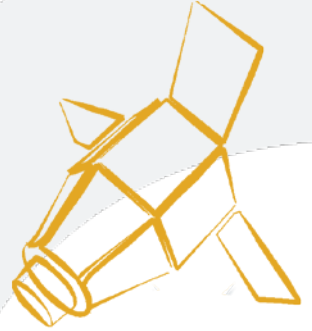




Updating a National Spatial Data Infrastructure : How satellite imagery contributes in France ?

Jean-Philippe Cantou
IGN Espace

IGN France : key figures 2015



1 622 employees

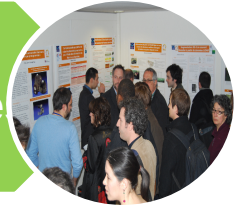


5 Inter-regional branch offices
(60 to 70 employees in each)



1 Aerial Survey Department

5 Research laboratories



1 Space Center
(IGN Espace, Toulouse, **80**
employees)



190 M€ budget
(2014)



IGN duties

Produce and update
the large scale reference NSDI

Manage the French Inspire portal

BD ORTHO®

Orthophotography DB

BD TOPO®

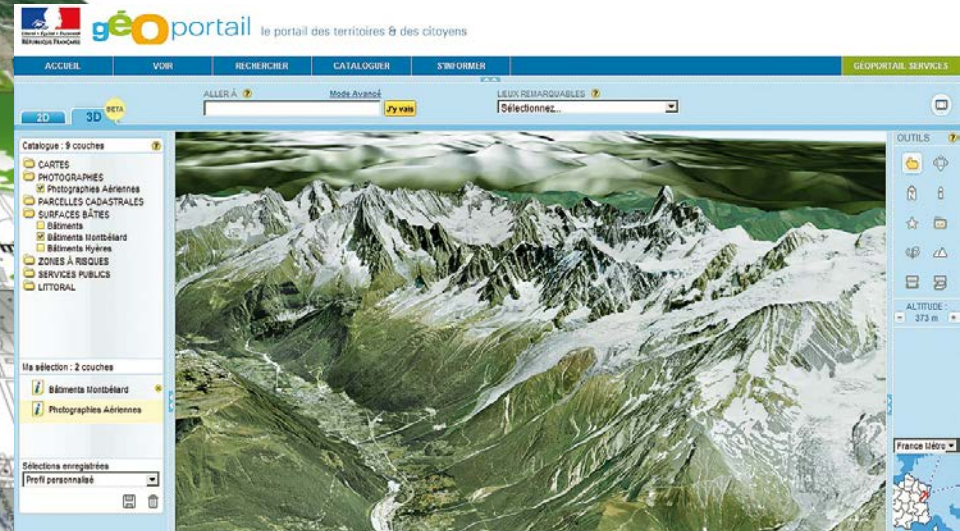
Topography DB,
including **RGE Alti®**
Altimetry DB

BD PARCELLAIRE®

Land property DB

BD ADRESSE®

Address DB



40 millions visits in 2014

<http://www.geoportail.fr>

CONTENT

Image demand : IGN is the national focal point for public bodies

Pléiades and SPOT image archive gathered since 2013

Product dissemination

Product experimentations / operational applications at IGN

SPOT 1.5 m images reveal rapid changes in infrastructure

LE PORTAIL IGN

< DETECTION DES CHANGEMENTS - BÊTA

Comparer

SPOT 6 - 2014

Avec

Photographies aériennes

34000 Montpellier

SPOT 2014

Aerial survey 2012



Attribution

Pléiades 50cm images reveal coastal changes due to hazards

Comparer Photographies aériennes Avec PLEIADES - 2014

**IGN systematic
aerial survey**
Summer 2012

Pleiades
Spring 2014



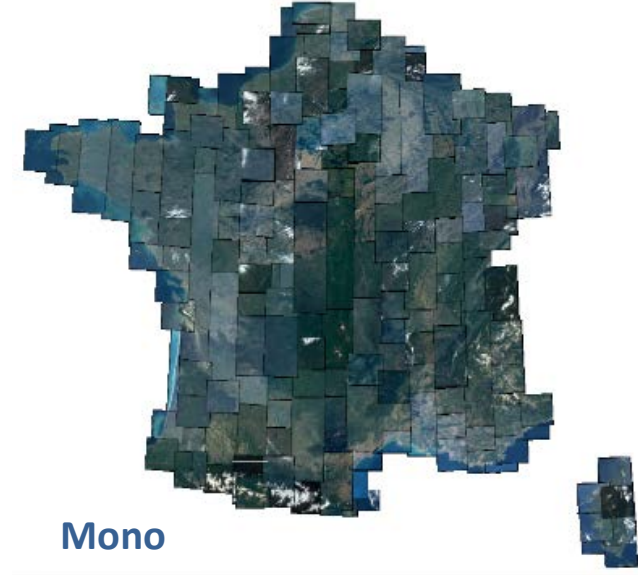
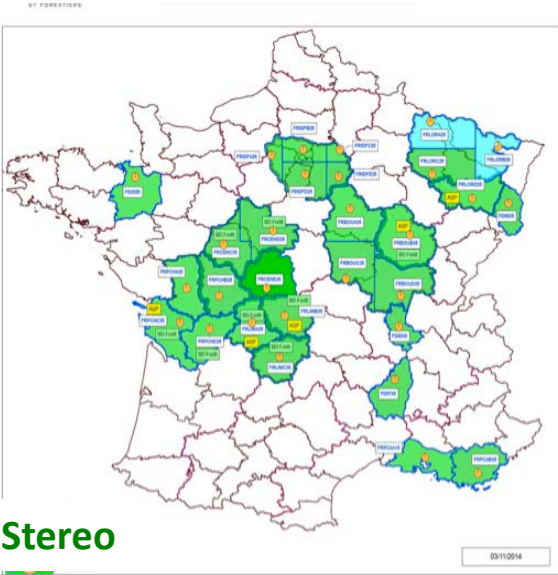
*Atlantic
coast
north of
Bordeaux*

