

2008 Mars PAC conference, Ljubjana



Evaluation of SpotLight TerraSAR-X imagery as a surrogate for VHR optical data

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Ljubljana 04/12/2008

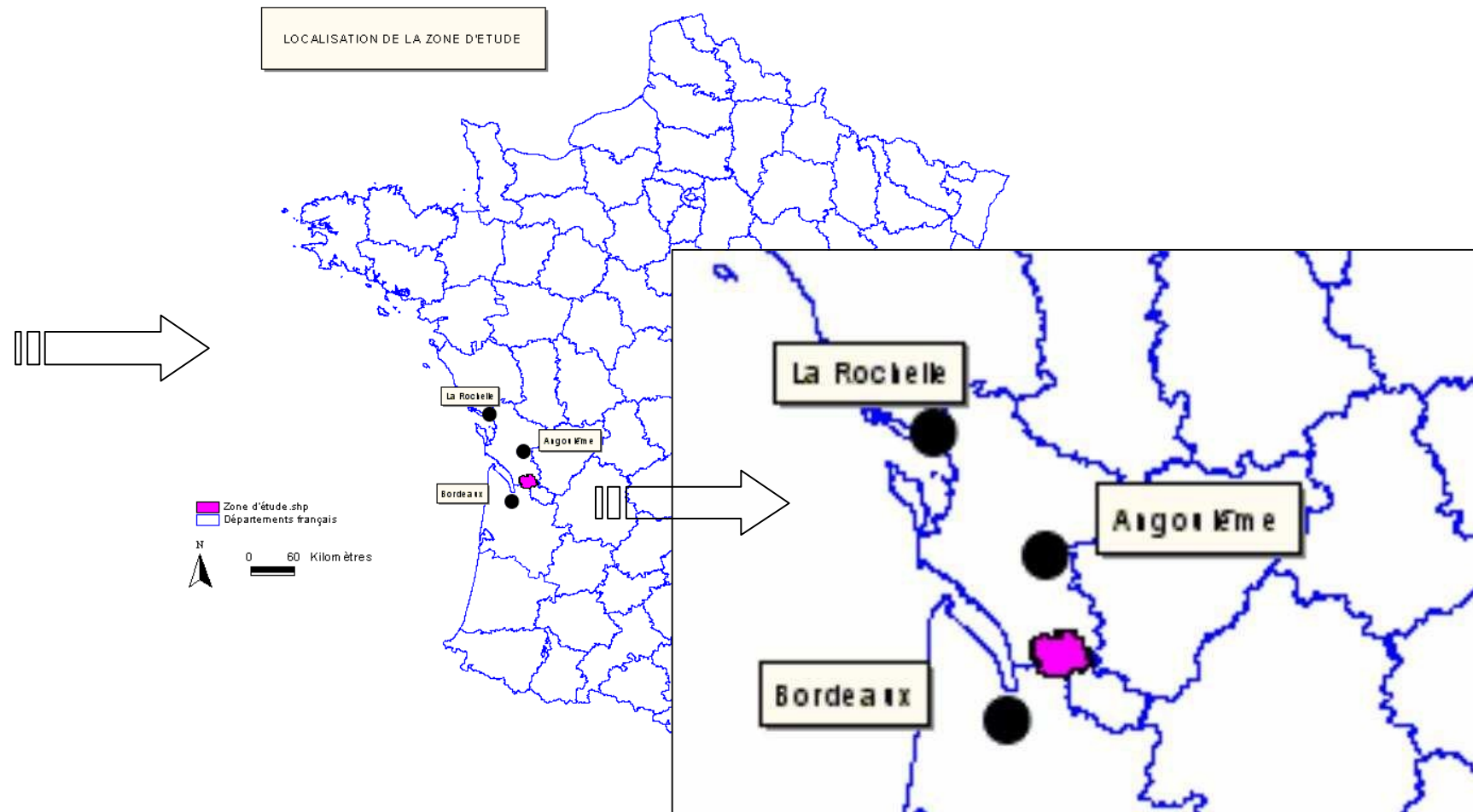


Thanks

- AUP (french administration), which enabled us to use:
 - The french administration CAPI software (HORUS)
 - A sample of 2008 farmer's dossiers
 - The LPIS data
- JRC, for their support
- SPOT-Image and Infoterra GmBh, which provide us Terra SAR imagery

The test site

The test site is located in the southern part of Charente-Maritime.



