

Suivi Vidéo du littoral

Didier Rihouey



Principe de fonctionnement

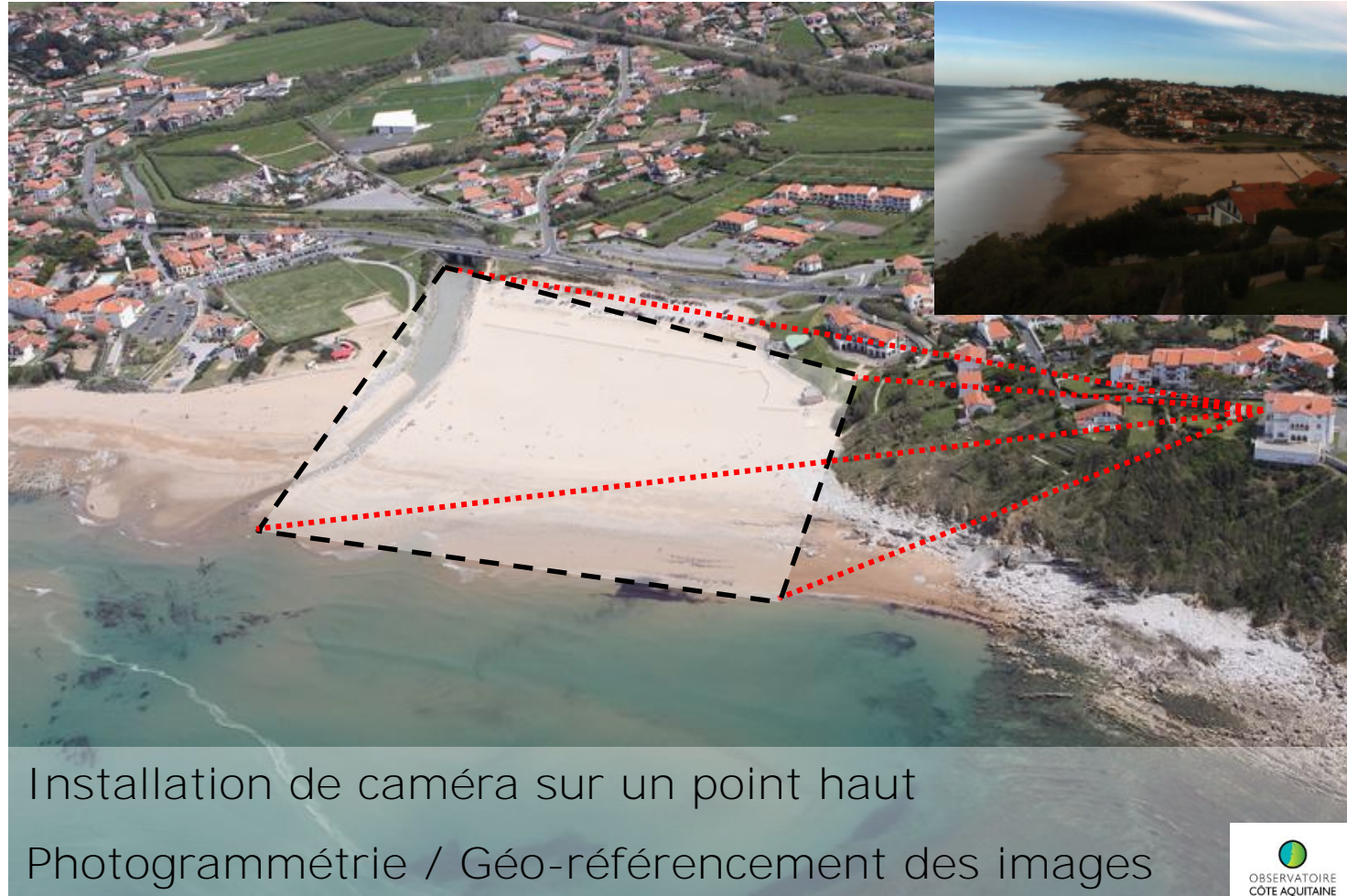


Installation de caméra sur un point haut



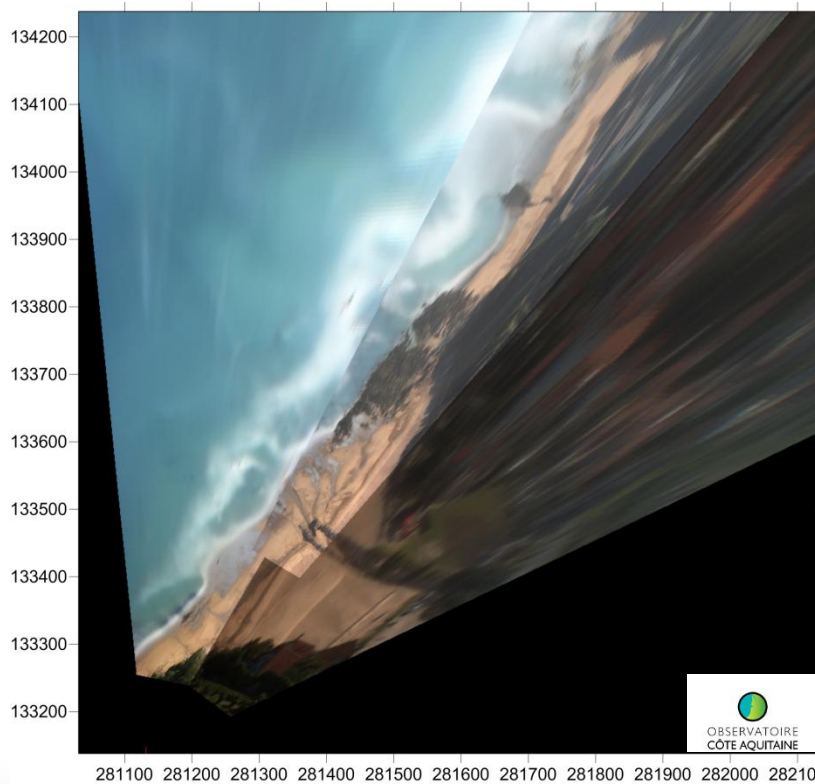
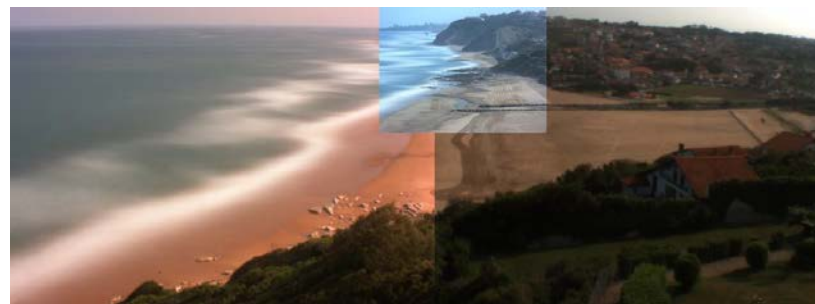