2014 was the first hybrid acquisition plan

Aerial surveys

PLEIADES

SPOT 6-7



- **Aerial surveys**
 - Cover 30% of the national territory every year at 25 to 35 cm GSD → BD Ortho®
 - Update the national topographic data base → BD Topo®
- **SPOT 6-7**
 - Guaranty an annual coverage of the metropolitan territory to all public bodies / local authorities
 - Publish an entire seamless mosaic before the end of each year
- **PLEIADES**
 - Cover sensitive and urban areas every 1 or 2 years to speed up BD Topo® updating
 - Cover overseas regions every 3 years
 - Publish the georeferenced images as soon as processed

Pleiades targets covered in 2013 and 2014 and **SPOT** coverages of France since 2014 can be seen by all citizens and downloaded for free by public bodies

Suggestions 8

3

Saumur Y ALLER +

Résolution...

Remonter le temps 2D 3D

Rue

Pléiades 2014
50 cm

SPOT 2014
1.5 m

www.geoportail.gouv.fr

Echelle 1 : 3.385 0 100 m

Catalogue de données

Ma sélection de données

IGN

AIRBUS

cnes

AIRBUS

CATALOGUE

SERVICES
PUBLICS

ENSEIGNEMENT
ET RECHERCHE

ENTREPRISES

SUPPORT
& CONTACTS

DOSSIERS
& ACTUALITÉS

TÉMOIGNAGES

RECHERCHE

ACCUEIL / CATALOGUE

CATALOGUE

Les cartes >>

■ Les ortho-images >>

BD ORTHO®

BD ORTHO® Historique

Ortho satellite

Les bases de données en
format vectoriel >>

Le parcellaire cadastral >>

Les modèles numériques
3D >>

Les géoservices en ligne >>

L'offre de prestations >>

Mises à jour des données et
services >>

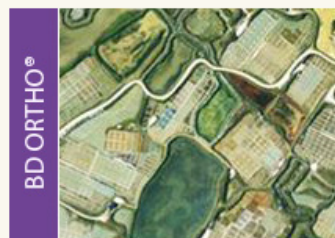
IMPRIMER

ENVOYER

PARTAGER

Les ortho-images

Des ortho-images riches dont le détail et la qualité géométrique en font un support de référence pour l'aménagement, la gestion et la valorisation du territoire.



BD ORTHO® >>

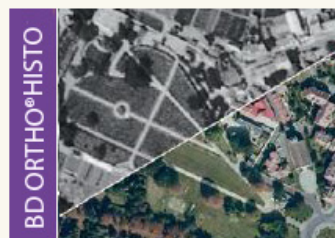
VOIR LE TERRITOIRE

L'image géographique du territoire national, la France vue du ciel.

→ ORTHO HR®

→ BD ORTHO® 50 cm → BD ORTHO® 2,5 m → BD ORTHO® 5 m

→ BD ORTHO® éd. anciennes → PVA



BD ORTHO® HISTORIQUE >>

IDENTIFIER LES ÉVOLUTIONS DU TERRITOIRE

La BD ORTHO® Historique permet de remonter le temps.

La France vue du ciel ... depuis 1945 !



ORTHO SATELLITE >>

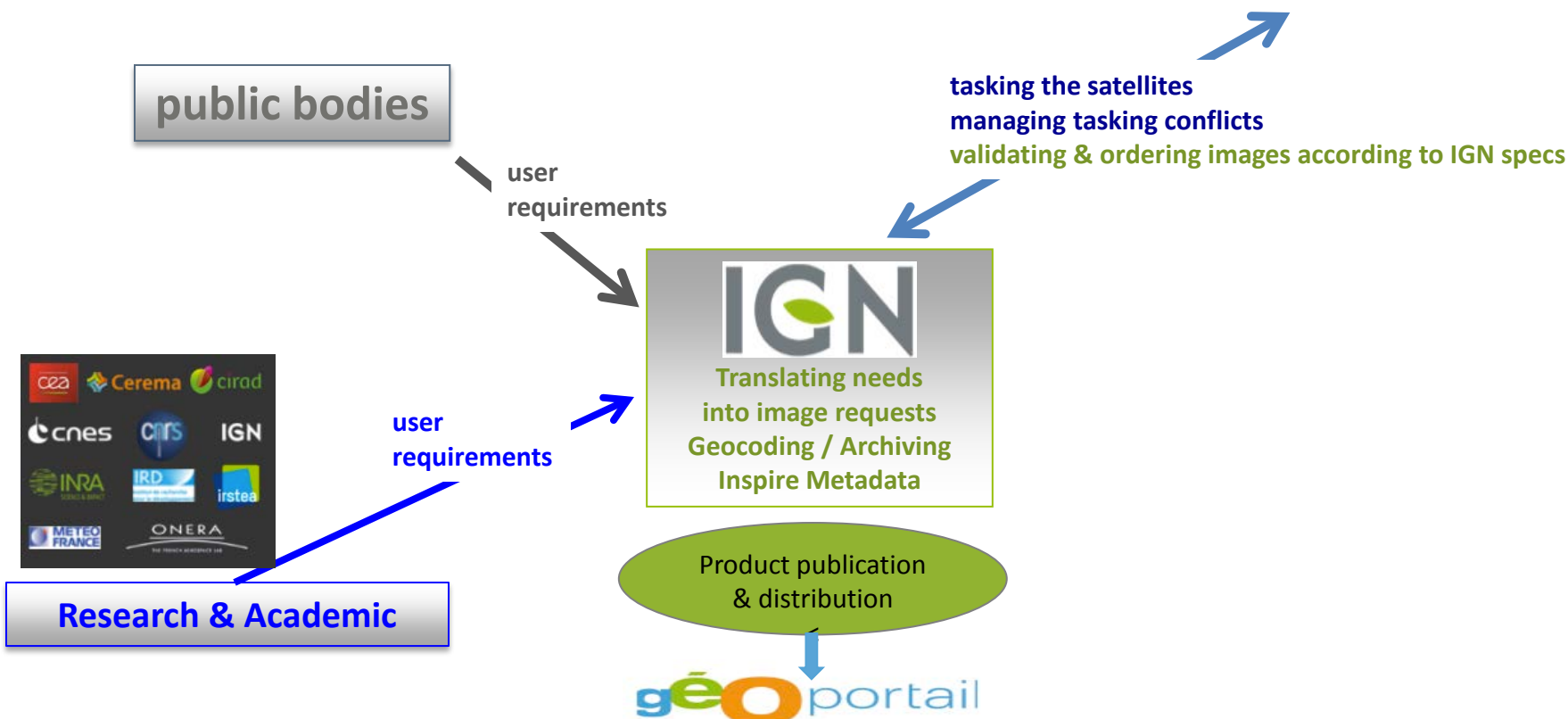
VOIR LE TERRITOIRE... PLUS SOUVENT !