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Agronomy

The main interest of this site is the good agronomic diversity.

- Winter cereals(28.2%) ;
- Summer crops (mainly maize and sunflower): 27.7%) ;
- Fodder / grassland: 13.2% ;
- vineyard(11.9%).

Cultures**	%
Winter cereals	28.2
Maize	15.6
Fodder	13.2
Vineyard	11.9
Sunflower	11.8
Fallow	10.7
Rape	5.2
Other	3.4
Summer crops	27.7

VHR DATA

2 mosaics of TerraSAR-X SpotLight VV and Quickbird were acquired at closely dates.

TerraSAR X	15 / 06 – 03 / 07 / 2008
QUICKBIRD	27 / 06 – 10 / 07 / 2008

Aim of the study

The aim of the study was to assess to which extent TerraSAR-X SpotLight data could be used **as a surrogate** for traditional VHR data

TEST 1 : The **first objective** of the study was to develop an appropriate sampling scheme to test whether the use of SpotLight data could be used to reliably extract agricultural parcels.

TEST 2 : The **second objective** of the study was to test the use of SpotLight TerraSAR-X imagery under operational conditions.

TEST 1 : Farmers blocks analysis

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TEST 1

- Farmers block analysis:

An area frame sampling approach was adopted using the LPIS as a reference and resulting in a sampling rate of about 13% with two replicates.

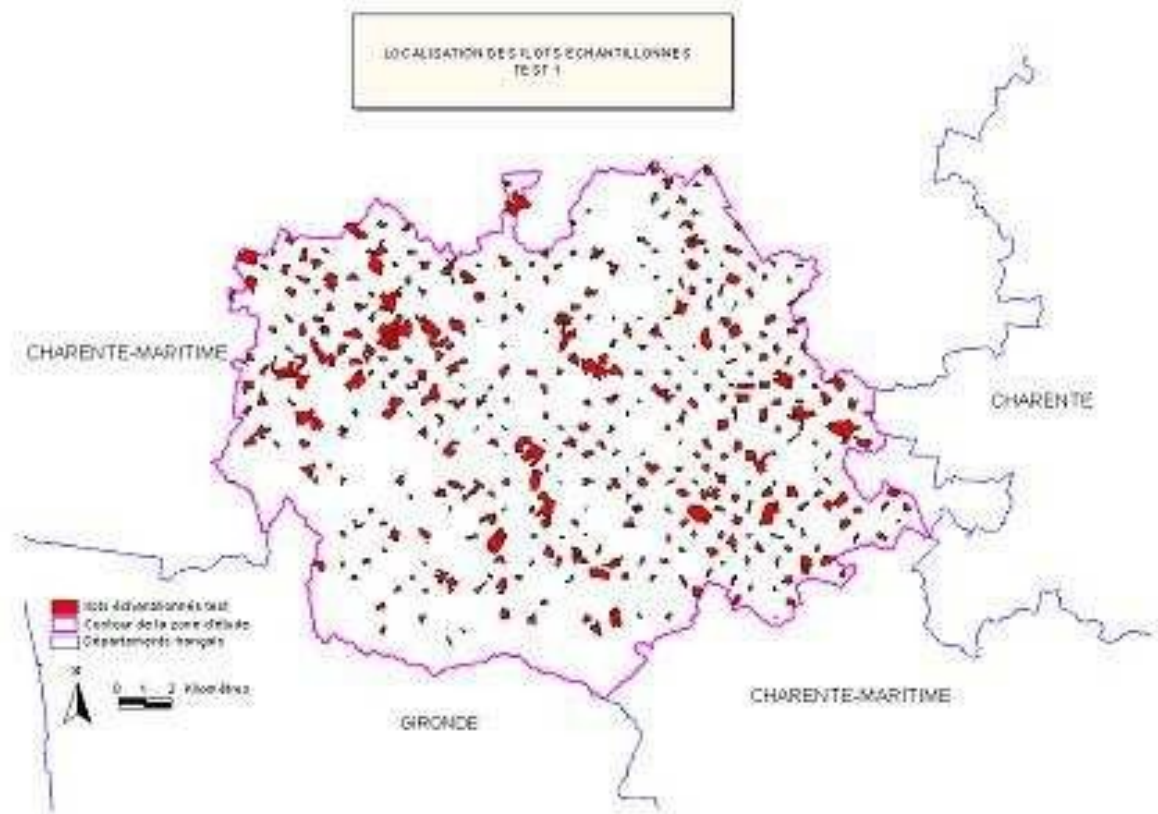
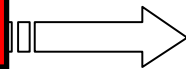
The SAR and optical imagery was interpreted independently by two experienced photo-interpreters using a simple land cover classification scheme.