Principe de fonctionnement





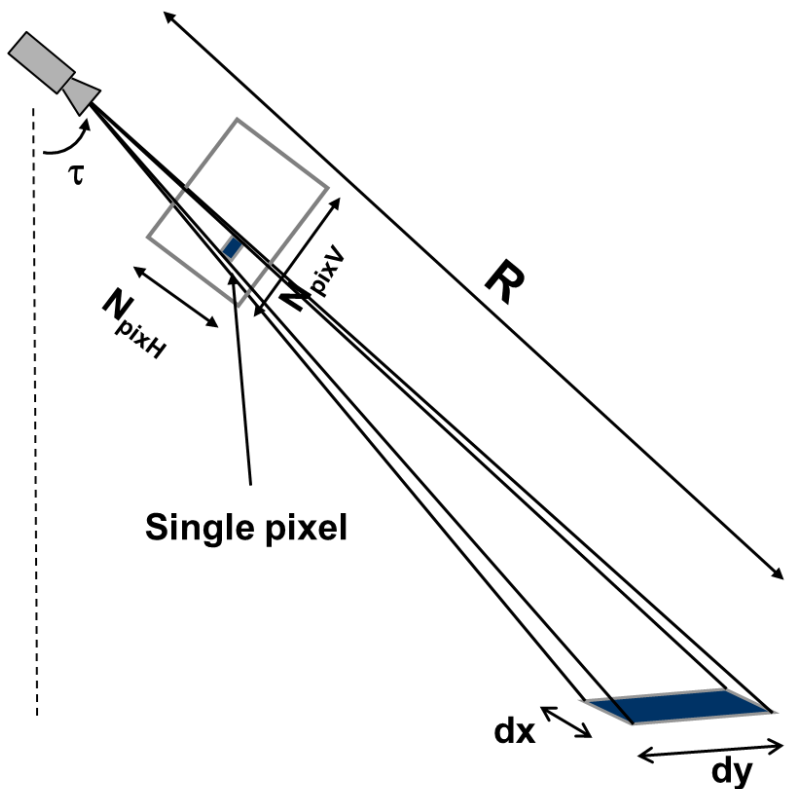
Principe de fonctionnement





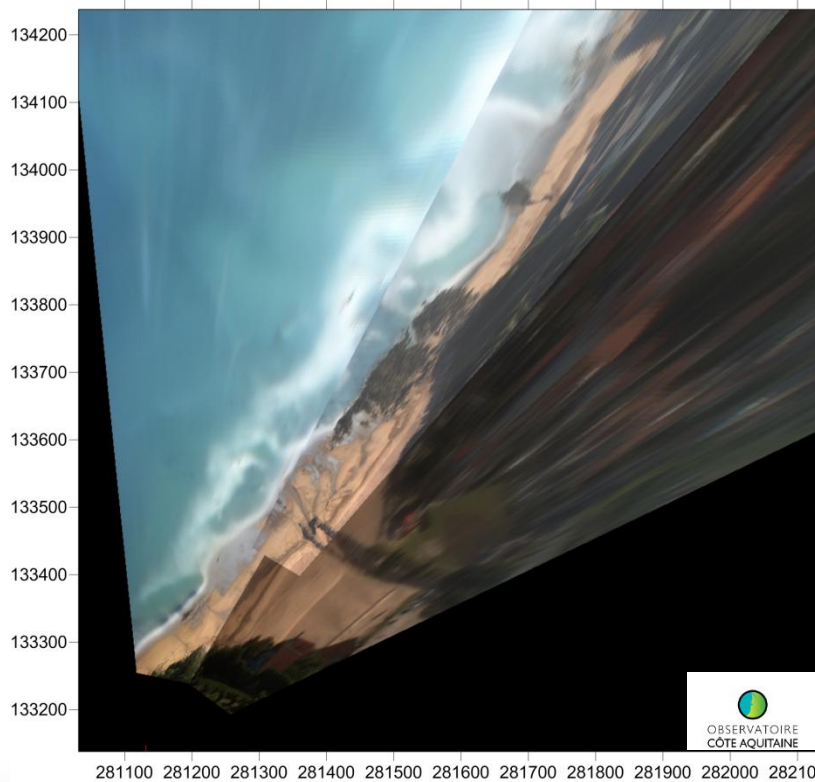
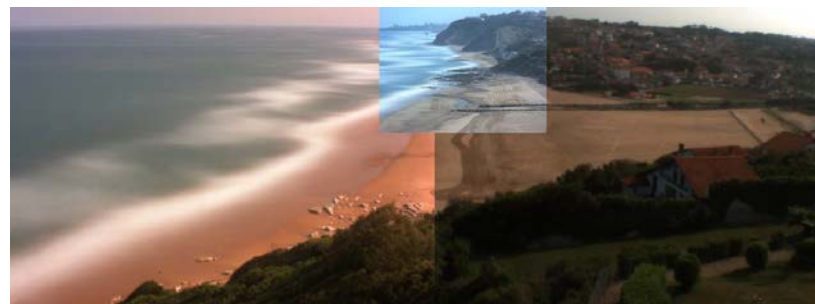
Principe de fonctionnement