Les ortho-images issues de prises de vues satellitaires sont complémentaires des données du RGE® et peuvent être mises à jour plus fréquemment.

Organization in France : optimize and share the satellite resource

images-satellites@ign.fr

**IGN is the national contact point
for Governmental and Local Authorities**



Requests collection and processing

■ Process the requests

A unique contact point for public bodies : images-satellites@ign.fr

A unique contact point for researchers : <http://www.satelliteimageaccess.eu/>

■ Bring technical assistance

User requirements are refined

Suggestions : sensor , archive or tasking

■ Commitment to respect the license

Users shall :

- use the products within their public duties
- respect license conditions
- commit themselves to give feedback on the use



1 - ZONE D'INTERET GEOGRAPHIQUE	
NOM :	
SURFACE DE LA ZONE (en km²) : (fournir un shape)	
2 - UTILISATION	
ORGANISME DEMANDEUR	CONTACT
Nom :	Nom :
Adresse :	Tel :
.....	Mail :
APPLICATION VISÉE :	

4 – ENGAGEMENTS

En signant le présent acte d'engagement j'atteste que :

☒ J'ai pris connaissance de la « **Licence d'Utilisation des Produits Pléiades aux Utilisateur Institutionnels Autorisés français** » - v1 jointe, et m'engage à en respecter les termes et conditions pour les produits décrits ci-dessus.

NB : la signature du présent document vaut signature de ladite licence

☒ J'ai pris connaissance et accepte que la **responsabilité de l'IGN** ne saurait être engagée sur l'adéquation du (des) produit(s) livré(s) aux attentes de l'utilisateur ou sur l'aptitude à un usage spécifique. Par conséquent l'IGN ne saurait être tenu responsable d'aucun dommage direct ou indirect lié à l'utilisation ou la non-utilisation du (des) produit(s) livré(s).

☒ Je m'engage à porter le logo IGN sur toute représentation graphique de ce produit géoréférencé.

Contracting & Financing

■ *Image acquisition*

○ **Pleiades**

- IGN signed a 2014-2016 supply contract with Airbus
- A budget amount was granted by the *Agence Nationale de la Recherche* to stimulate Pleiades use until 2017
- An IGN dedicated budget amount allows to meet requirements linked to NSDI updating



○ **SPOT**

- A consortium of 6 public bodies has committed itself to finance an annual coverage of the French territory for the coming years
- A specific SPOT receiving station has been set up in Montpellier

■ *From acquisition follow up to product dissemination*

- financed by IGN



Products

- **Ortho-image 16 bits 50cm**

- 4 spectral bands RGB NIR
- Applications: classification, interpretation, ...



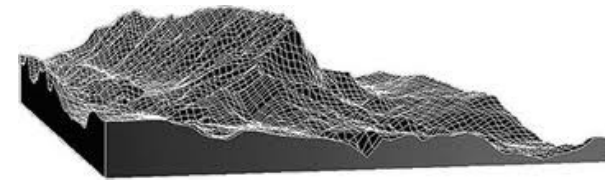
- **Ortho-image 8 bits 50cm**

- 3 spectral bands RGB (if needed : seamless mosaic)
- Applications: data capture, discovery



- **Image + geometric model fitted to NSDI**

- Standard format
- Applications: ortho from user's own DEM, image matching



- **Discovery service : National Geoportail** <http://geoportail.gouv.fr>
 - RGB Pléiades targets and SPOT seamless mosaics
- **Downloading service :** <http://professionnels.ign.fr/ortho-satellite>
 - Téléchargement des couvertures ortho RVB SPOT
- **Streaming service for use in GIS :** <http://professionnels.ign.fr/api-sig>
- **Specific portal for RS processing services :** <http://geosud.ign.fr>
 - Visualization of 4 spectral bands
 - Orthorectification
 - DEM generation

Access portal for discovery and RS processing services

GEOSUD  

Se déplacer :

[Carte IGN](#)  

Recherche 

Intervalle temporel :
Du 01/03/2013 Au 04/12/2014

Zone de recherche :
[Ecran](#) [Emprise](#) [Fichier](#)

