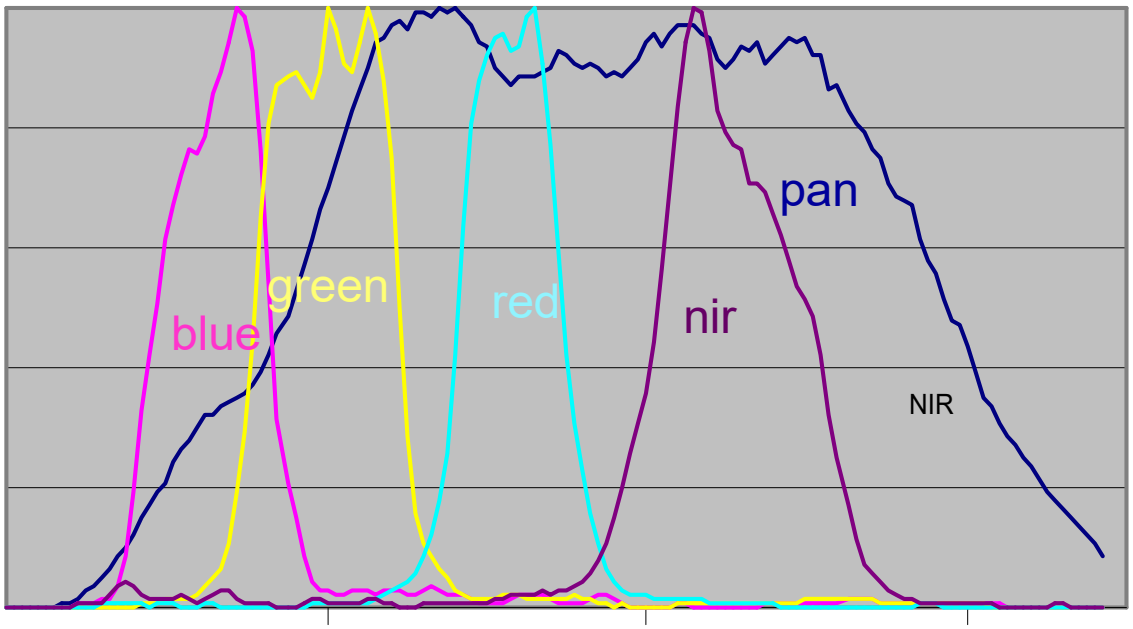
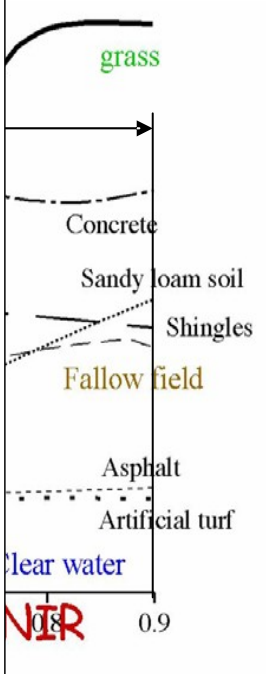
What can we check with VHR Pan and HR multispectral imagery?

Rationale

- VHR prime sensors (IK and QB) close to acquisition limits
- New VHR (PAN only) sensors with GSD < 1m (EROS B, WV-1)
- Could these new VHR PAN be used for CwRS as VHR prime sensors?
  - Limitation due to lack of multispectral (MS) component
  - Possible compensation with additional HR (B,G,R,NIR)
  - Is pansharpening feasible?



ites



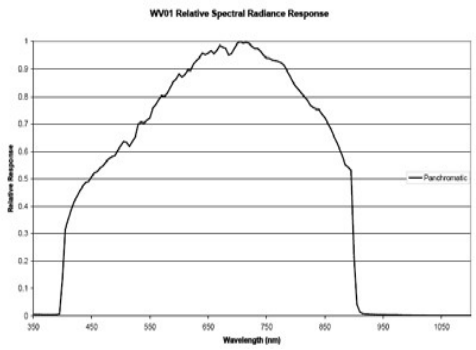
l discrete

nce data.

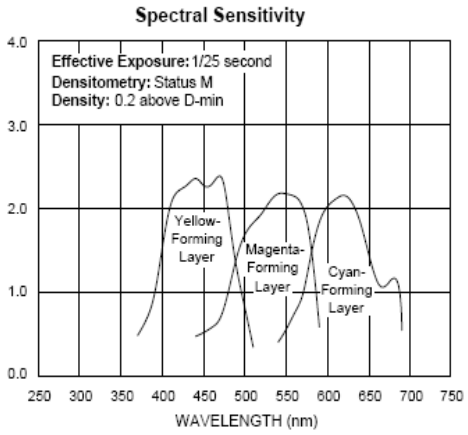
Panchromatic images are collected with higher spatial resolution than the multispectral image, due to the broad spectral range (more light energy)

