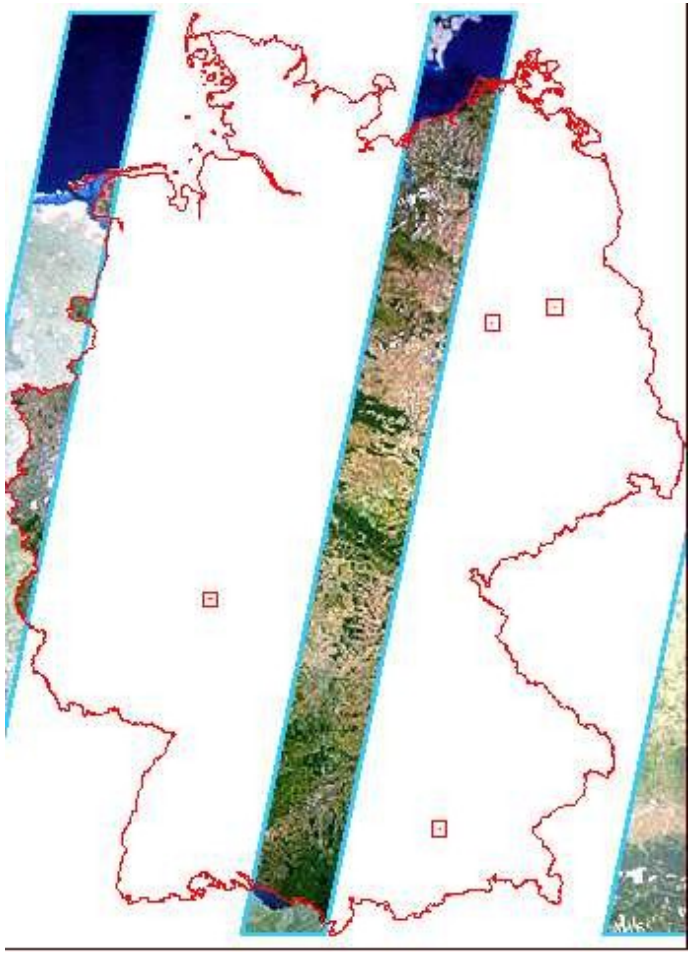
RapidEye proprietary information

DIN EN ISO 9001 certified

Coverage example Germany (nadir)

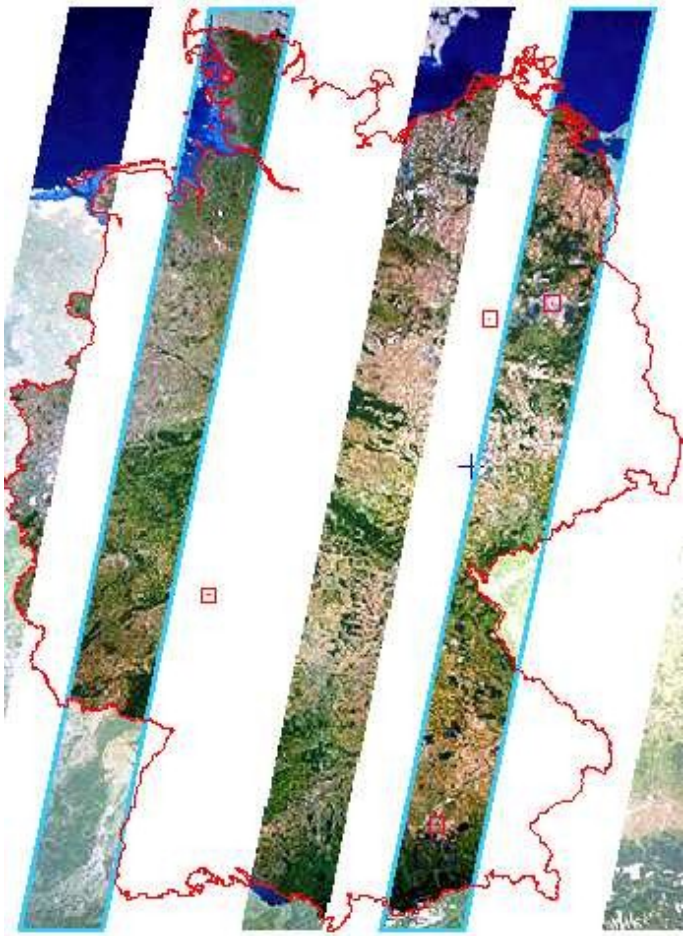


Coverage example Germany (nadir)