Satellite :
Pléiades ☒ Spot ☐

Résultats 15

[Résultats](#) [Ma Sélection](#) ☐ Co-visualiser

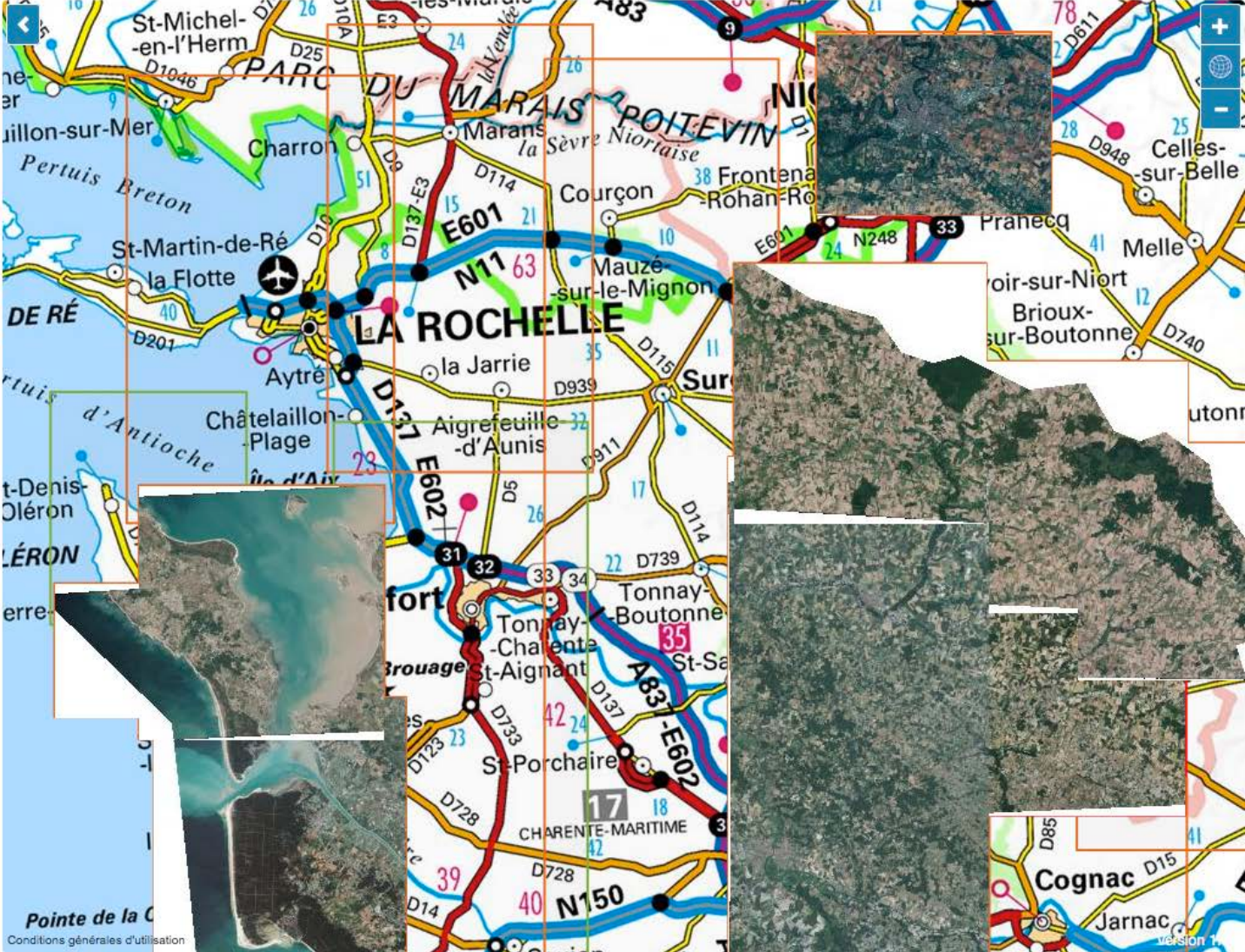
☒ Masquer les emprises ☒ Masquer les couches

Position	Date	Actions
Niort	2013-09-22	   
Niort	2013-09-22	   
Dolus-d'Oleron	2013-07-06	   
Les Touches-de-Perigny	2013-06-16	   
Aulnay	2013-07-31	   
Cherac	2013-06-16	   
Bernay-Saint-Martin	2013-07-31	   
Chives	2013-07-31	   
Aytre	2013-07-11	   
La Tremblade	2013-07-11	   
Dolus-d'Oleron	2013-07-06	   
Nere	2013-07-25	   
Marans	2013-07-11	   
Clerac	2013-07-18	   
Benon	2013-06-04	   

« 1 / 2 »