Résolution / Précision



$$dx \approx R * \frac{H_{fov}}{N_{pixH}}$$

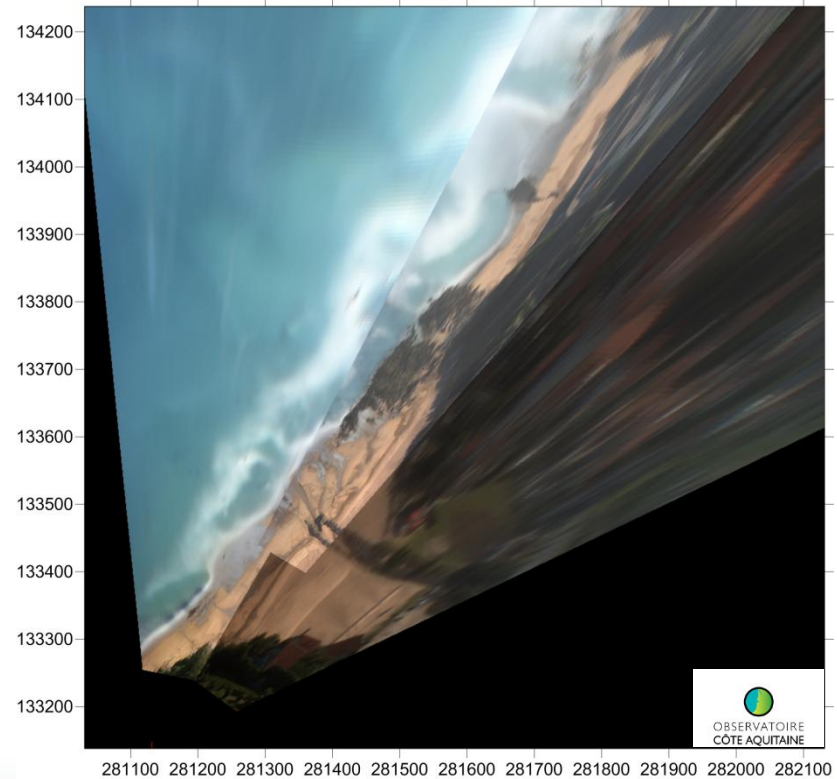
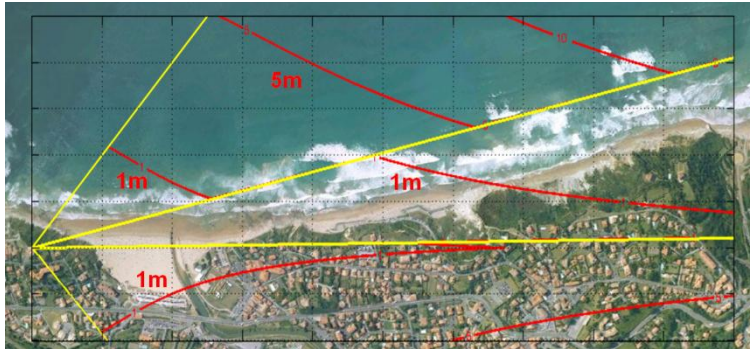
$$dy \approx \frac{R^2 * V_{fov}}{H * N_{pixV}}$$





Principe de fonctionnement

Résolution / Précision

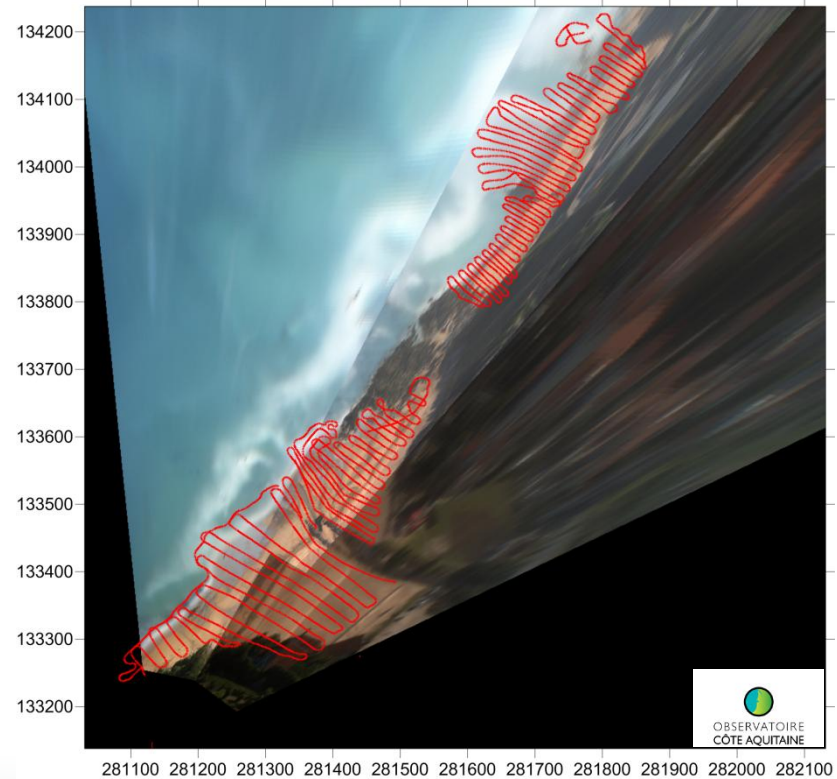
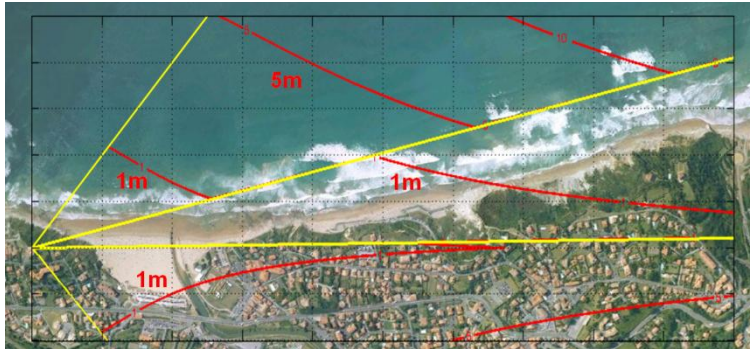


$$dx \approx R * \frac{H_{fov}}{N_{pixH}} \quad dy \approx \frac{R^2 * V_{fov}}{H * N_{pixV}}$$



Principe de fonctionnement

Résolution / Précision



$$dx \approx R * \frac{H_{fov}}{N_{pixH}} \quad dy \approx \frac{R^2 * V_{fov}}{H * N_{pixV}}$$



Systèmes de suivi vidéo opérationnels en France



● VM₄GIS / CASAGEC

● CAM-ERA / UMR EPOC



● ARGUS / BRGM





Systèmes de suivi vidéo opérationnels en France



- VM₄GIS / CASAGEC

- ▣ Collectivités locales :

- ▣ CG 64

- ▣ CG 34

- ▣ Ville de Biarritz,

- ▣ Ville de Capbreton

- ▣ **Ville d'Hendaye**

- ▣ Organismes de recherche :