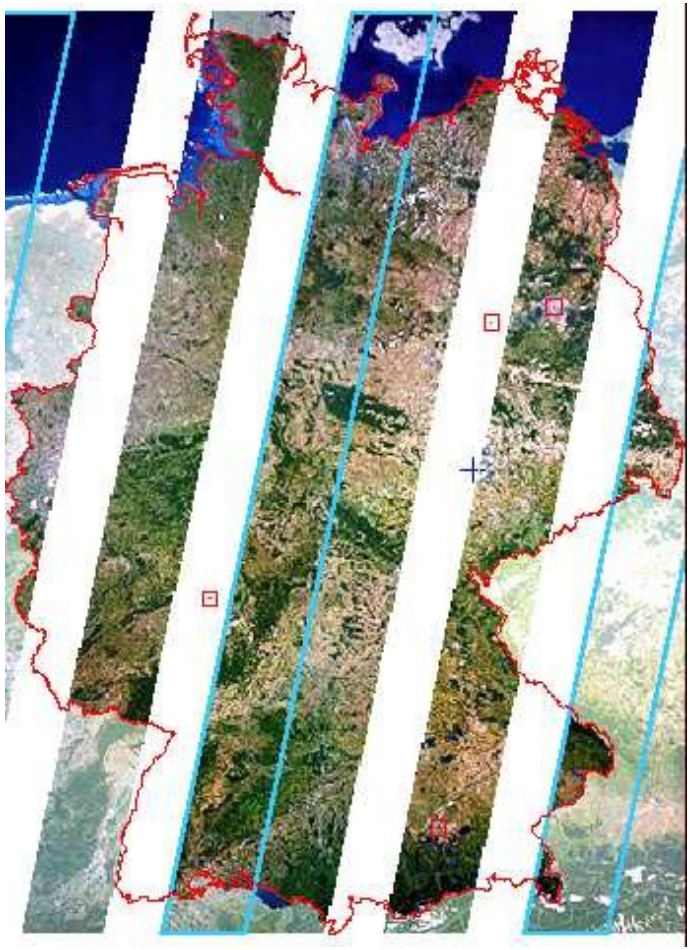
Day1

Coverage example Germany (nadir)



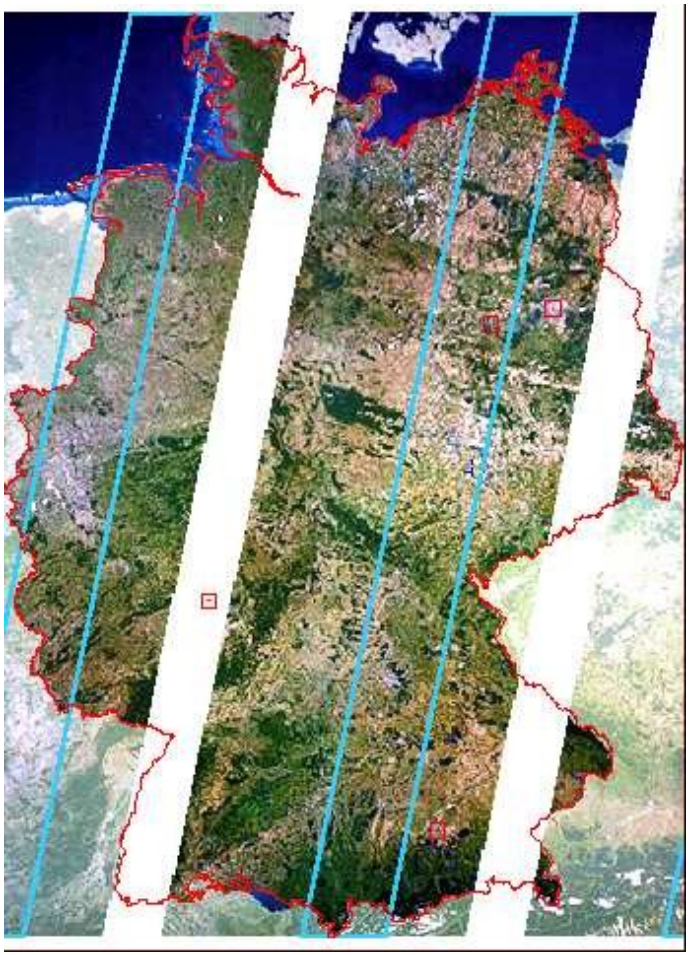
Day2

Coverage example Germany (nadir)