VHR PAN vs. Aerial

Different spectral range

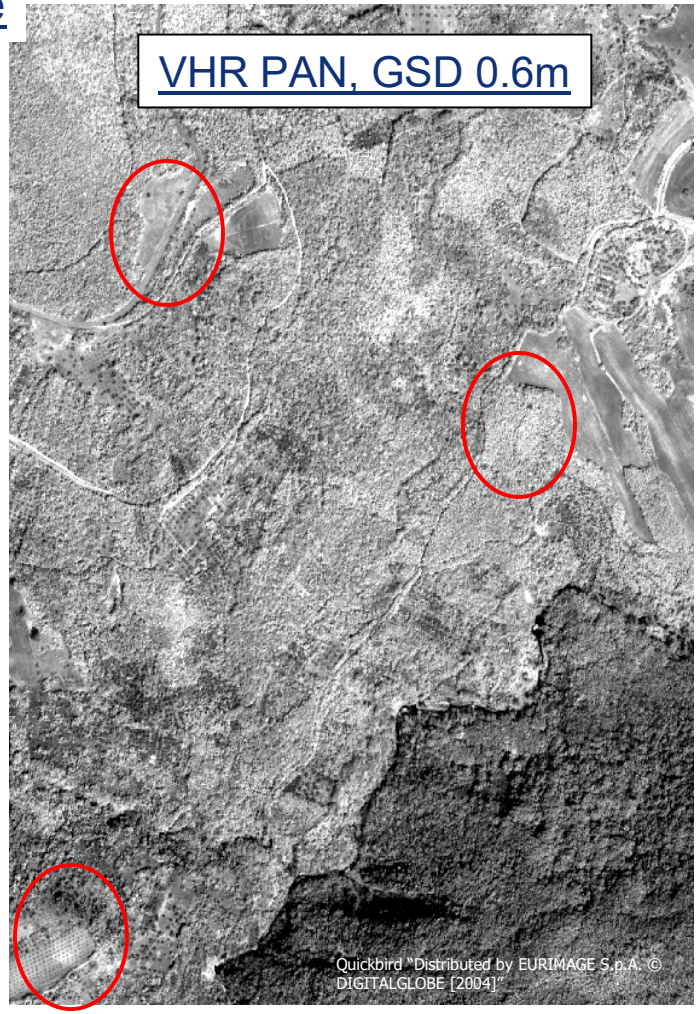


WV1 Relative spectral Radiance Response



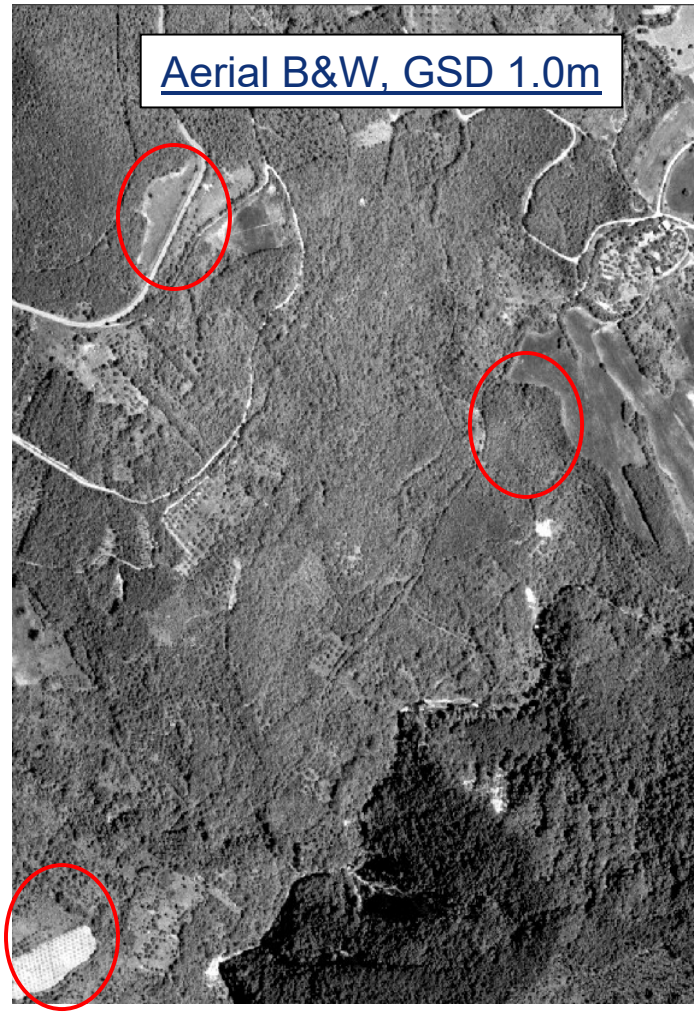
KODAK AEROCOLOR III Negative Film 2444

VHR PAN, GSD 0.6m



Quickbird "Distributed by EURIMAGE S.p.A. © DIGITALGLOBE [2004]"

Aerial B&W, GSD 1.0m



Spatial and Spectral Resolution

QB PAN 0.6 m GSD

QB XS 2.4 m GSD

Image Resolution and Information Content

VHR PAN (Ranking IR-2.5)

Indicative digital GSD: 0.6 - 1.0
&
Indicative scanned aerial GSD:
1:30,000 photoscale scanned at 21µm /
1:25,000 photoscale scanned at 28µm

Minimum resolved features descriptor	*Example identifiable and measurable features*
High contrast area features with dimensions 3 - 5 m	Outdoors sheds, Helipad marking
Low contrast area features with dimensions 3 - 6 m	Cross-overs/Driveways, Car ports
High contrast linear features of 1 m width	Median/lane divider strips, Obstruction marking
Low contrast linear features of 1 - 1.5 m width	Bicycle tracks, Cricket pitch

VHR MS (Ranking IR-5)

Indicative digital GSD: 2.5 - 5.0 m
&
Indicative scanned aerial GSD:
1:80,000 photoscale scanned at 30µm /
1:50,000 photoscale scanned at 30µm

Minimum resolved features descriptor	*Example identifiable and measurable features*
High contrast area features with dimensions 10 -20 m	Industrial building complexes, Water tanks, Dams
Low contrast area features with dimensions 10 - 30 m	Tree clusters
High contrast linear features of 8 - 20 m width	Major road network, Bridges
Low contrast linear features of 10 - 30 m width	Field boundaries, Secondary hydrology network