- ▣ BRGM / OCA

- ▣ UMR EPOC

- ▣ UMR M2C



Systèmes de suivi vidéo opérationnels en France

VM₄GIS / CASAGEC

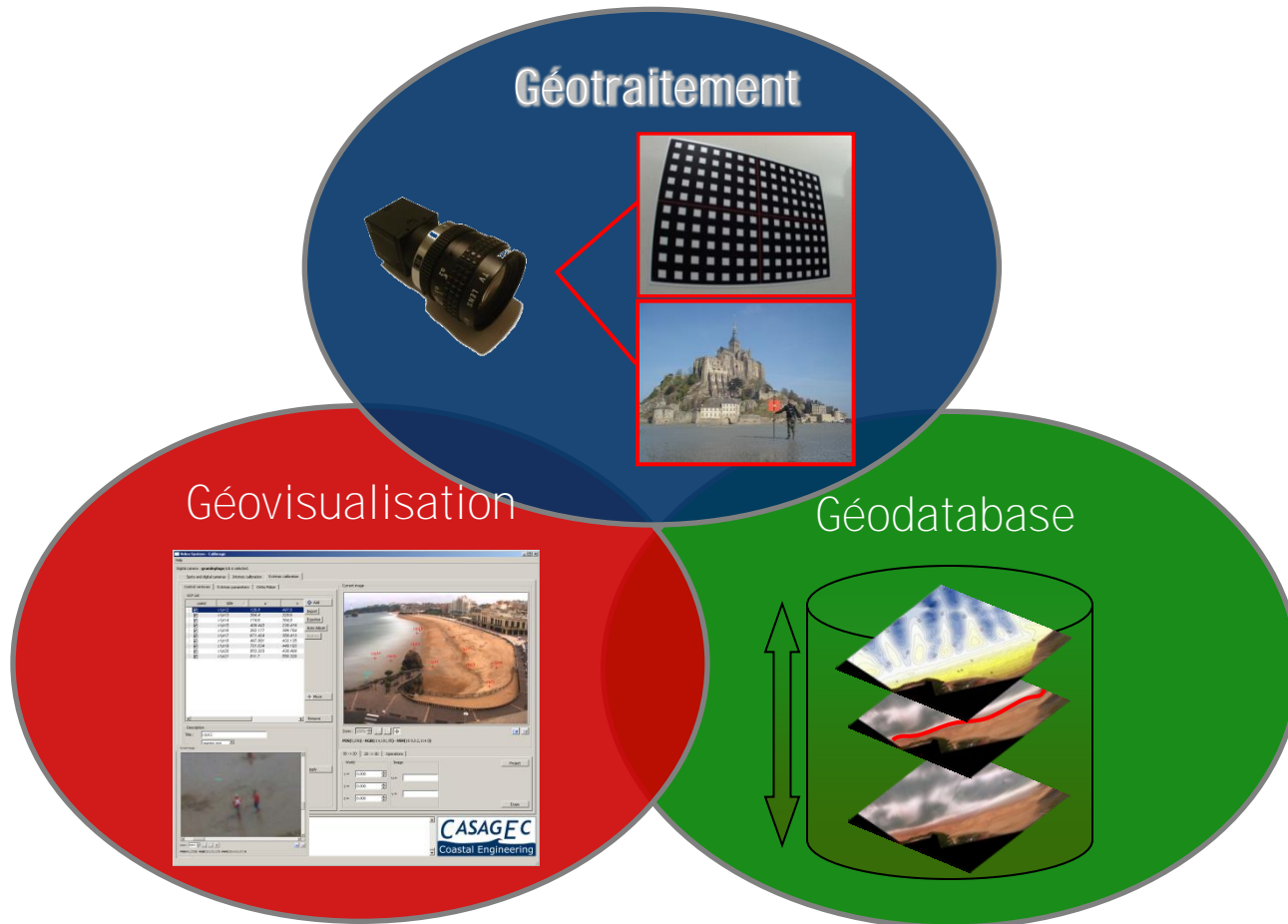
- 13 Stations Opérationnelles
- 43 Caméras en activité
- 12 Lignes téléphoniques
- Gestion a distance du parc
- Affichage temps réel sur Site Web