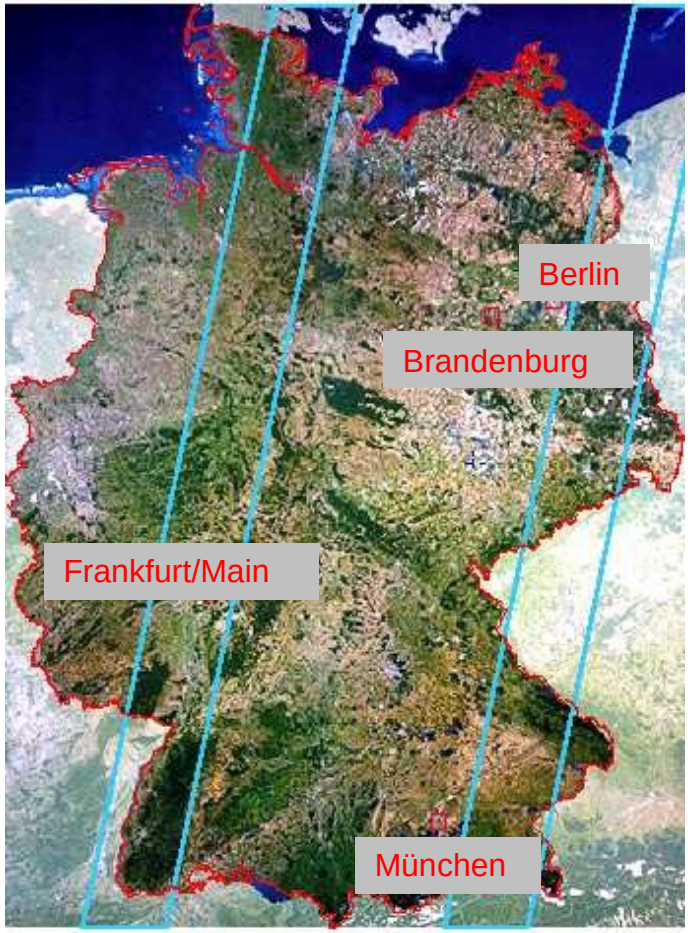
Day3

Coverage example Germany (nadir)



Day4

Coverage example Germany (nadir)

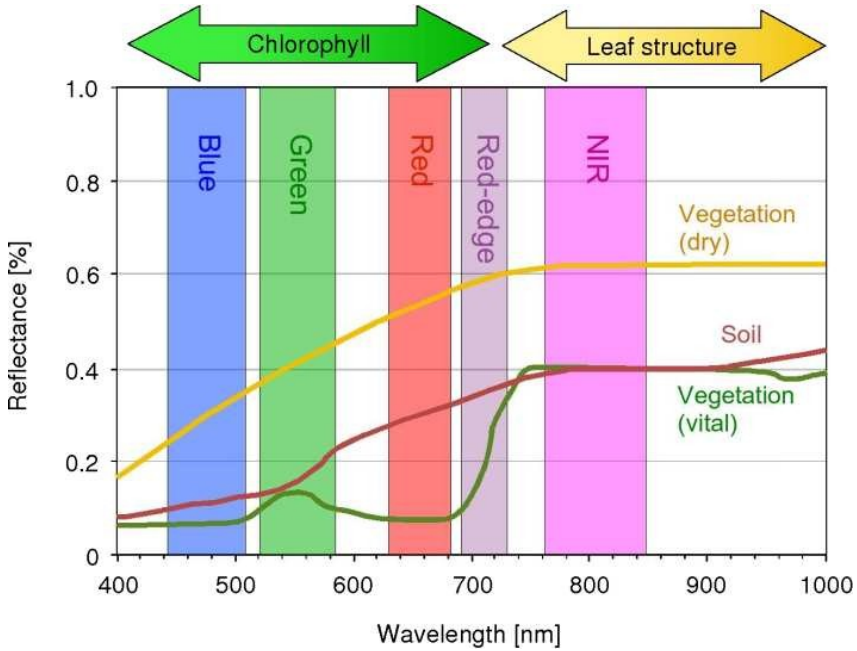


Day5

RapidEye Camera Characteristics

Five spectral bands

- Blue
- Green
- Red
- Near Infrared
- Red-Edge



- RapidEye is the first commercial system offering the Red-Edge band.
- The combination of these five spectral bands is ideally suited to monitor vegetation conditions and to detect growth anomalies.