LA ROCHELLE

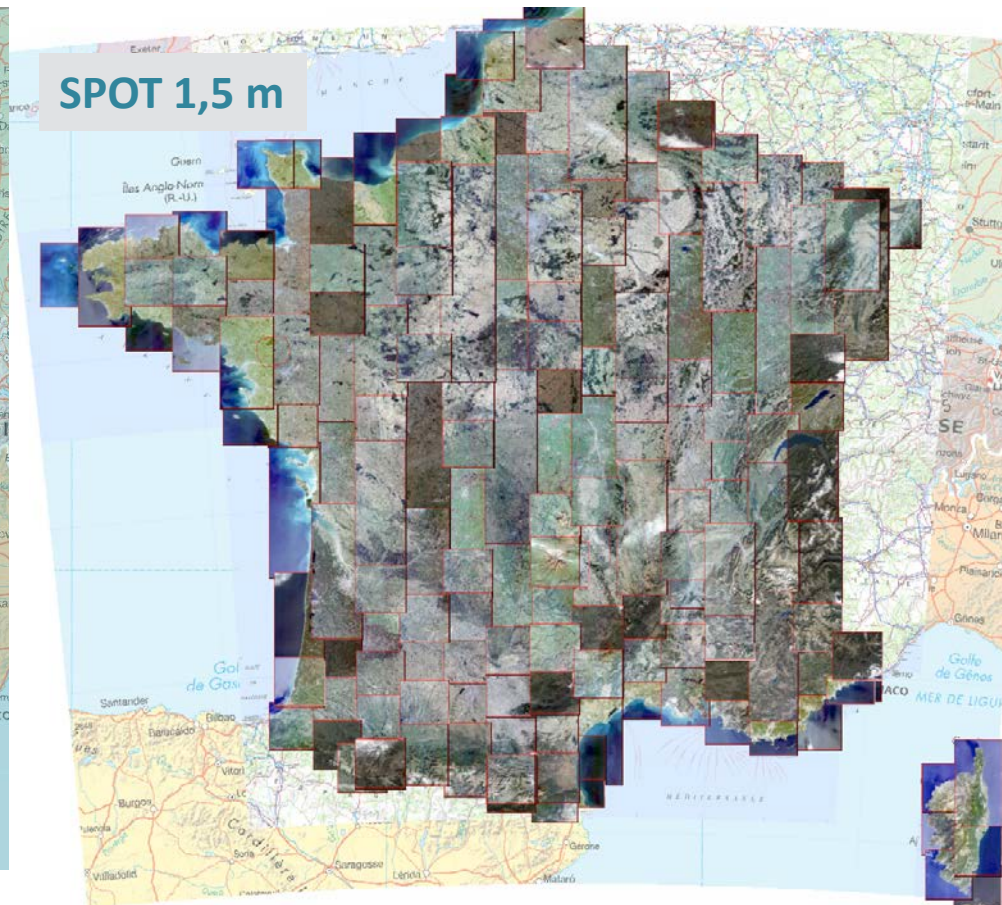
Conditions générales d'utilisation



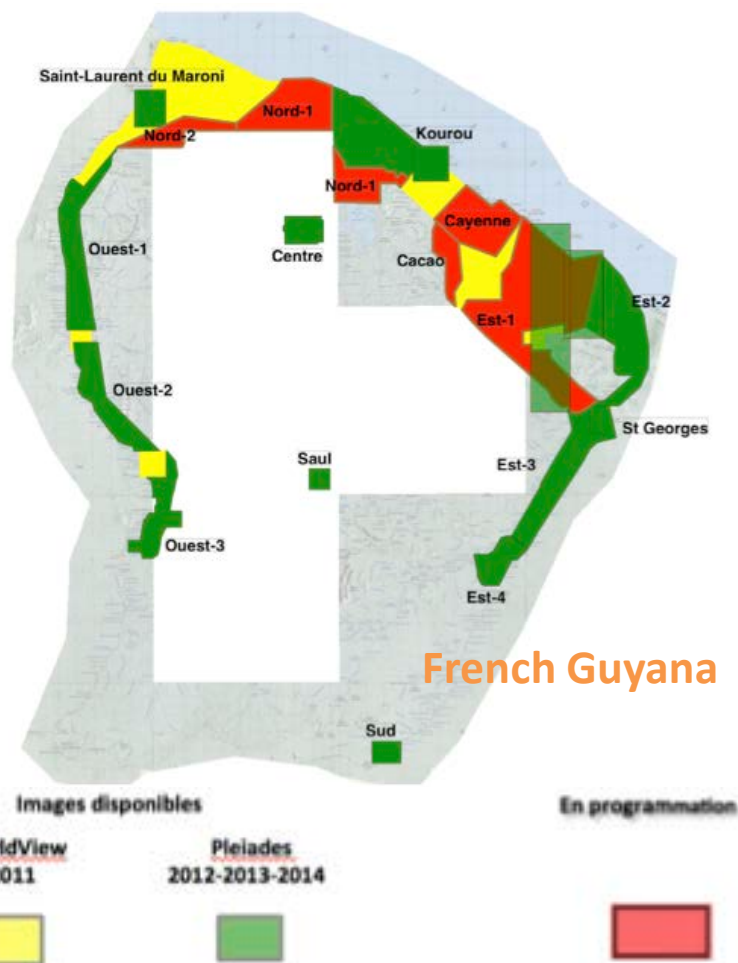
Satellite programme 2015 over metropolitan France

3D topographic data capture : 2 high speed train lines, 10 towns
Annual coverage of coasts subject to erosion

Metropolitan France annual coverage
A base for land monitoring projects



Overseas territories : covered by **Pleiades** in 2013-2014



Guadeloupe



Mayotte



Martinique



Réunion

French Guyana : IGN produces cloudfree seamless mosaics for local authorities



Best image among 3



Cloudfree patchwork

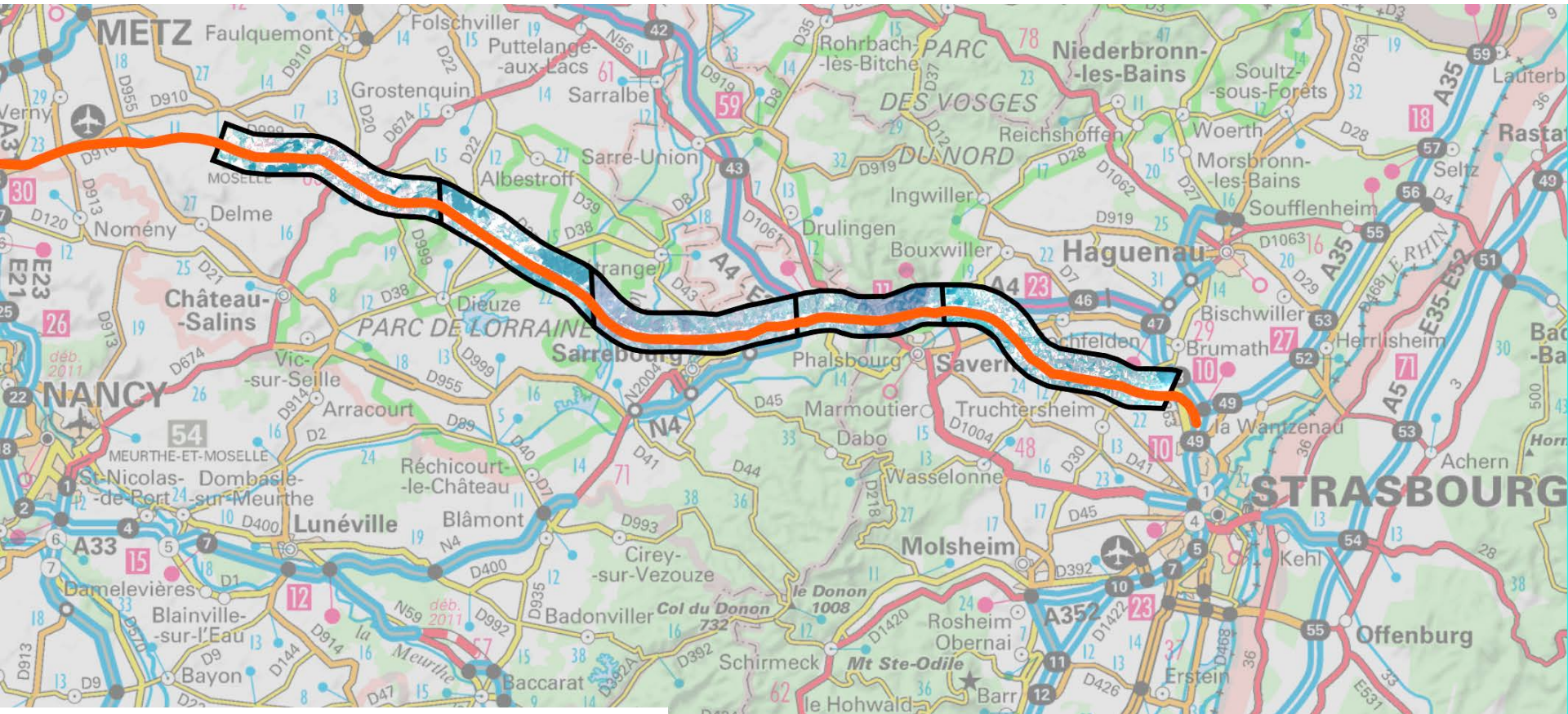
1. BD Topo® updating : are retrieved 3D vector data from Pleiades stereo compliant with data base specifications ?