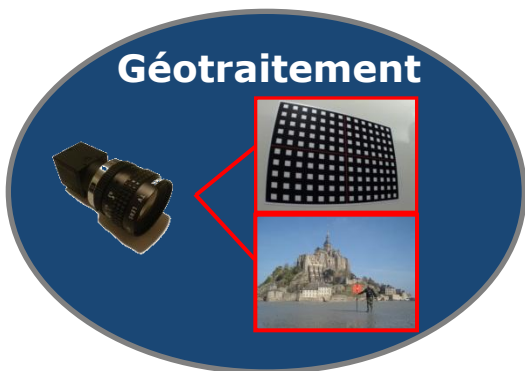
Structuration de *VM₄GIS*

Trois volets

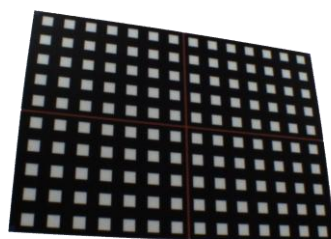




Structuration de *VM₄GIS*



Géotraitement
OpenCV - Intel®



BD paramètres
Optiques / Géographiques



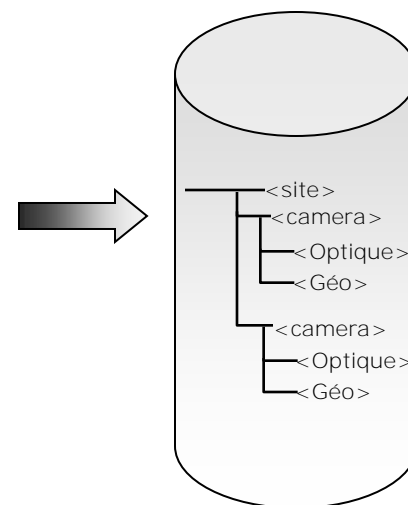
Installation

Paramètres
Optiques

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Paramètres
Géographiques

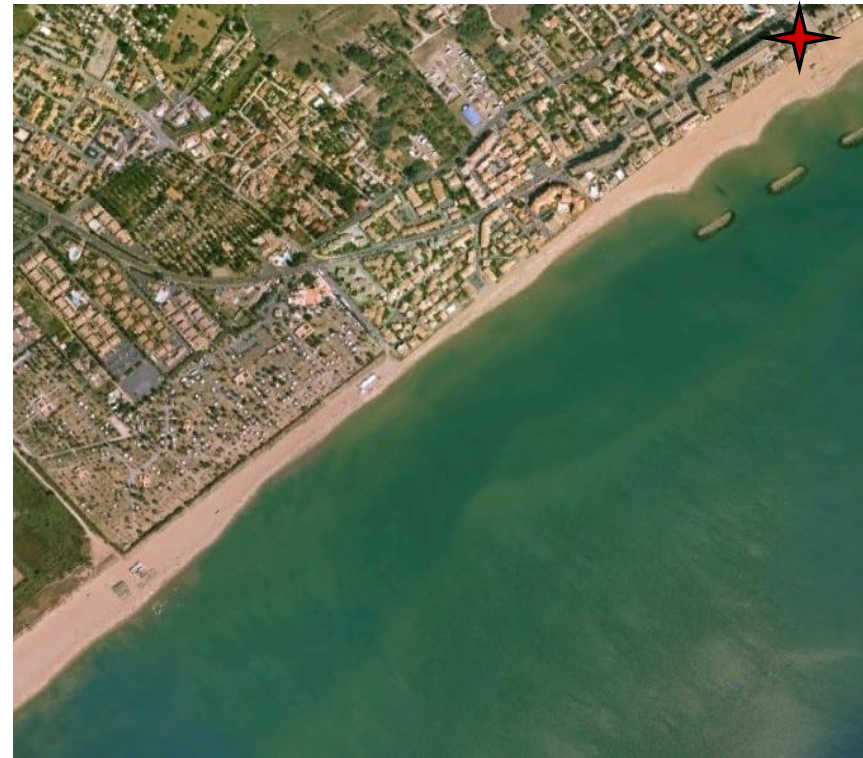
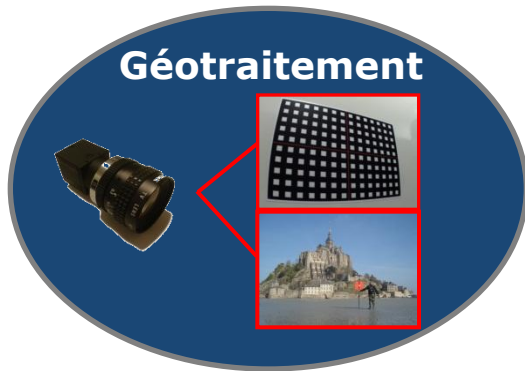




Structuration de *VM₄GIS*

Géotraitement

DE L'IMAGE A LA MESURE ...

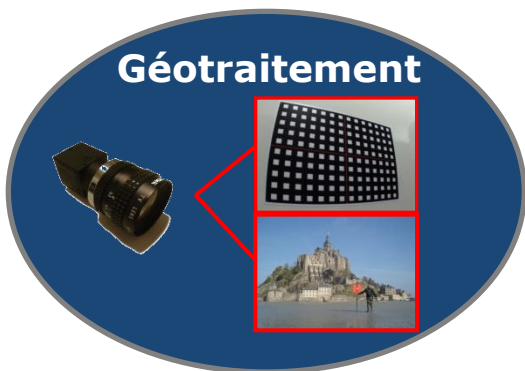




Structuration de *VM₄GIS*

Géotraitement

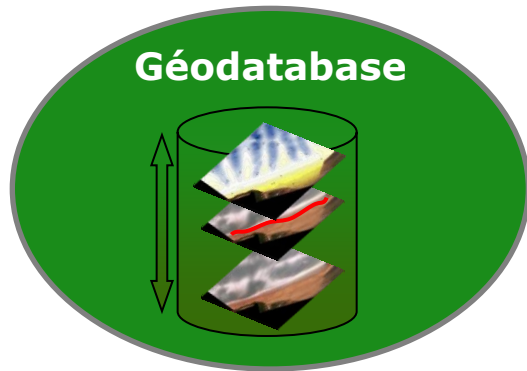
DE L'IMAGE A LA MESURE ...