The Calibration and Validation Concept

- Calibration establishes a physical relationship between the signal from the ground and the digital output of the satellite sensor.
  - Geometrical component
  - Radiometrical component
- Validation assesses the long term stability of
  - Geometric accuracy
  - Radiometric accuracy

Operational Calibration and Validation

- Is based on:
  - Repeated vicarious calibration campaigns
  - Statistical sampling of all image data in order to detect anomalies quickly
- Is performed by:
  - The RapidEye operations team as part of their regular routines
  - The RapidEye calibration engineers who work with scientific partners to ensure long term stability of entire system

RE Data Products

- Raw data
- Level 0
- Level 1B RE-BASIC
- Level 3A RE-ORTHO

Ortho-rectified Image Products

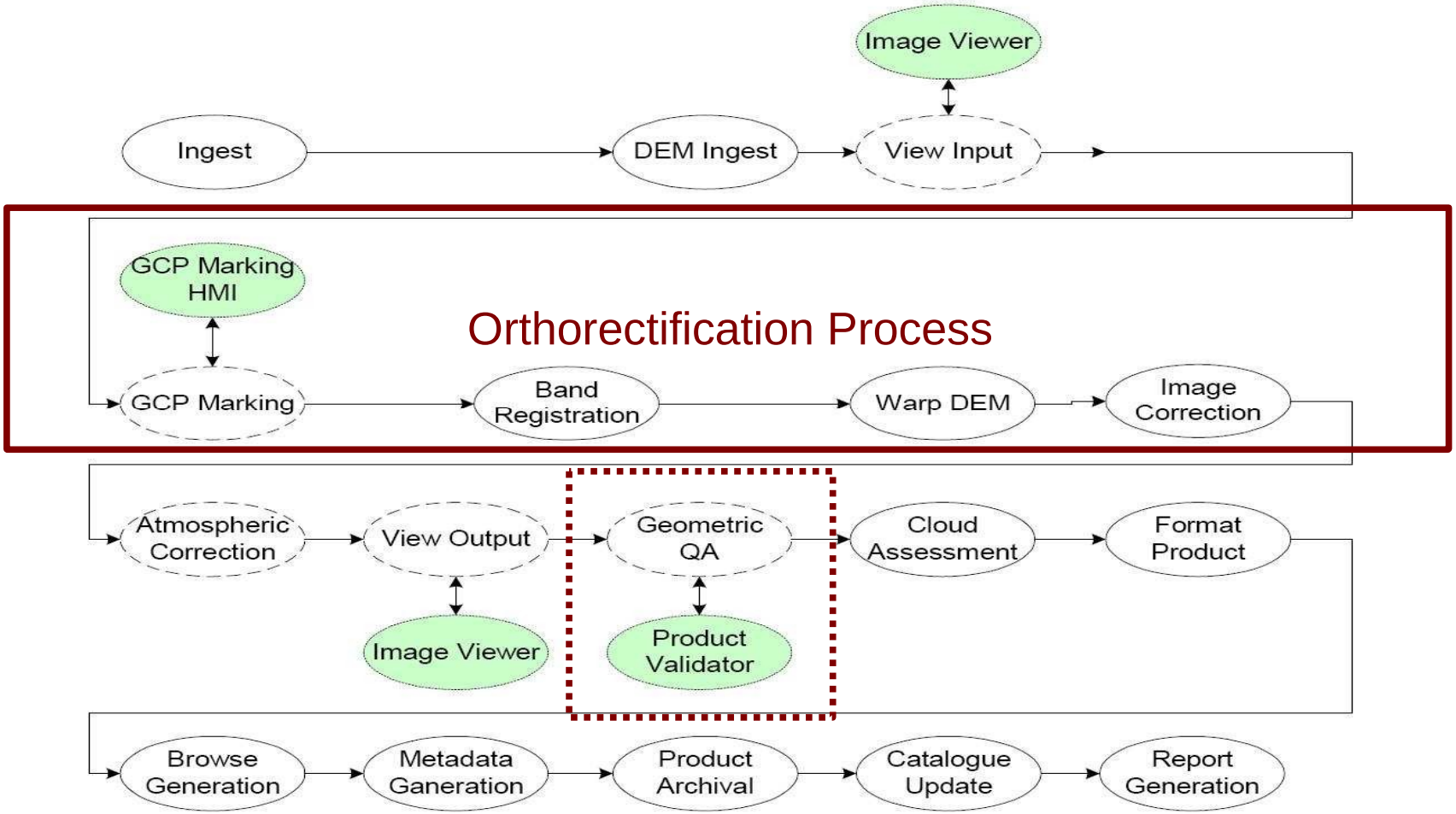
- The most geo-locationally accurate RapidEye product
- Ortho-rectified image products are corrected for sensor related effects, band co-registered and are map projected
- Ortho-rectified image products are tile-based, size is 25 x 25 km²
- Atmospheric correction optional
- Location accuracy 6m RMSE