Rating proposed by the CRC.SI, Universiry of Melbourne in 2006

Image Resolution and Information Content

VHR PAN

Good spatial resolution

High detail, more objects are resolved

Texture more visible

Smoothness of objects preserved

Poor spectral resolution

Spectral variations are difficult to detect

Low sensitivity to change of reflection

Compactness of objects is less evident

VHR MS

Poor spatial resolution

Low detail, less objects are resolved

Texture less visible

Smoothness of objects decreased

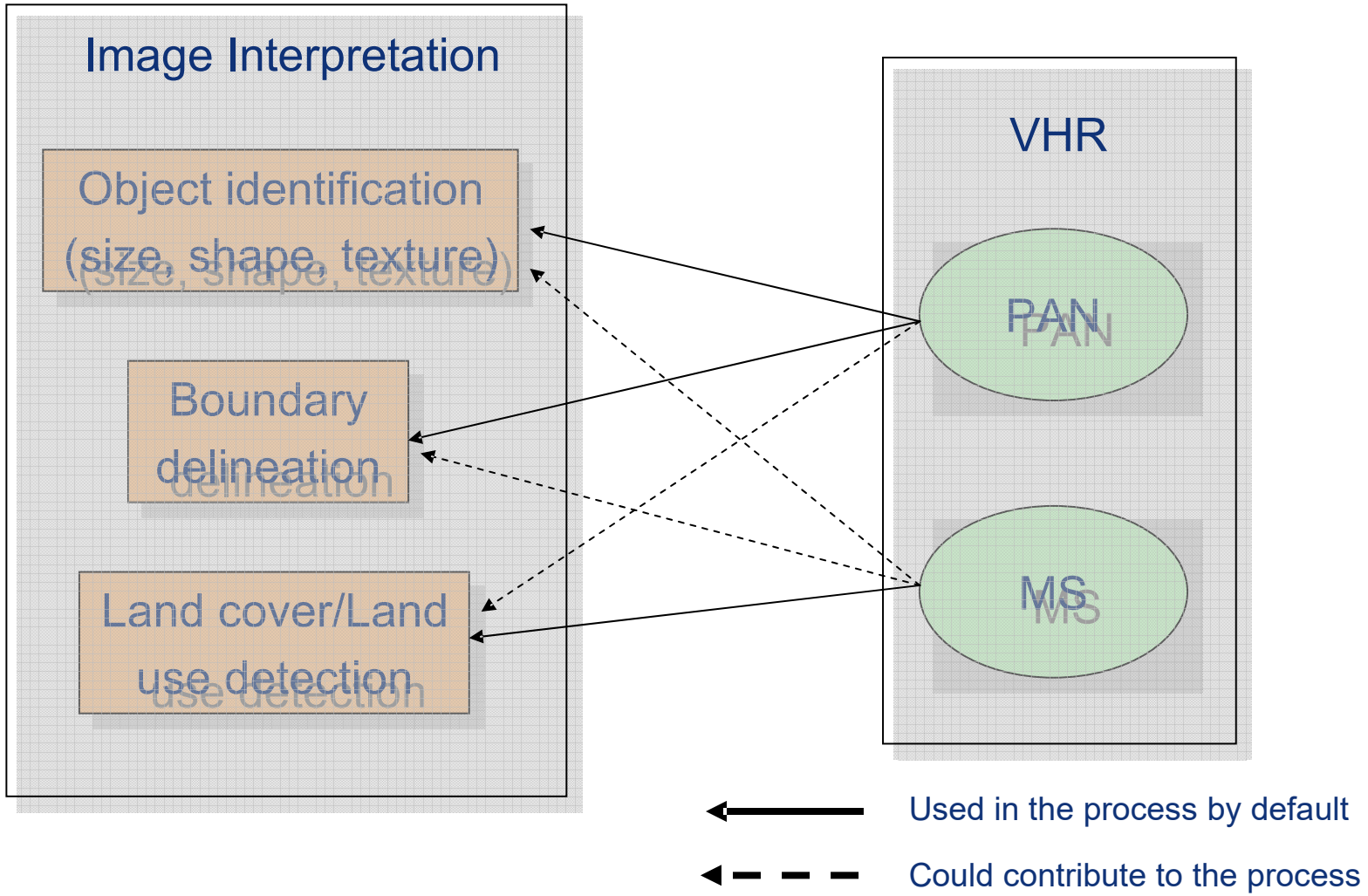
Good spectral resolution

Spectral variations are easy to detect

High sensitivity to change of reflection

Compactness of objects is better presented

PAN + MS in the context of CwRS



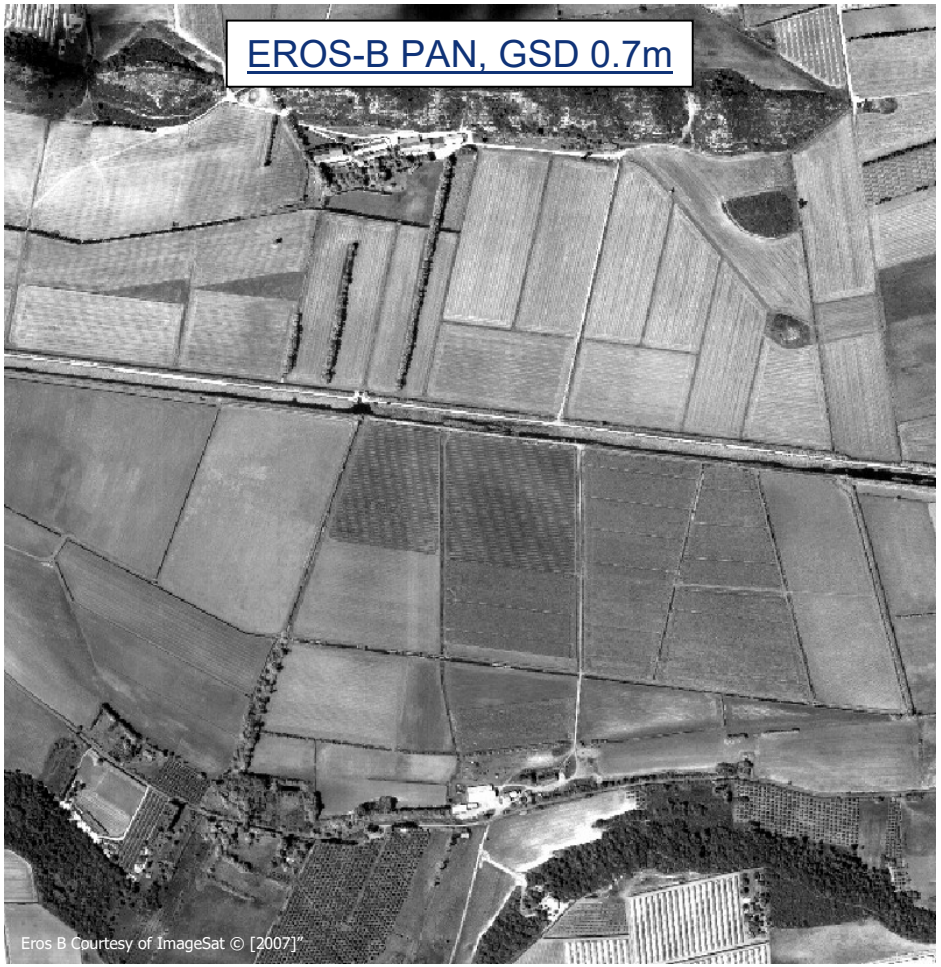
Examples – WV-1 over Mausanne (FR)

Note: Images acquired in different years and seasons!