1. BD Topo® updating along a High Speed Railway under construction

■ Railway *Nancy-Strasbourg*

- "ribbon" of 100 km x 5 km to be covered by **Pleiades** in stereoscopic mode



1. BD Topo® updating along a High Speed Railway under construction



1. BD Topo® updating : results and recommendations

■ Processing and data capture

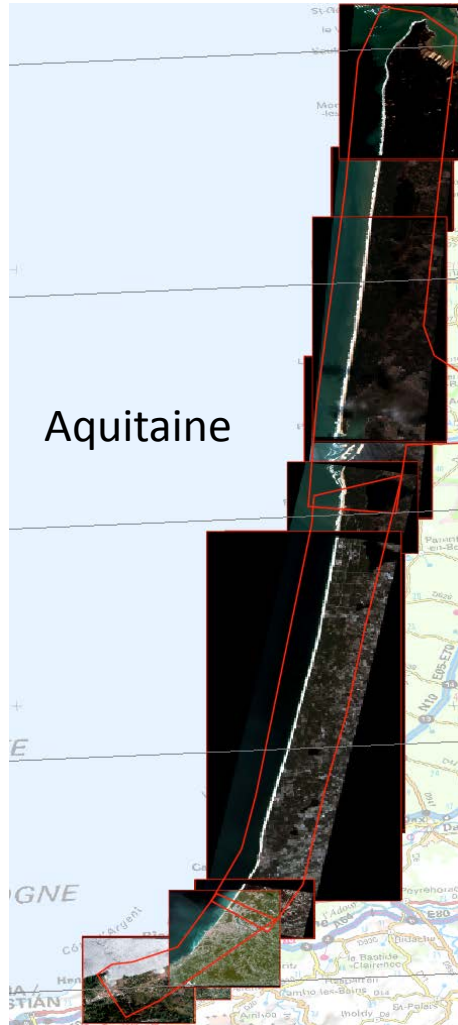


- Pleiades stereo pairs : B/H ratio recommended from 0.5 to 1
- Features retrieved in 3D : railway axis, secondary network, hydrography

■ Results

- Processing duration correct
- XYZ accuracy assessed against ground control and geodetic points : better than 1 m, matching BD Topo® specifications
- Visual comfort is suitable, with slight preference for colour to B&W
- Drawback : no possibility to see the objects from several angles of view
- Advantage : a large coverage (up to 20x21 km) which reduces switches between several photo pairs
- Vectors obtained have been integrated into the BD Topo® data base