Product Attribute	Description
Product Components and Format	RE Ortho image product consists of the following file components: •Image File – GeoTiff file that contains image data and geolocation information •Metadata File – XML format metadata file •Browse Image File – JPG format •Unusable Data Mask (UDM) file – GeoTIFF format
Product Orientation	Map North up
Product Framing	Image Tile (image tiles are based on a worldwide, 24km by 24km fixed grid system (see Appendix B for full tile grid definition). To each 24km by 24km grid square, a 500m overlap is added to produce a 25km by 25km image tile. Image tiles that are only partially covered by an image take will be black-filled in areas with no data).
Pixel spacing	5m
Bit Depth	For radiometrically corrected products, 16-bit unsigned integers. For atmospherically corrected products, 16-bit signed integers.
Product Size	Tile size is 25km (5000 lines) by 25km (5000 columns). 250 Mbytes per Tile for 5 bands at 5m pixel spacing.
Geometric Corrections	• Sensor-related effects are corrected using sensor telemetry and a sensor model, bands are co-registered, and spacecraft-related effects are corrected using attitude telemetry and best available ephemeris data. • Ortho-rectified using GCPs and fine DEMs (30m to 90m posting)
Horizontal Datum	WGS84
Map Projection	Universal Transverse Mercator (UTM)
Resampling Kernel	Cubic Convolution (default), MTF, or Nearest Neighbor

Ortho-Image Product Generation

- The ortho-rectification process is performed within the RapidEye Ground Segment (GS) – Data Processing Subsegment (DPS)
- The ortho-rectification process is based on GCPs stored within a RapidEye Global GCP database inside the GS, and on DEMs also stored inside the GS
- All ortho-images generated are cataloged and archived by the Archive Management system (AMS)
- GCP Marking is a fully automated process performed already during the initial raw image cataloging, it automatically request operator interaction in case the pre-calculated accuracy will be not sufficient for the product requirements

Ortho-Image Product Generation - Workflow



Output Quality and Accuracy

- There are several checks within the automated processing chain to ensure quality and accuracy.

- In addition to these checks, RapidEye will screen all products coming out of the system to ensure the highest quality of product is achieved.

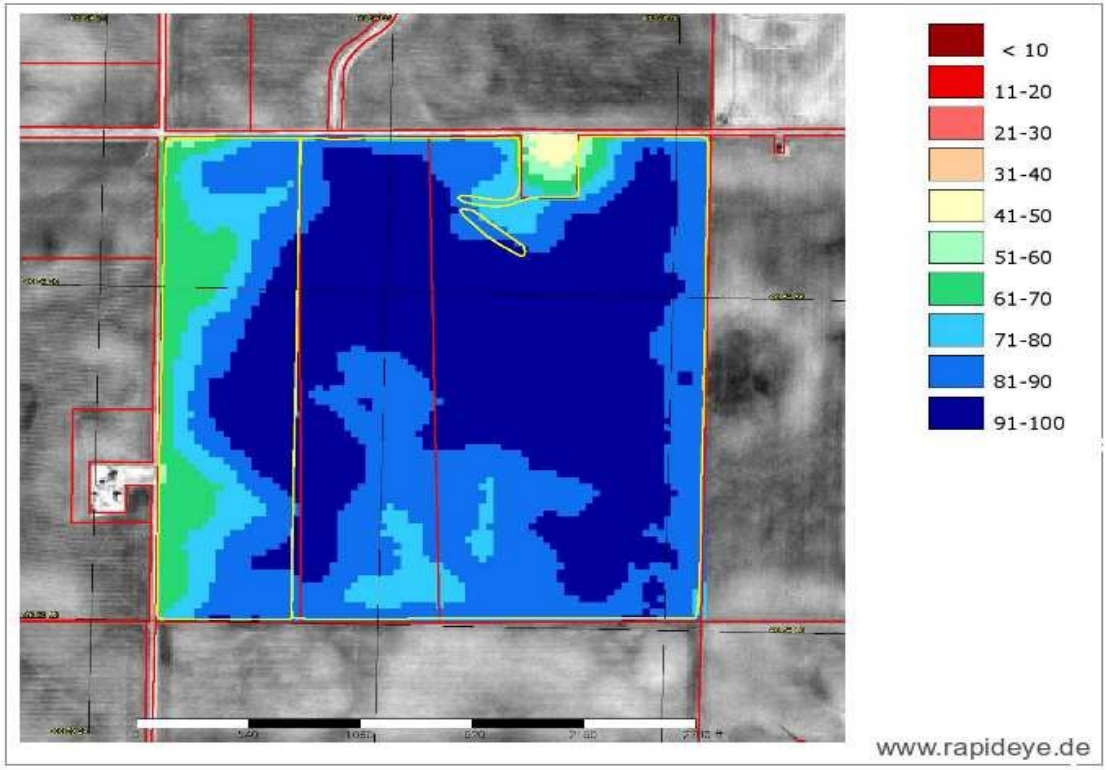
- More information on the RE Ortho product at: www.rapideye.de/home/products