Examples – EROS B over Mausanne (FR)

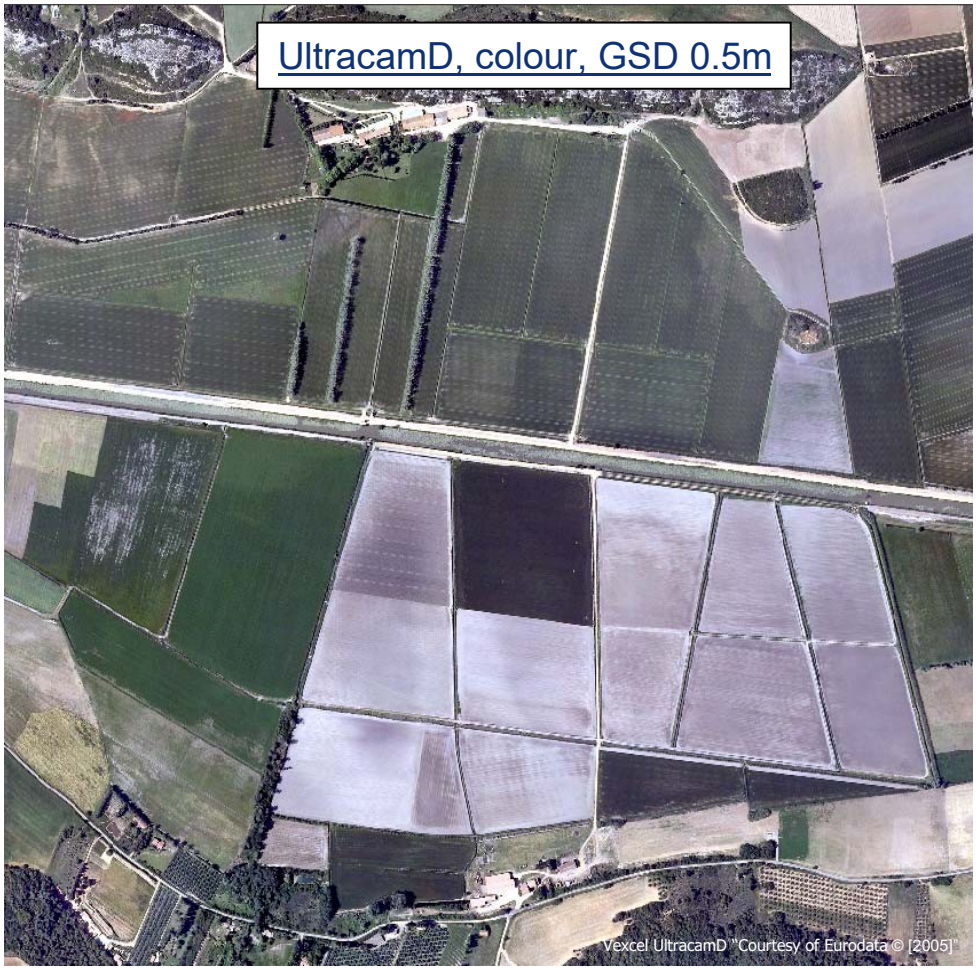
Images acquired in different years

EROS-B PAN, GSD 0.7m



Eros B Courtesy of ImageSat © [2007]"