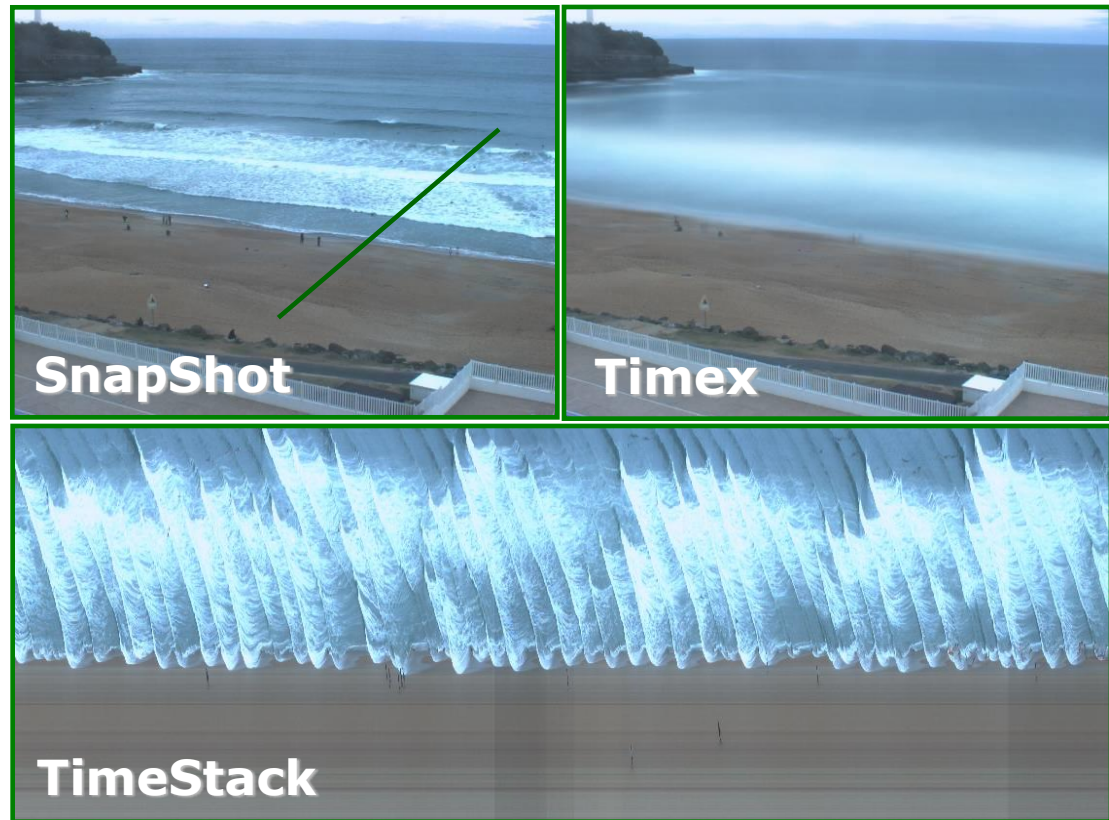


Structuration de *VM₄GIS*

Géodatabase IMAGES VIDEO

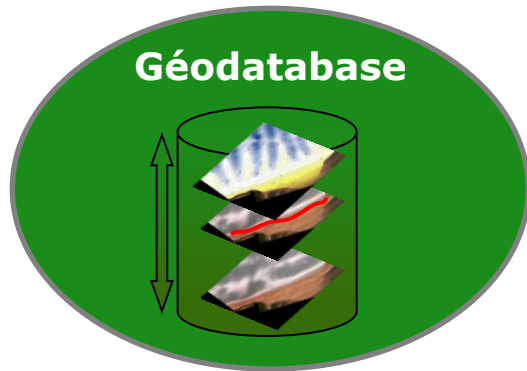


**Données Vidéo
Brutes
Récoltées**

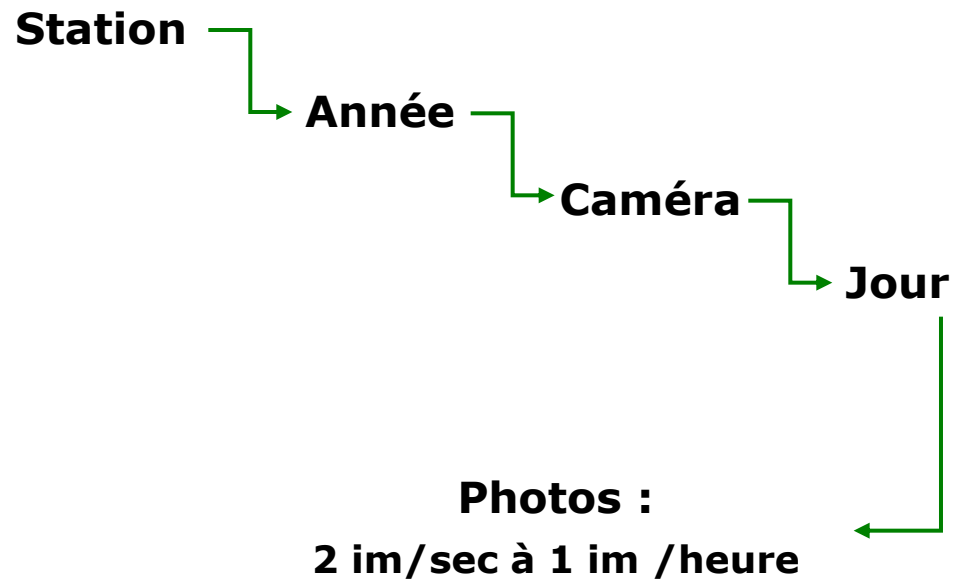




Structuration de *VM₄GIS*



Géodatabase
IMAGES VIDEO

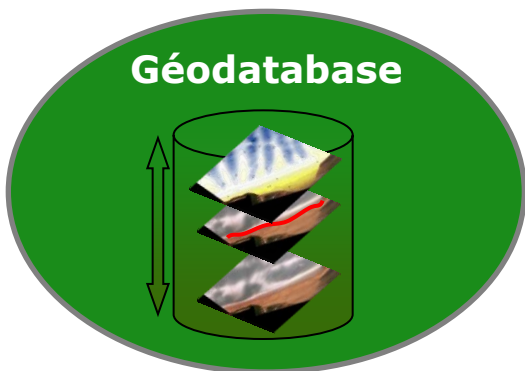




Structuration de *VM₄GIS*

Géodatabase

DONNEES OCEANOGRAPHIQUE

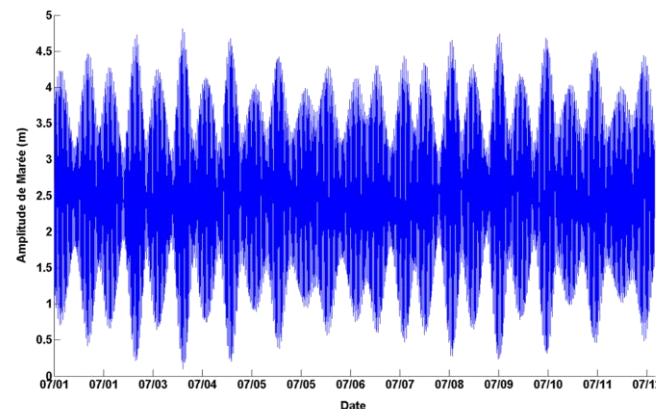
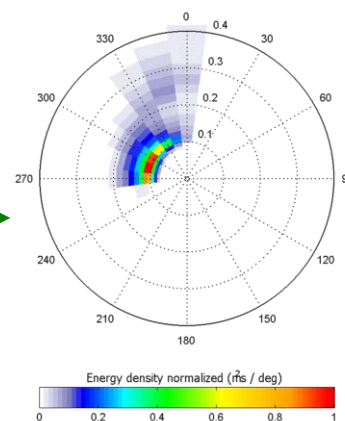