2. Coastal erosion : assessment of height accuracy in **Pleiades** derived DSM/DEM



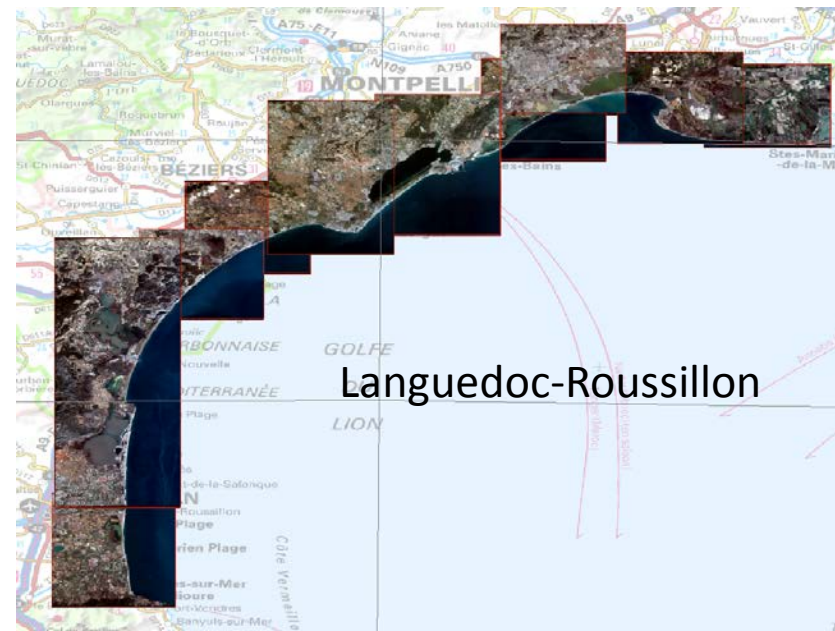
DSM Lidar 2011



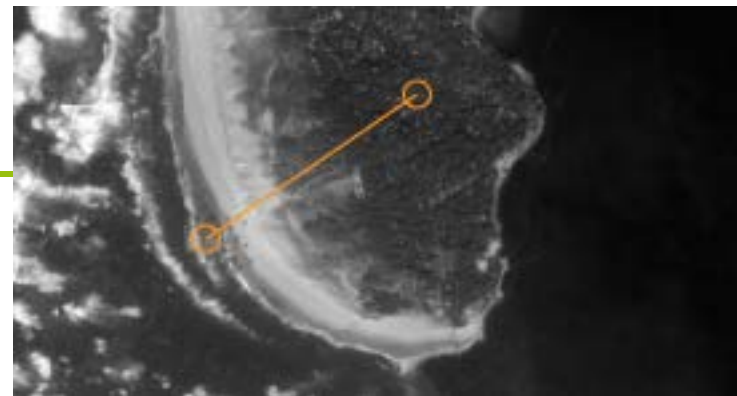
DSM Pleiades 2013



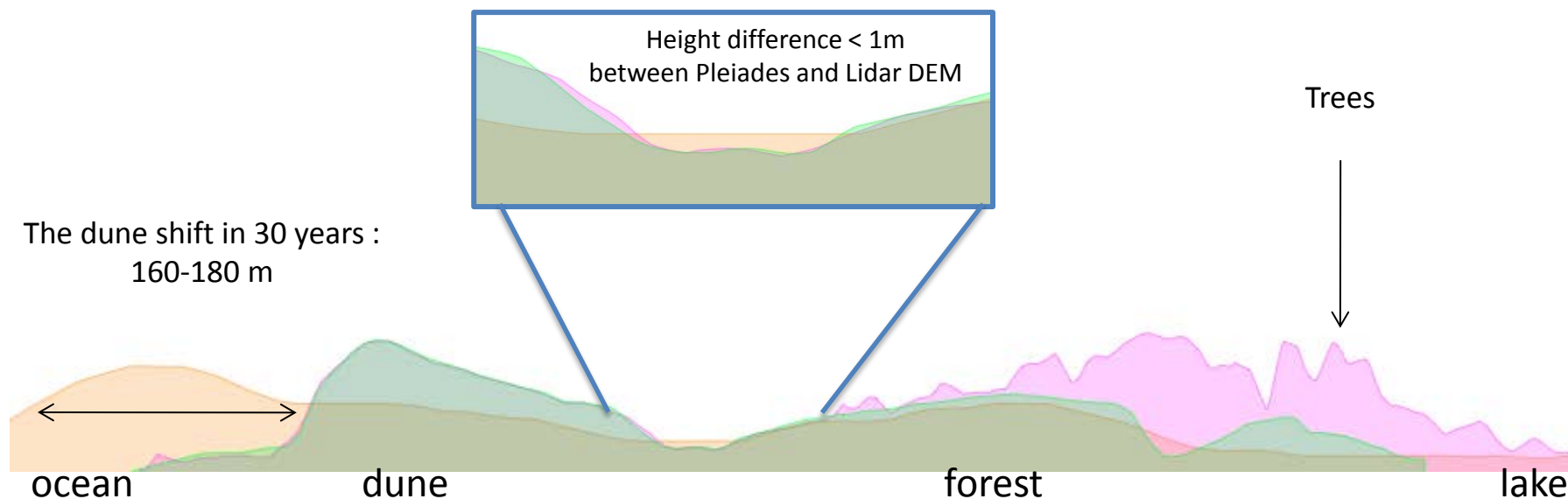
In areas with no vegetation, the 2 DSM look similar



Cap-Ferret (Atlantic) : Evolution of dune shape



Pleiades **march 2014**
aerial Lidar **october 2014**
BD Alti® **1980's**



3. DTM generation over high mountains

- Purpose of the study

- Generate DTM in mountainous areas where existing BD Alti® data base is less accurate
- Test area Corsica (Bavella) :
 - 3 pairs were acquired on the same area :
 - 2 with 20° roll angle but with 26 days interval
 - One with low roll angle later



- Methodology

- Geometric modelling of images
- DSM production
- Transformation DSM => DTM (existing production line)
- Comparison with :
 - BD ALTI® accuracy > 6 m
 - INTERMAP (radar data) accuracy about 7 m
 - Qualified points xyz (geodetic, networks) submetric accuracy

Comparison of Pleiades and SPOT6 DSM over Corsica

SPOT6 DSM (6m)
Pleiades DSM (0.5m)



4. Generation of an artificial land layer from SPOT 6/7

- Context : IGN is producing a large scale land use and cover map with a slow updating cycle
- Between 2 versions a simplified land use map is produced annually from SPOT 6/7 coverage
- The objective is to follow the degradation of agricultural land (determination of artificialization index)
- 2 products are experimented :
 - a 6 classes map
 - a binary map



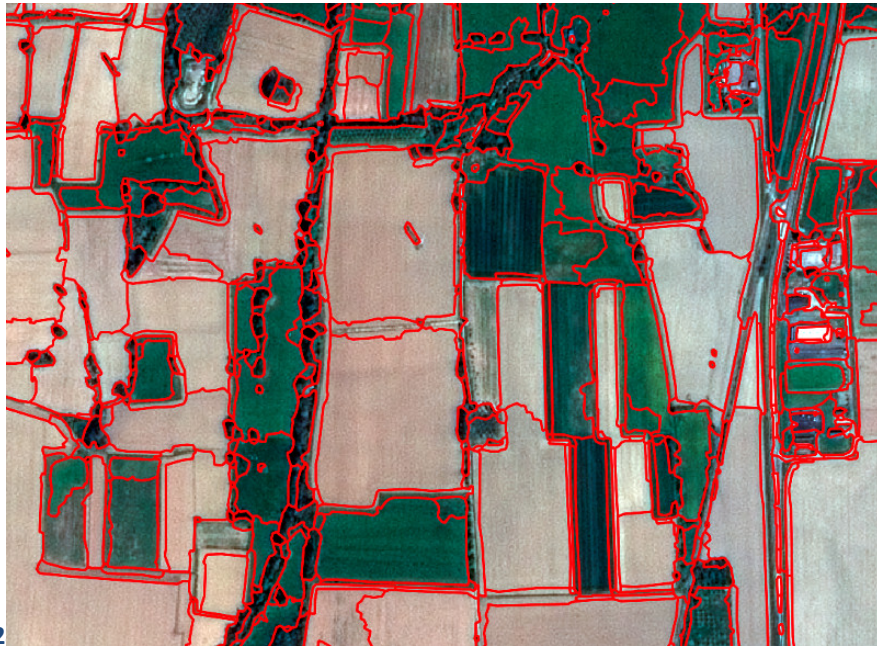
Spot 6 image, april 2013

A hybrid processing line

- Use of IGN and external databases as input
- Investigation focussed on the fringe agri/urban