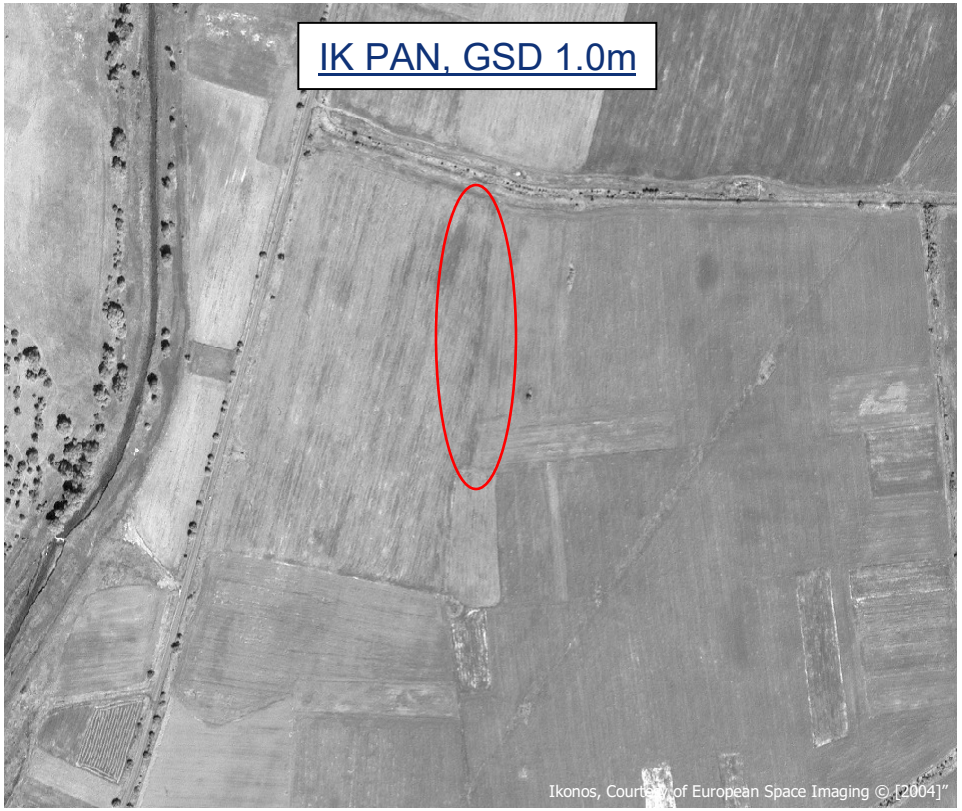
UltracamD, colour, GSD 0.5m

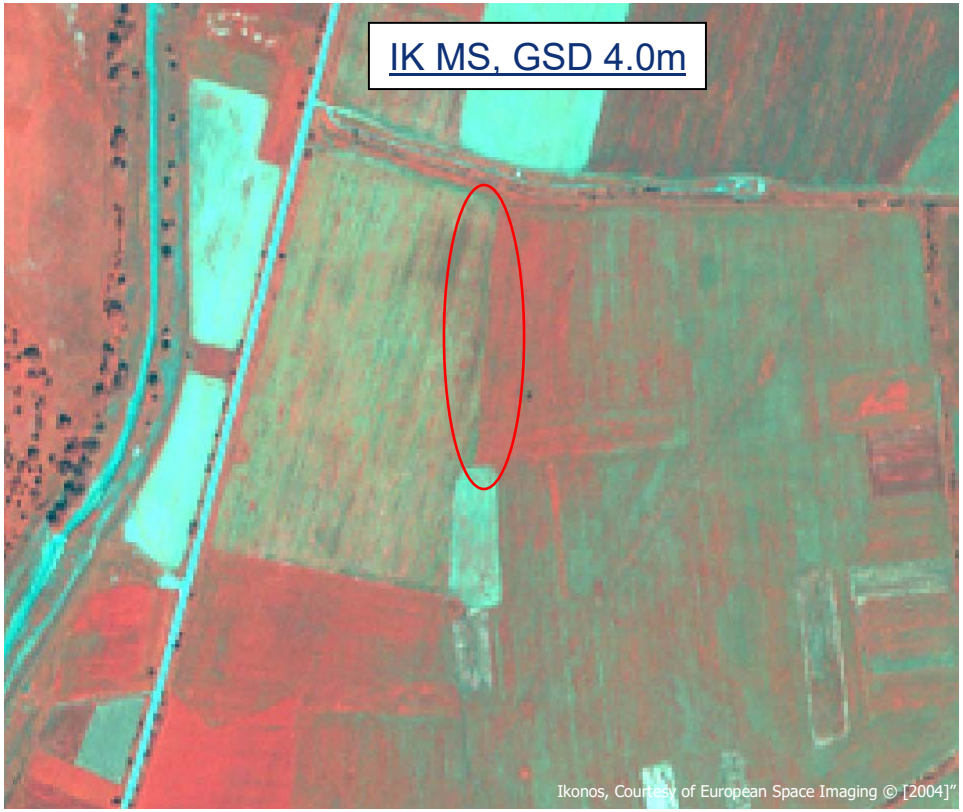


Vexcel UltracamD "Courtesy of Eurodata © [2005]"

Examples – IK over Sofia (BG)

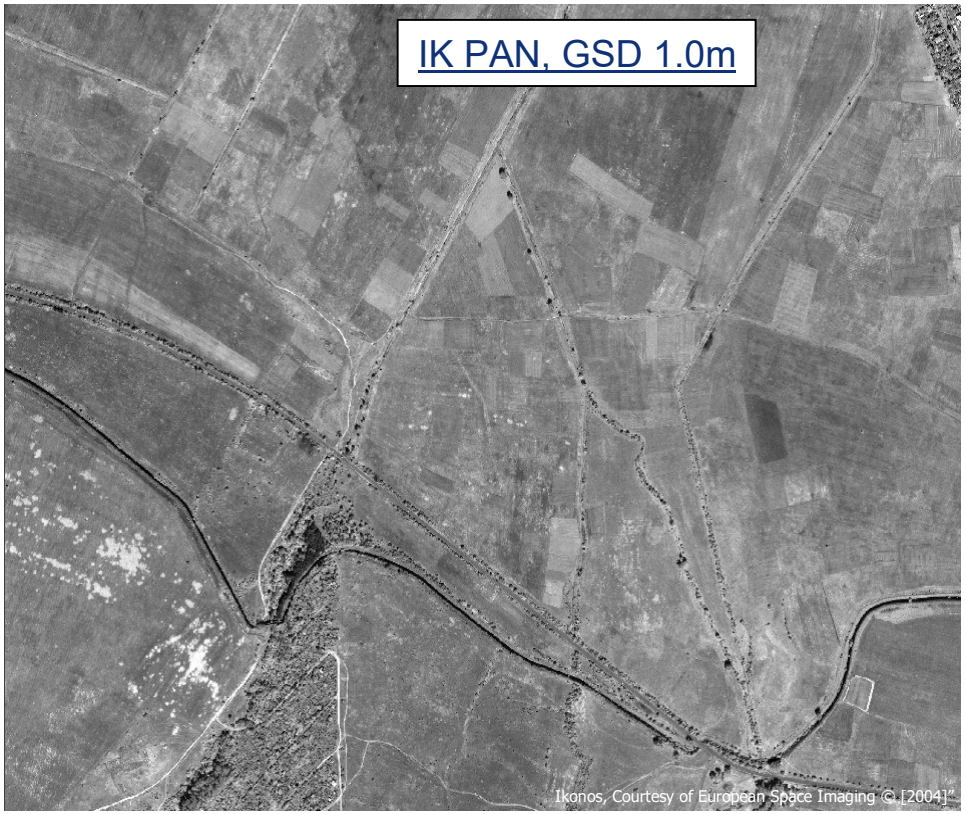
Images acquired simultaneously (bundle product)