METHOD

Sample extraction of 411 Farmers blocks (13,5 % surface):

- crossing LPIS layer with a 1 km x 1 km grid:
 - selection of 1 ilot per kilometer cell
 - the size of the selected ilots is from 0.12 to 44 ha
- the sample is divided between 2

Selected ilots



III. Land cover classification scheme

Désignations
Built up area
Agricultural parcel
Grassland band
Vineyard
Orchard
Bad maintenance
Wood
Wood border
Wide hedge
Water course
Pond
Other non agricultural area

← Land cover

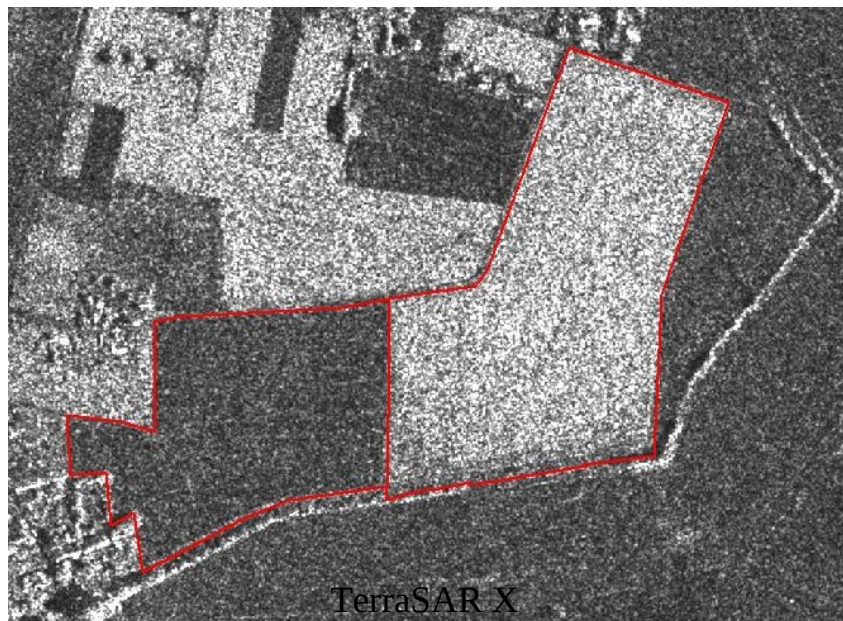
Crops

Désignations
Grassland
Summer crop
Winter / spring crop
Parcel after harvesting / bare soil
Vineyard, orchard
Non agricultural area
Unknown cover
Growing problem

III. Ilot analysis : qualitative results

Good – very good discrimination :

- **Summer crops which are growing in july (high backscattering) /**
- **Winter crops which are dry or harvested (low backscattering)**