RapidEye Service Partnerships with the Value Adding Industry

- RapidEye provides Business-to-Business solutions globally
- RapidEye customizes core solutions for our business partners
- RapidEye solutions are attractively priced
- RapidEye delivers reliably and fast

Ground Cover Map

RapidEye Field View: **Ground Cover**



Date: 07/27/2008
Farmer: Smith, W.
Field: Ray's

Ground Cover

The map on the left shows ground cover, i.e., the fraction of soil that is covered by green leaves when seen from above. Ground cover expresses the green leaf area on a scale from 0 to 100 %.

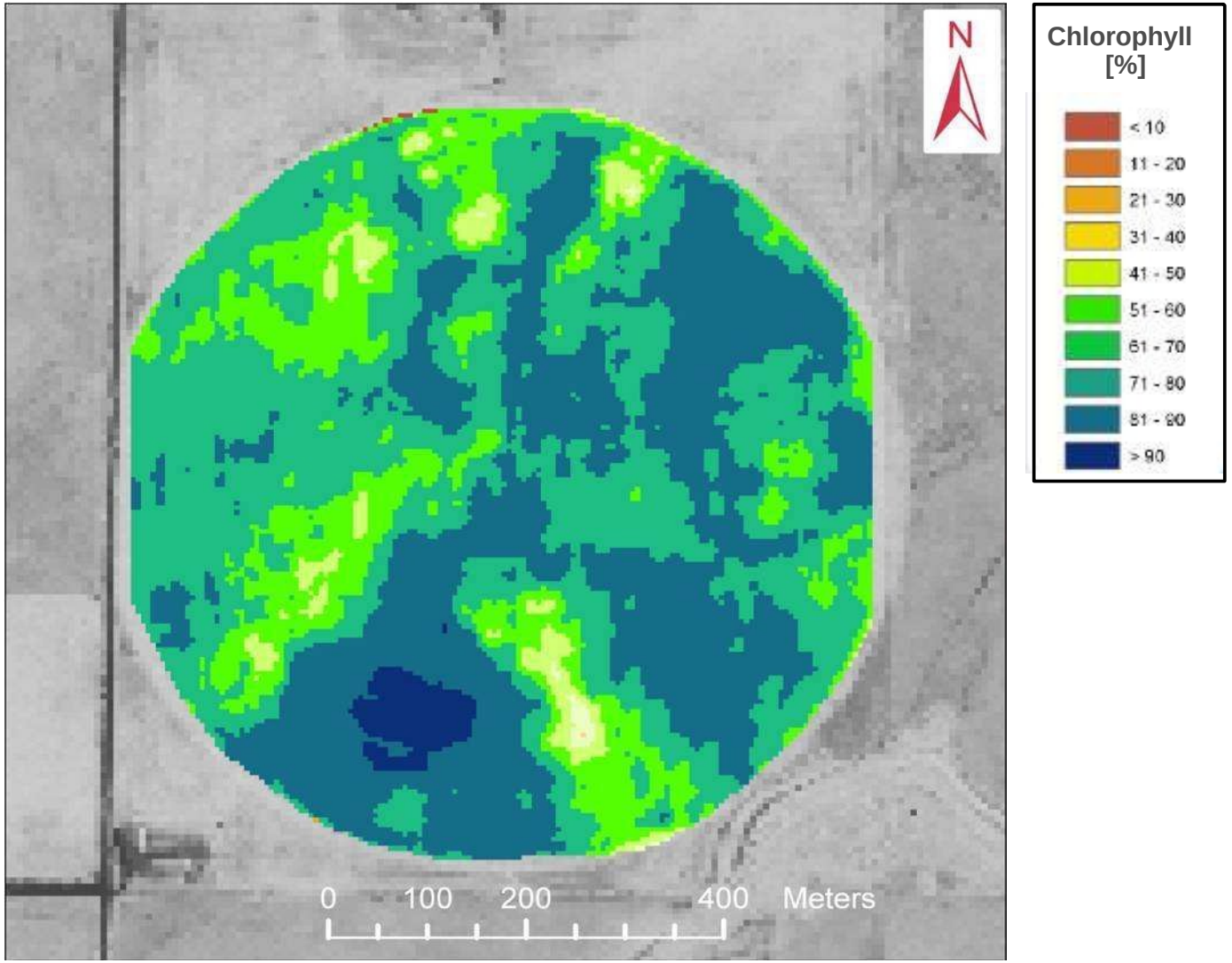
Areas with high ground cover intercept more light for photo-synthesis and therefore, tend to have high biomass and yield.