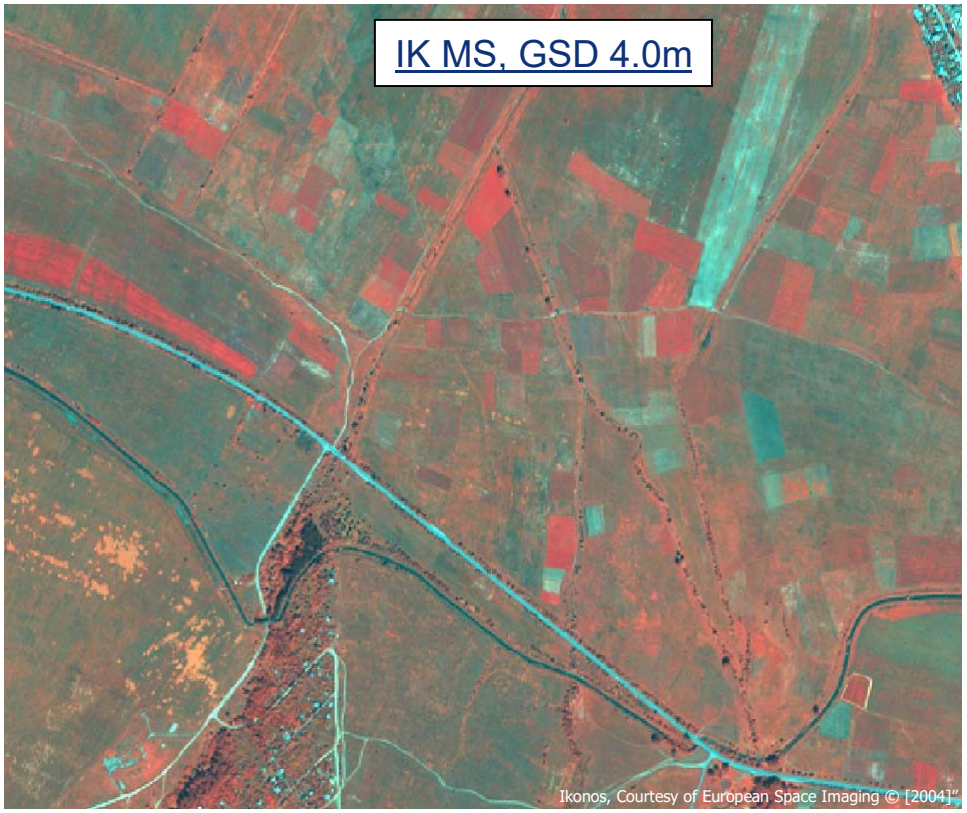




Examples – IK over Sofia (BG)

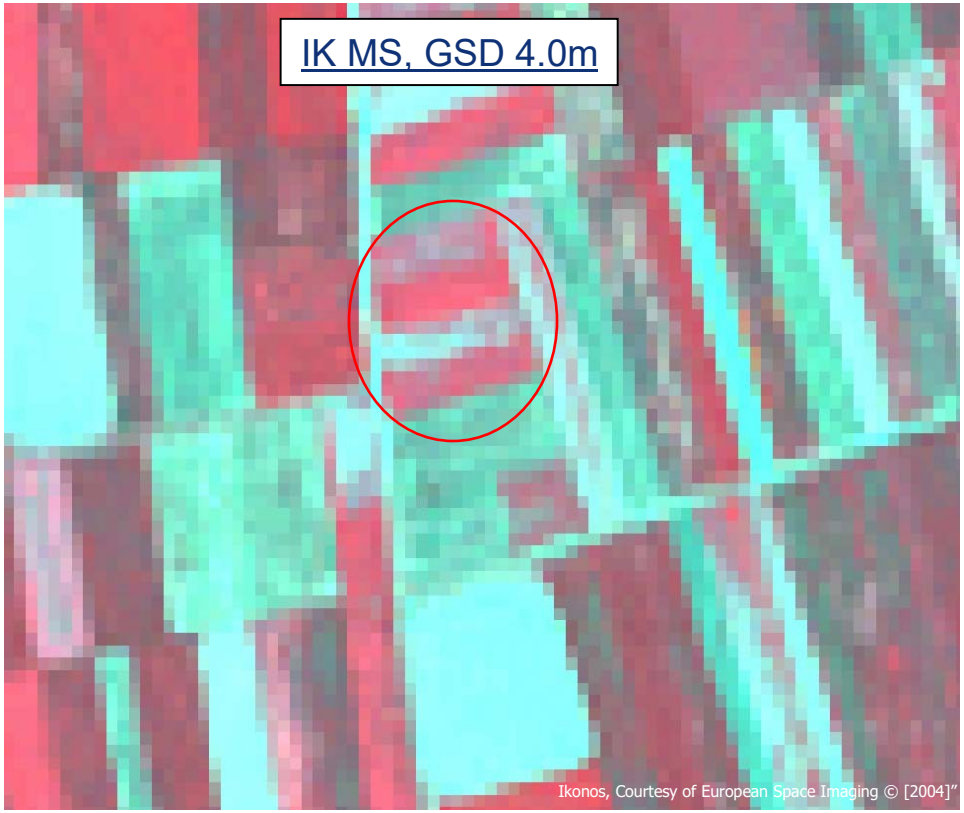
Images acquired simultaneously (bundle product)





Examples – IK over Sofia (BG)

Images acquired simultaneously (bundle product)



Objective for the use of PAN + MS

Too get the maximum information from both components (PAN and MS)

Specific considerations

•When VHR (PAN only) sensors have to be combined with additional HR, the following temporal and geometric factors should be considered:

•The PAN and MS component will be acquired separately in different weather conditions and with different viewing angles

•They will not have same Field of View and exterior orientation, as they belong to different sensors

•They might represent different vegetation status, due to larger time gap in the acquisition

•The spatial resolution of the HR might be too coarse for the combined use with VHR PAN

Test Case

QC site from CwRS 2007: STAK (LT)

Primary sensor: IKONOS (PAN+MS)

Backup sensor: EROS B (PAN only)

- Backup is acquired a day after the dedicated.

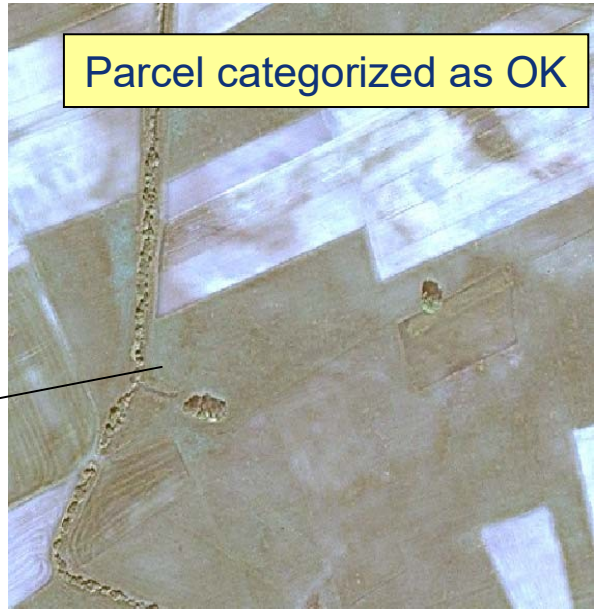
Complementary HR (SPOT 5, 10 m)

- Acquired 2 months after the dedicated VHR

QC vector data available.