TerraSAR X



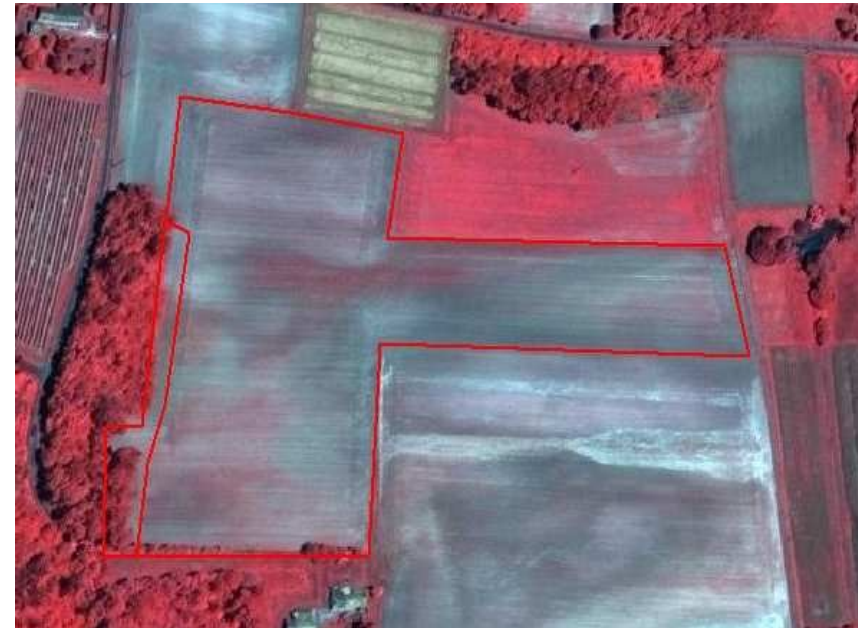
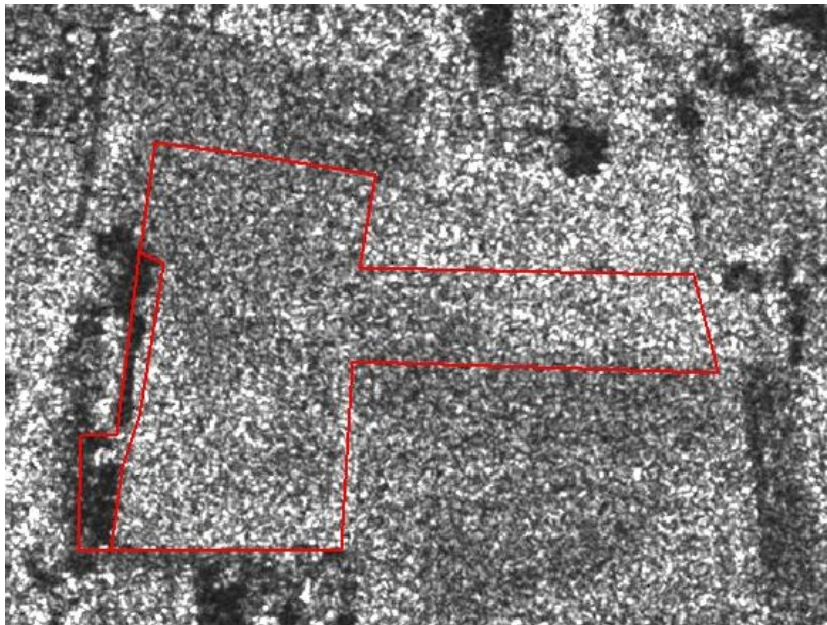
VHR Quickbird

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III. Ilot analysis : qualitative results

The photo interpreter can draw only some boudaries

- Summer crops with low cover;



VHR Quickbird

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III. Ilot analysis : qualitative results

The photo interpreter can draw only some boudaries

- grasslands ;