The areas with the highest ground cover and productivity are shown in blue, while the poorer areas are shown in brown.

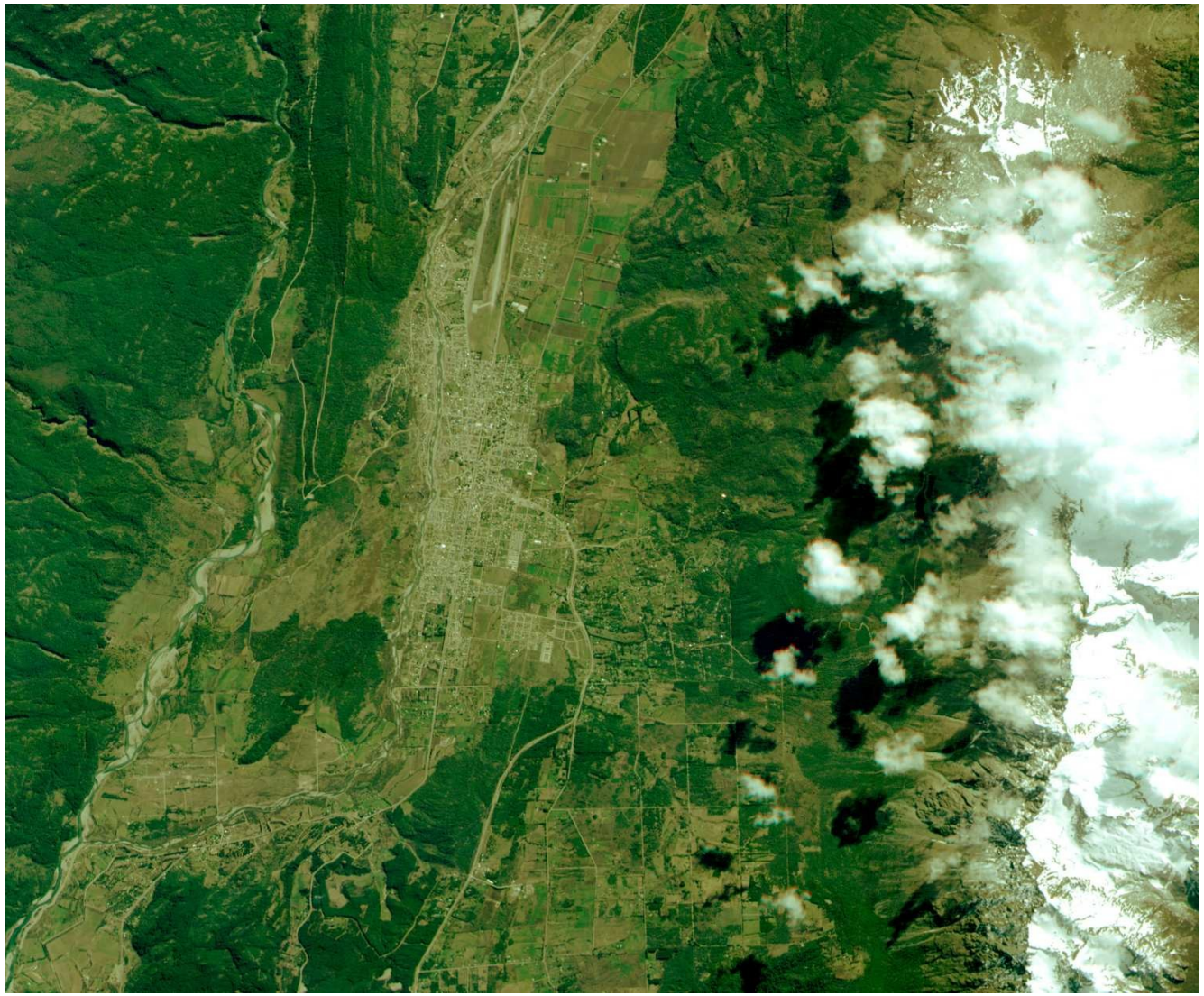
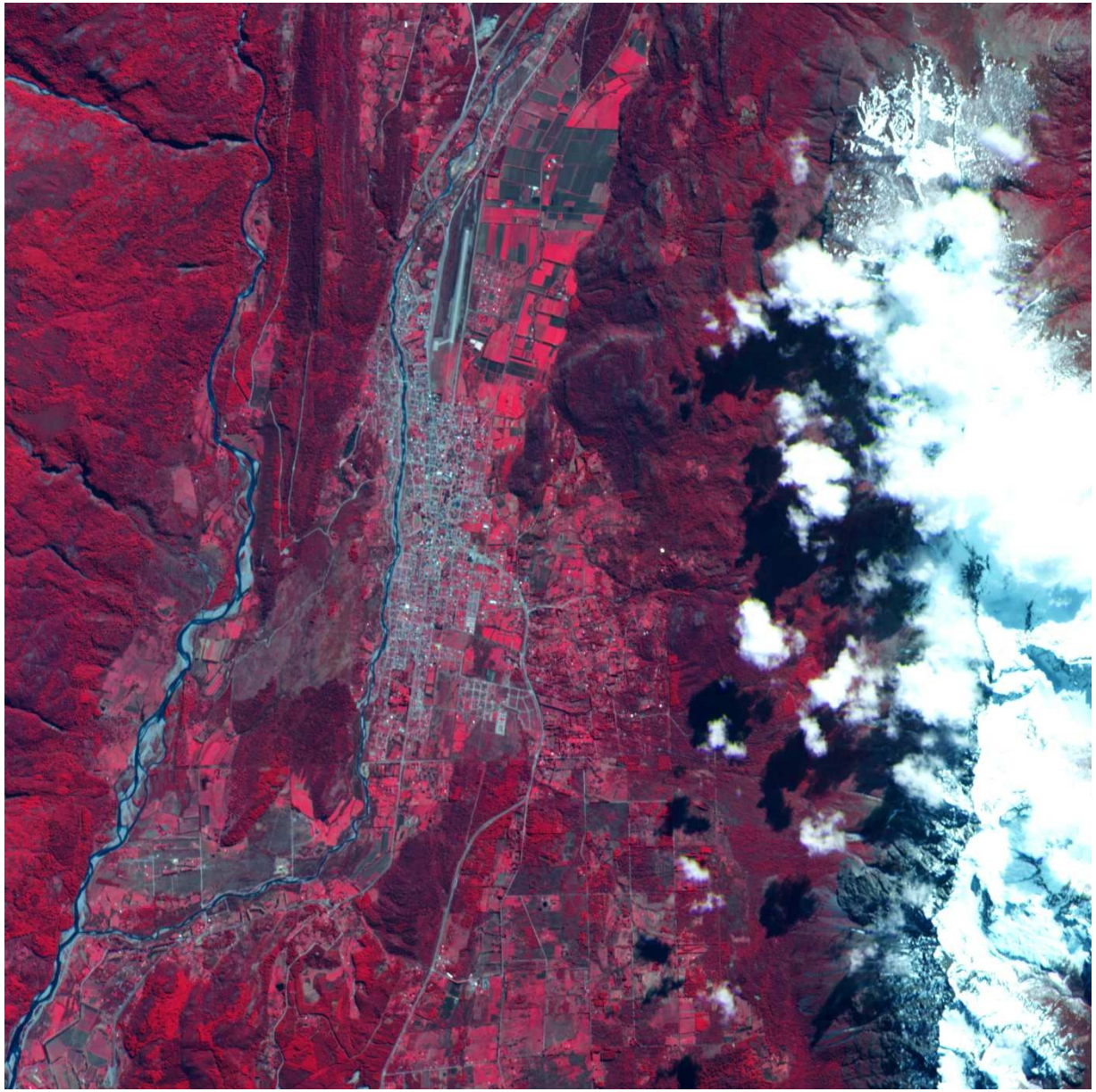
It is suggested to scout both the good and bad areas. High ground cover generally indicates good growing conditions. However, weeds can also increase ground cover. The bad areas are often due to poor plant stand, nutrient and water deficiencies, or pests.

Service Provider:
PremierCropAdvisors
Phone: (800) 000-000x

Chlorophyll Map (Field View)



Summary

- RapidEye is open for business now
- We operate on a global basis
- The five satellites, the processing system are now in final calibration phase
- We are working with customers to define their specific solutions now

The First RapidEye Image El Bolson Argentina