Analysis of the differences in CwRS workflow using the default (IK) and alternative (EROS B +SPOT 5) image datasets

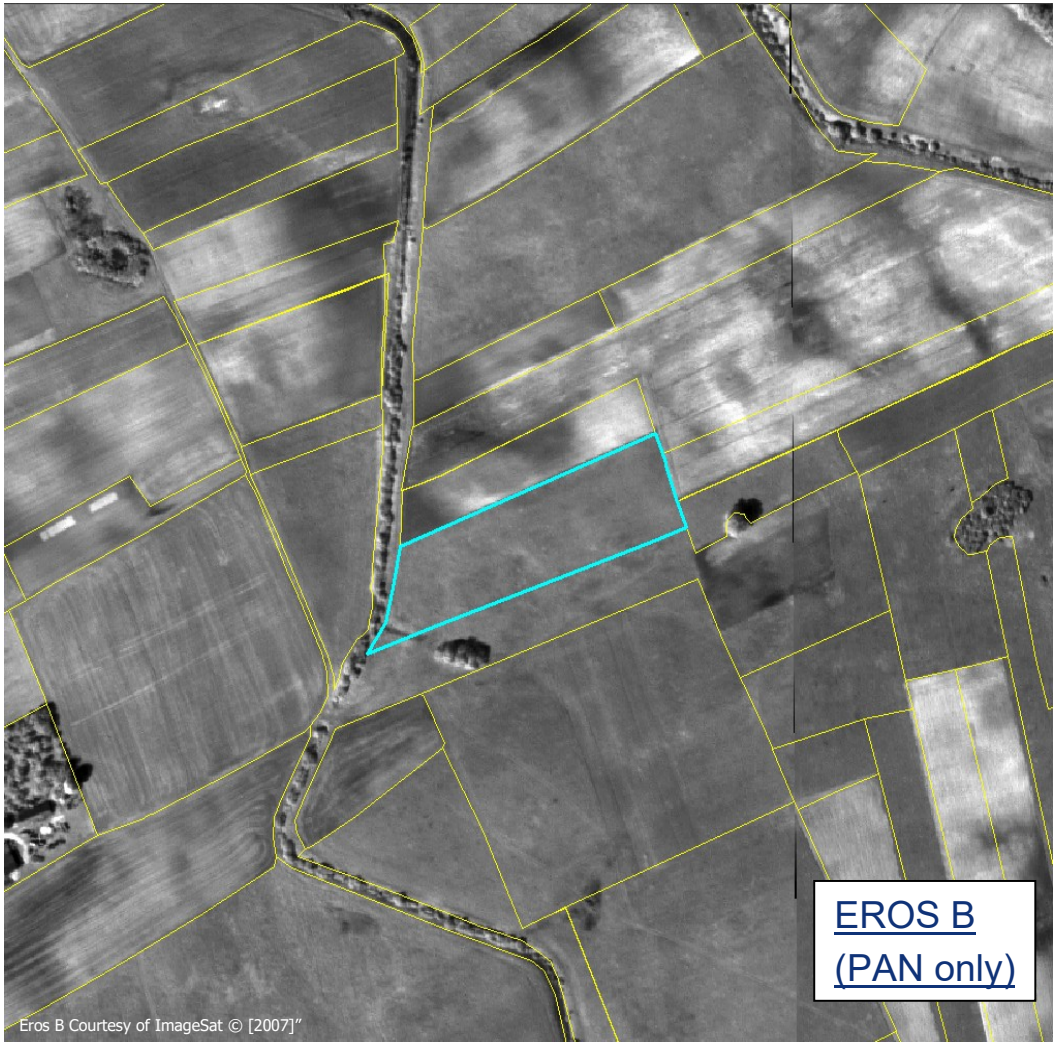
Test Case: 2007 CwRS site STAK (LT)

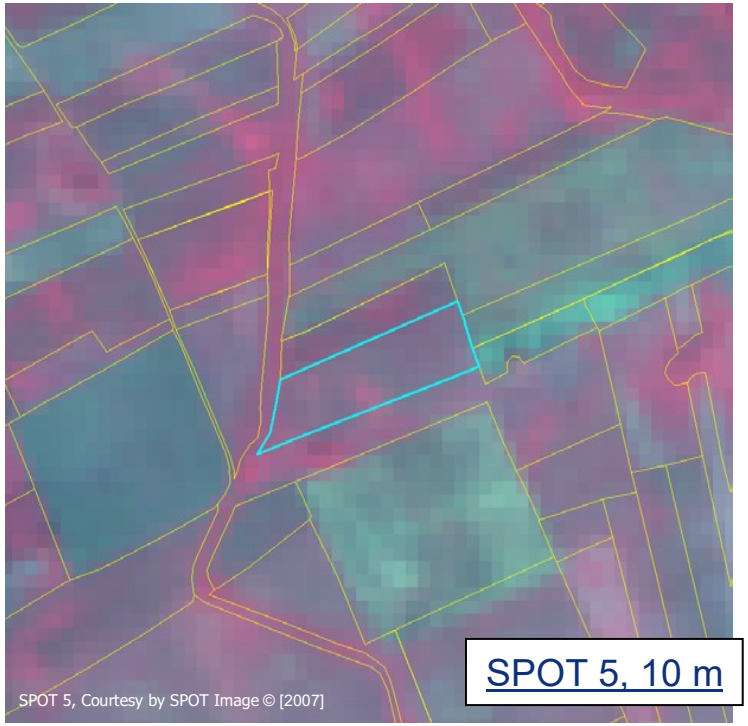


No clear boundaries visible even on the pansharpened IK

The default dataset:
IKONOS (pansharpened)

Test Case: 2007 CwRS site STAK (LT)