Données VIDEO

Données OCEANO

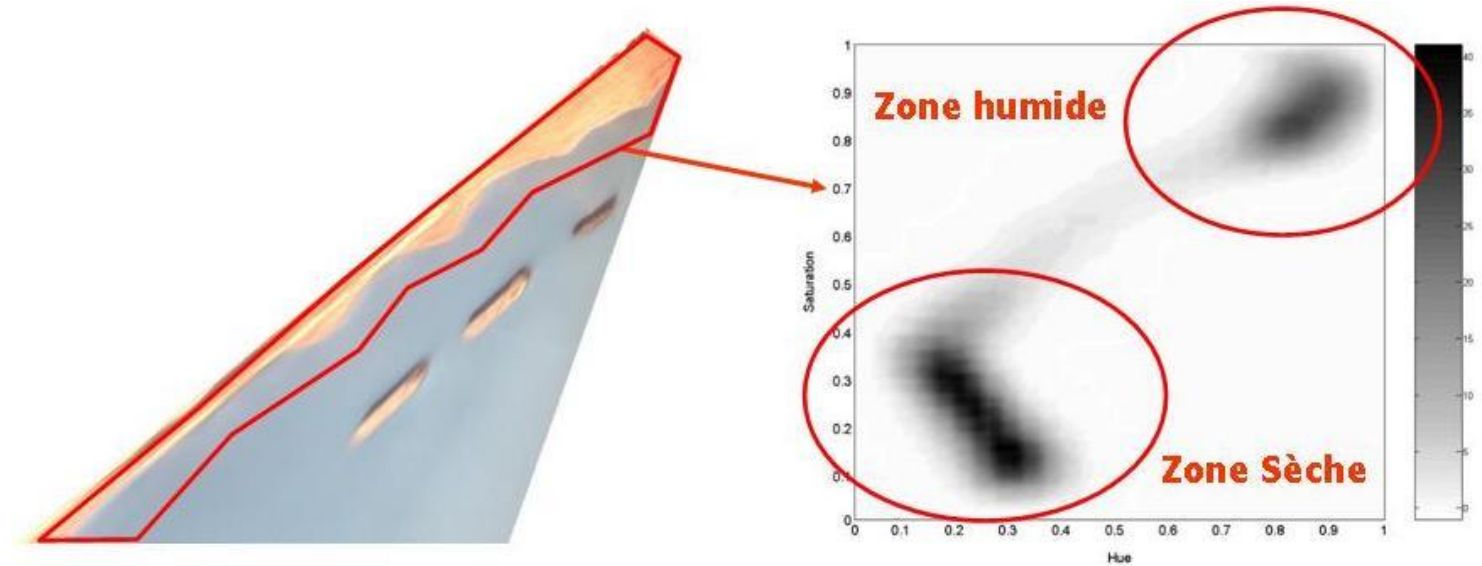
Données HOULE

Données MAREE



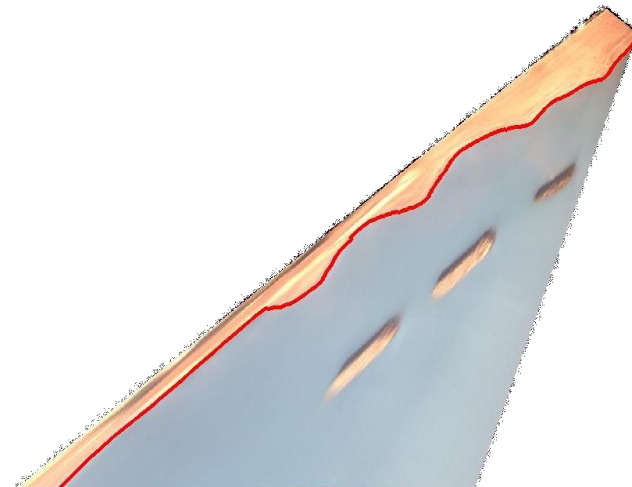


Application : Suivi du trait de côte



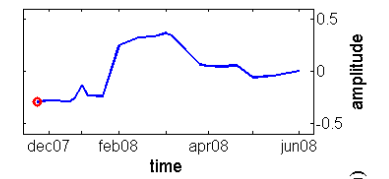
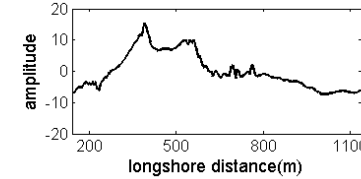
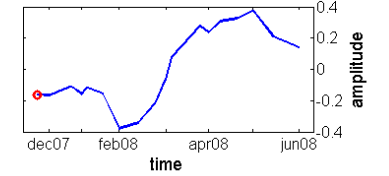
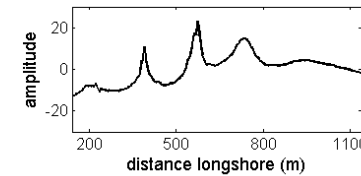
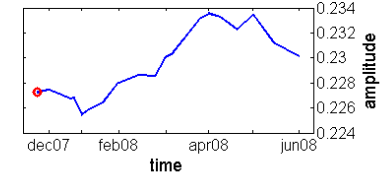
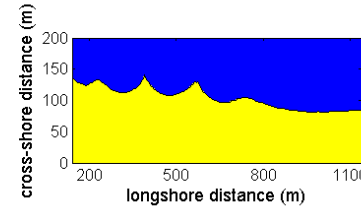
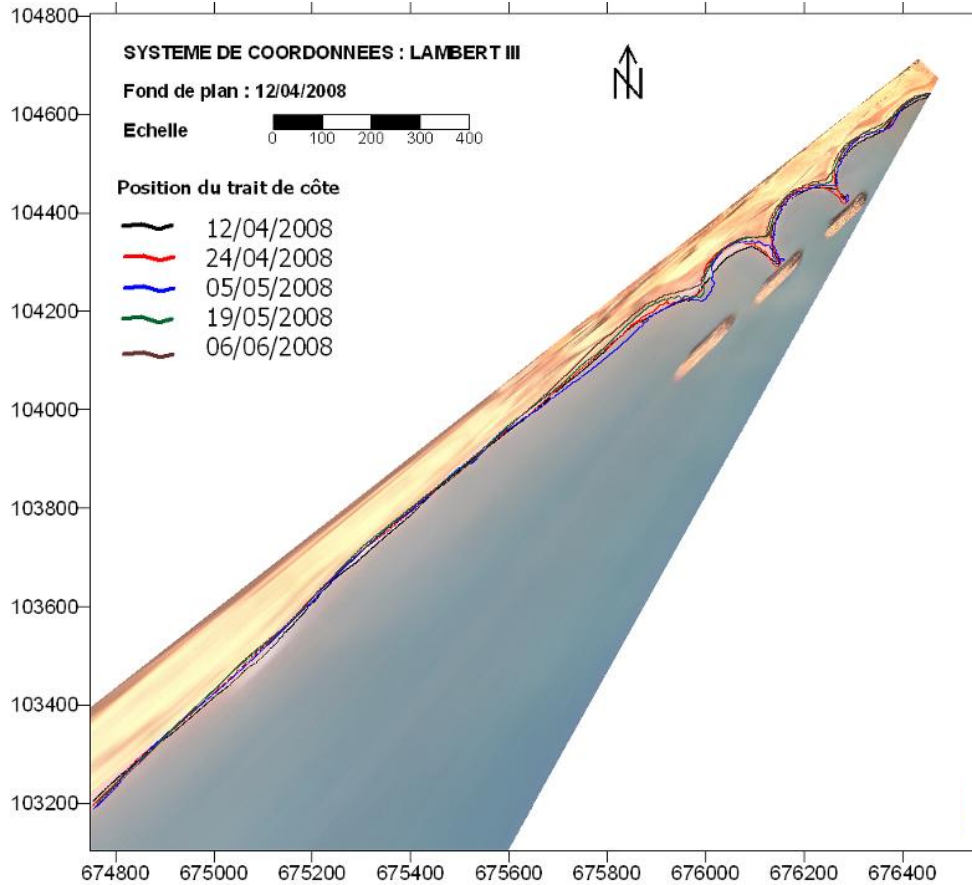
- Sélection d'une Région d'Interret (RI)
- Algorithme de segmentation (K-mean)
- transformation de la RI en binaire
- Détection de Contour (SOBEL)

(Morichon et al., 2008; Dailloux, 2008)