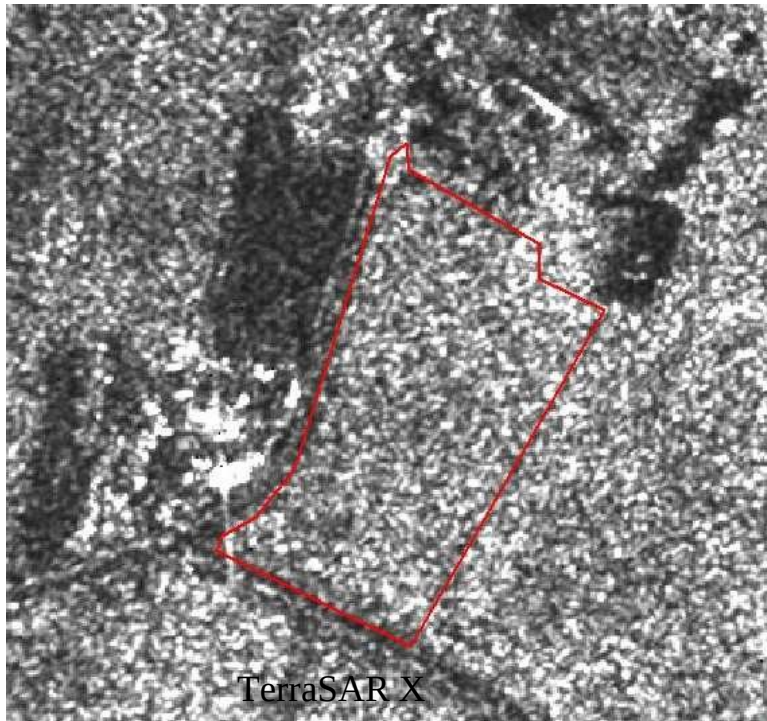


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III. Ilot analysis : qualitative results

The boundaries can be drawn with the roads, but not between vineyard and summer crop

- Vineyards;



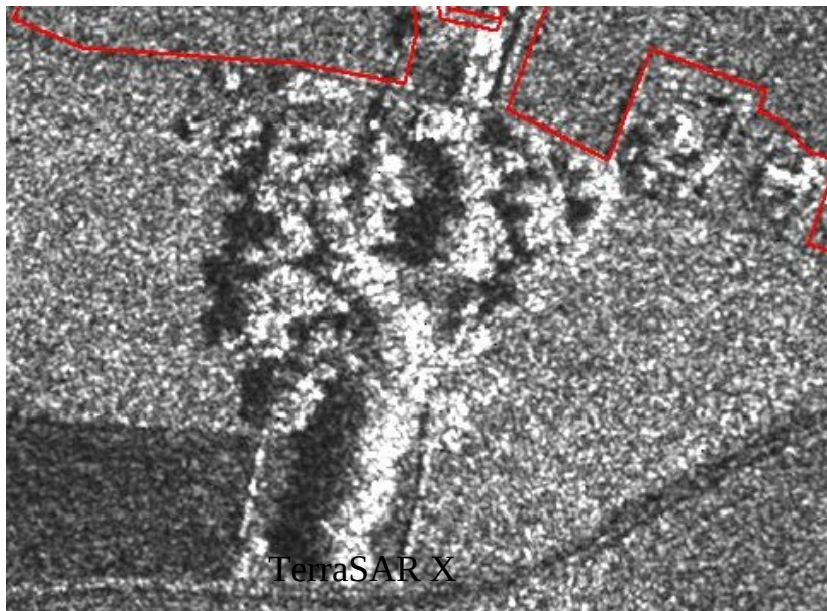
III. Ilot analysis– qualitative results

Good discrimination :

- Boundaries between crops and non agricultural areas

BUT

- buildings and trees are approximately similar at this scale



TerraSAR X



VHR Quickbird

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III. Ilot Analysis— quantitative results

MAIN RESULTS :

- 561 cutlines drawn on TerraSAR imagery
- 1578 cutlines drawn on Quickbird imagery