-  Agricultural plots (PAC declarations by farmers)
-  Houses
-  Roads
-  Not investigated

- > Use of automatic segmentation tools



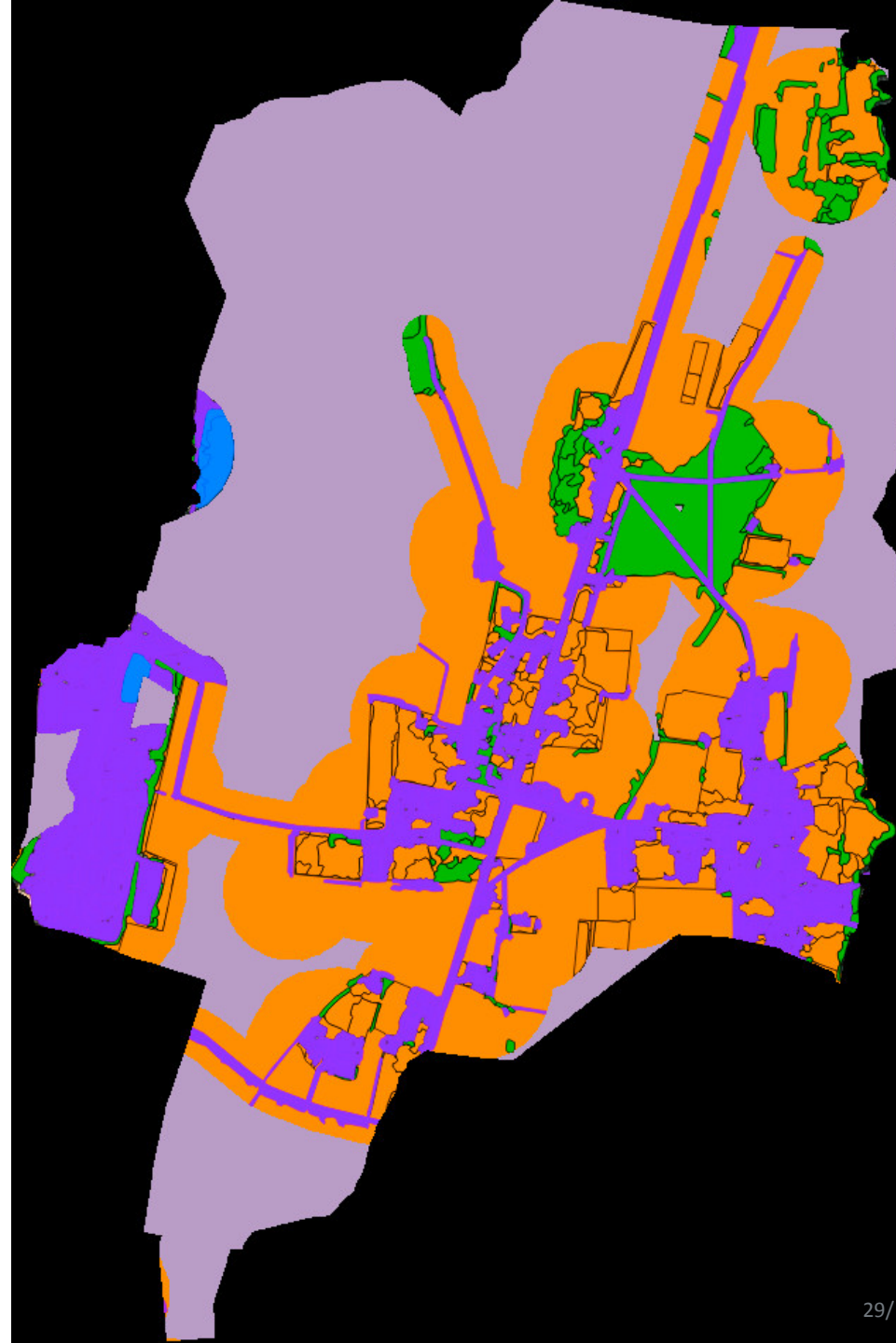
A hybrid processing line

> Computer assisted labelling of plots to be classified

> Simplified land use maps with 6 classes (merging of databases and labelling)

Nomenclature

	Artificialized land
	Natural environment
	Crops
	Forest / hedges
	Lakes / rivers
	Unknown but not artificialized
	Not processed



Conclusion : present uses of satellite imagery by IGN France

■ as a complementary source to aerial photography

- **Pleiades** (BD Ortho®) : speed up the frequency of observation (coasts, towns, overseas) *(operational)*
- **SPOT** (annual revisit) : point out changes in land cover / land use anywhere *(operational)*
- **Pleiades** (civil protection) : emergency response *(experimented)*
(floodings, forest fires and storm damages,...)

■ as a substitute to aerial photography

- **Pleiades** (BD Topo® updating) : 3D stereo plotting of urban and infrastructure features *(operational)*
- **Pleiades** height measurement (RGE Alti®) : DTM generation over high mountains *(to be implemented)*
- **SPOT** (annual revisit) : measuring the urban sprawl *(under development)*
- **Pleiades** (BD Forêt® updating) : 2D classification of forest species *(to be experimented)*

Challenge : How can European and National image coverage programmes cooperate ?