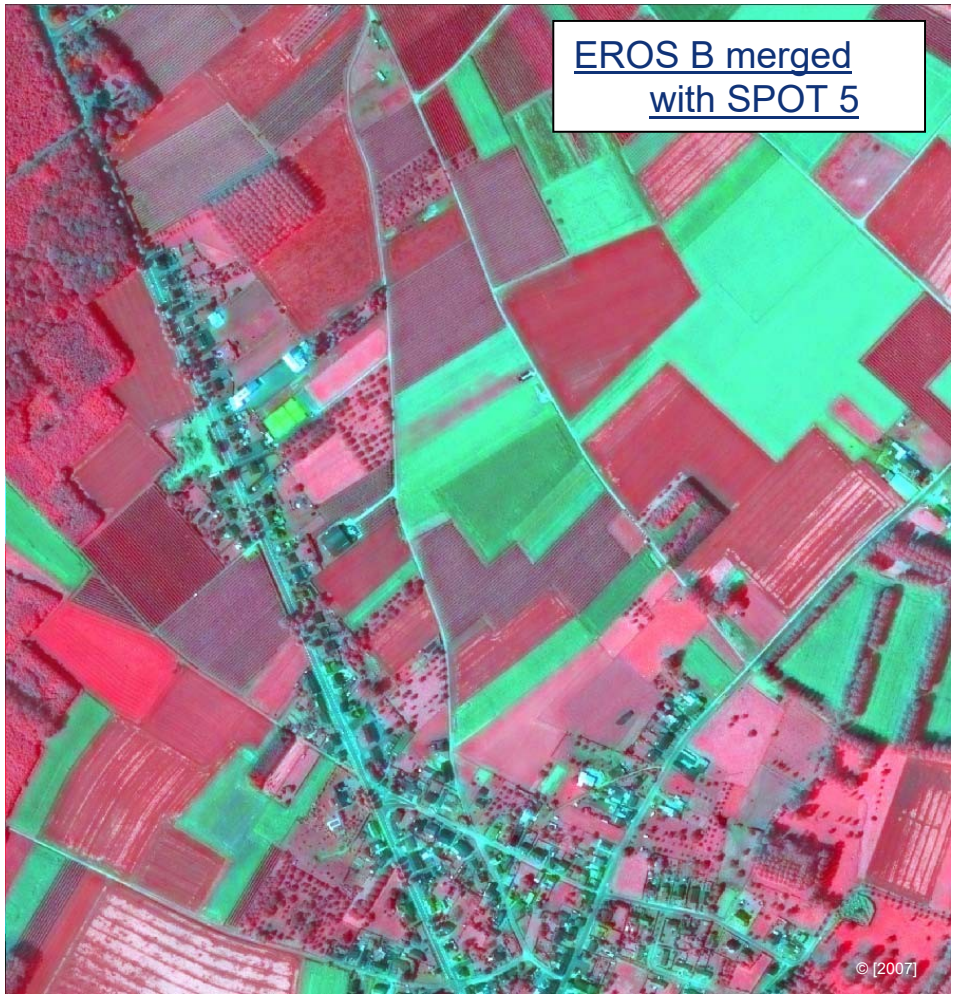




The alternative dataset:
EROS B + SPOT 5

Example of data fusion: 2007 CwRS site BILZ (BE)

One day difference between the acquisitions

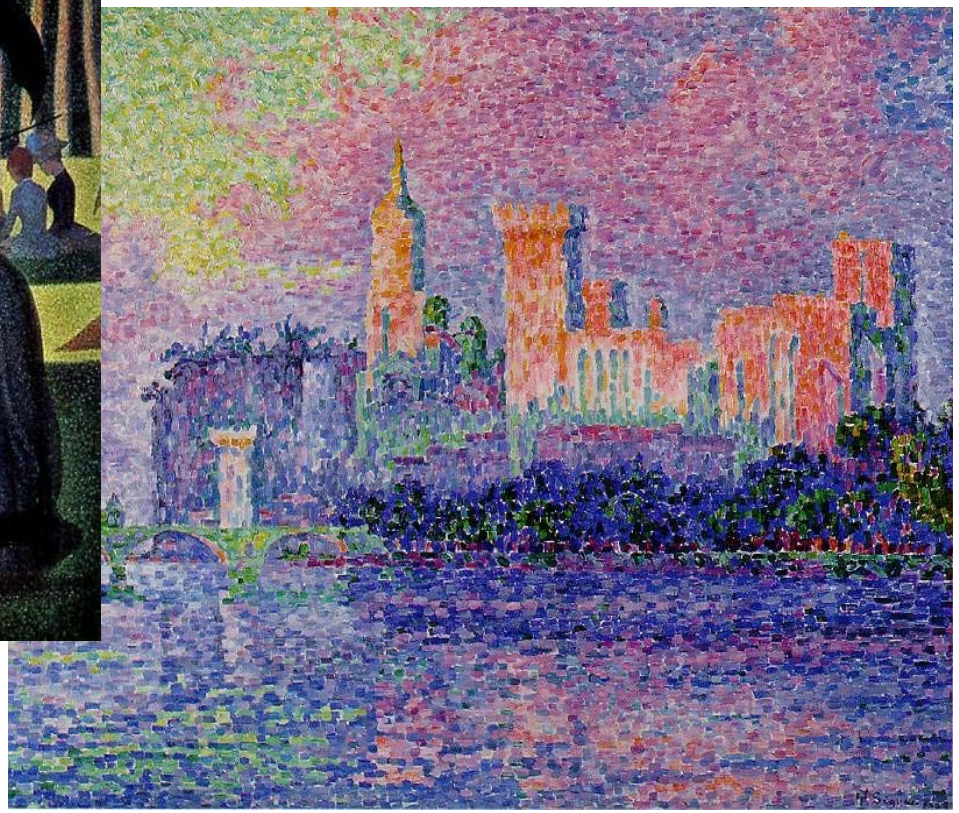


Conclusions

- The VHR PAN approach depends very much on the landscape and land management (ex. presence of permanent boundaries)
- The proper co-registration between the VHR PAN and the HR is essential
- The impact of the time gap between the VHR PAN and HR acquisitions should be analyzed
- A comprehensive evaluation is needed before taking decision on the use of VHR PAN as dedicated sensor

For further reading: http://en.wikipedia.org/wiki/Pointillism
http://en.wikipedia.org/wiki/Divisionism

Georges Seurat, Sunday Afternoon on the Island of La Grande Jatte



Paul Signac, Palais des Papes Avignon