**35,5 % of parcel boundaries can be extracted from
TerraSAR X**

**64,5 % of parcel boundaries needs optical data to be
extracted**

TEST 2 : DOSSIERS ANALYSIS IN OPERATIONAL CONDITIONS

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TEST 2

- Use SPOTLIGHT data in operational conditions:

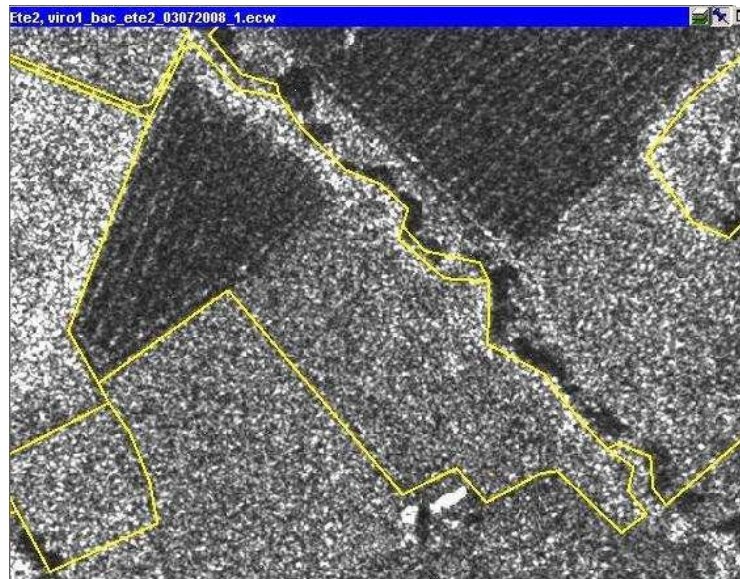
To this end a total of 123 farmers dossiers selected randomly were processed out of a total of 399 dossiers for the VIRO site.

The dossiers were processed independently by 2 experienced photo-interpreter :

- **one performing the interpretation under normal operational conditions using VHR and HR optical imagery**
- **and the other performing the interpretation by replacing the VHR imagery with the SpotLight data**

IV. Images

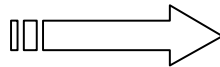
TerraSAR X	15 / 06 - 03 / 07 / 2008
Image THR QUICKBIRD	27 / 06 - 10 / 07 / 2008
SPOT4 HR Autumn	21 / 10 / 2007
SPOT 4 HR Spring	04 / 04 / 2008
SPOT 5 HR SUMMER	01 - 04 / 07 /2008



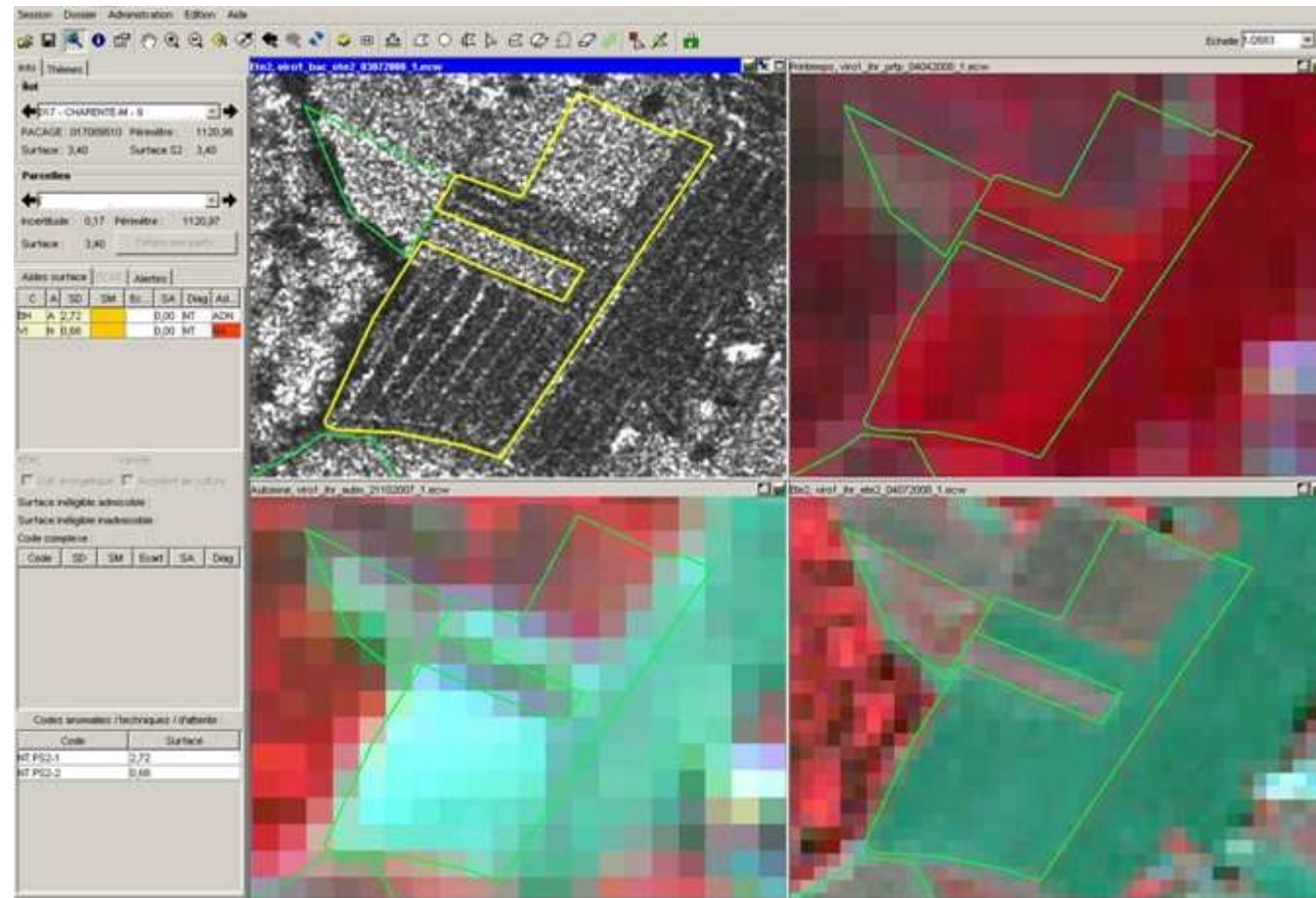
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IV. CAPI with HORUS software

For the CAPI with TerraSAR, the photo interpreter never used QB Data



**CAPI in
operationnal
conditions, with
farmer's
declaration**



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IV. Dossier analysis : Results

MAIN RESULTS

- **Dossiers without status change: 78%**
- **Dossiers with status change :**
 - **21,6 %** dossiers from accepted (optical) to rejected
 - **0,4 %** dossiers from rejected (optical) to accepted

> Global accuracy of diagnosis is 78 %,

But there is an over rejection of dossiers with TerraSAR X

IV. Dossier analysis : conclusion

An operationnal problem :

It is very difficult to produce good and « easy to use » maps for on the spot checks, after CAPI :

Radar imagery is not suitable for this use

So, we have to produce maps with 10 or 20 m resolution data.

That is to say we go back in 1995, for these documents.

IV. General conclusion

Could Terrasar X Spotlight data be used as a surrogate for optical VHR data ?

YES :

- **Global accuracy of diagnosis : 78 %**
- **Accepted dossiers with Terrasar are really accepted with optical data**
- **low risk to forget a rejected dossier**
- **35 % of parcels boundaries can be drawn with 1 m resolution TerraSAR X images .**

IV. Conclusion

BUT:

-CAPI « 1995 like », with 10-20 m resolution images for the rest :

- Crop identification**
- 65 % of parcels boundaries**
- maps for the support of ground controls produced with HR images**

- 21 % of rejected dossiers with TerraSAR are not rejected with optical data, that means useless on the spot checks

Thank you