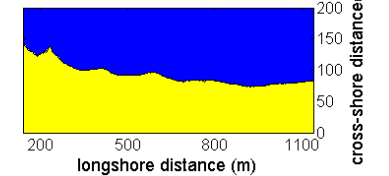




Application : Suivi du trait de côte



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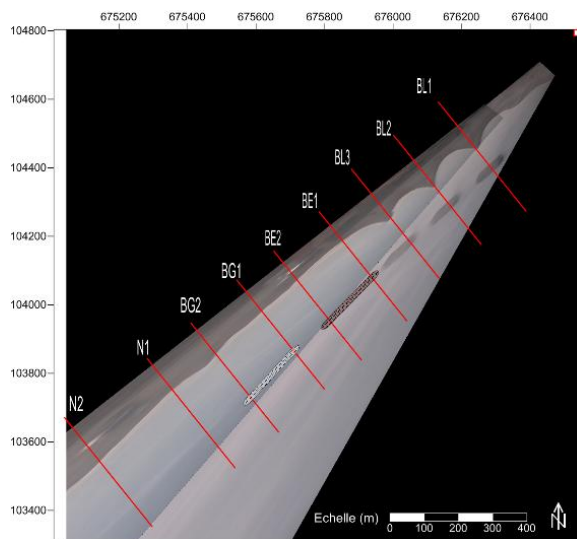
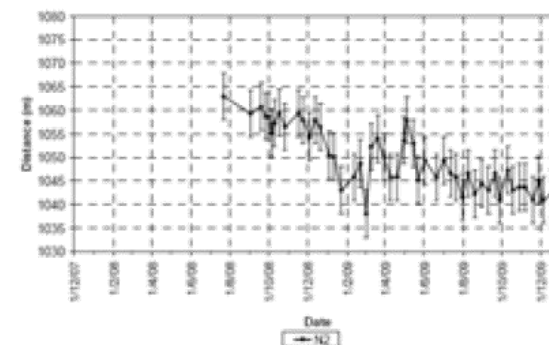
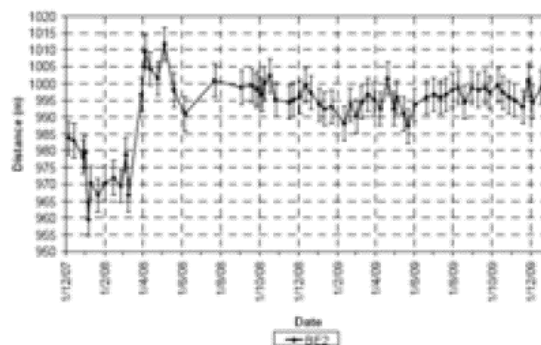
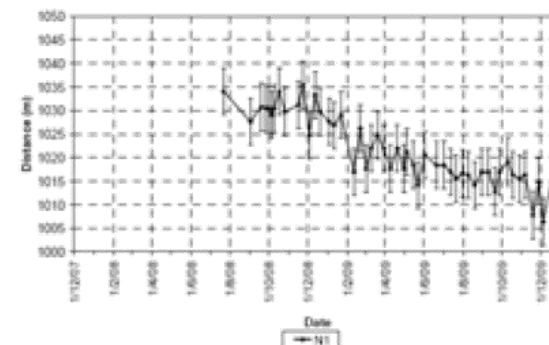
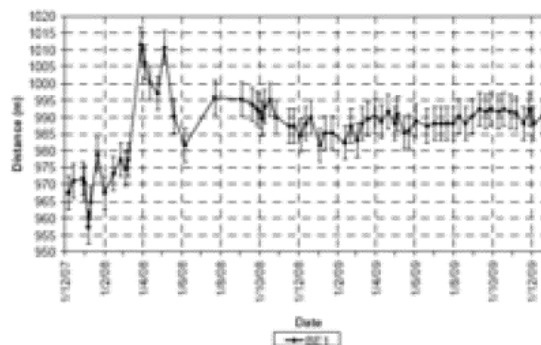


ICS Lisbonne 2009 (*Rihouey et al., 2009*)

JNGC 2008 (*Gaufres et al., 2008*)



Application : Suivi du trait de côte



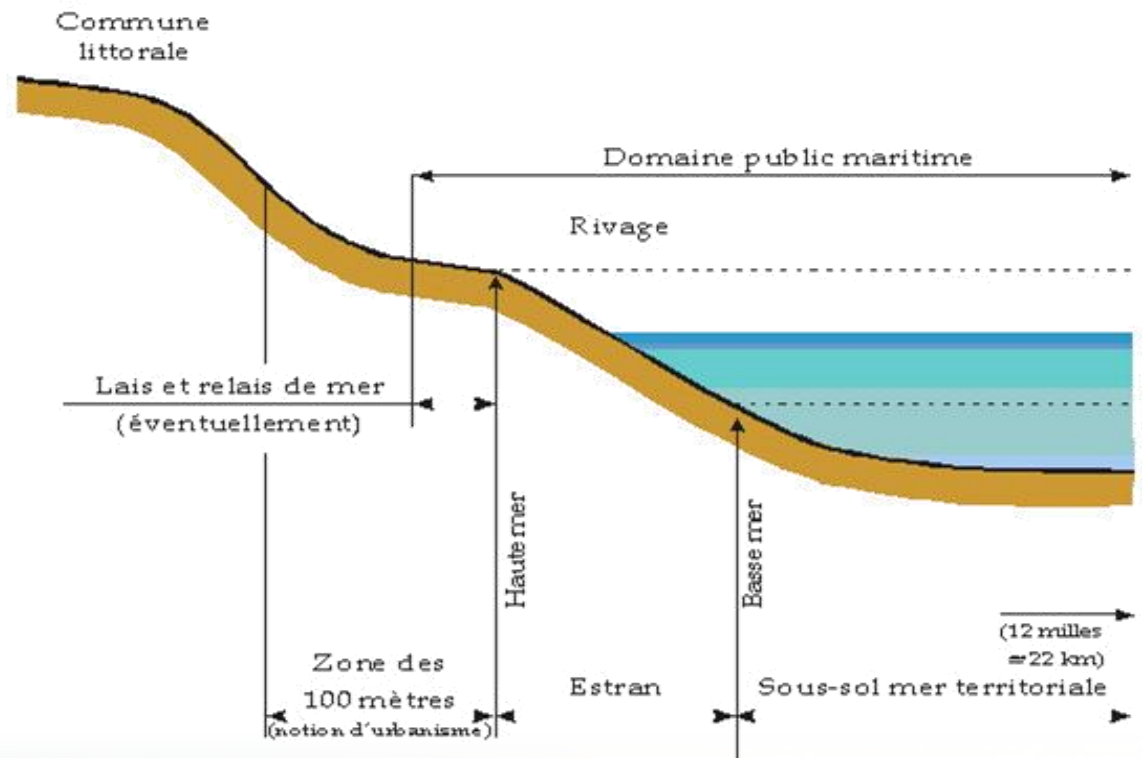
JNGC Sables d'Olonnes 2010 (*Mazeiraud et al., 2010*)



Application : Délimitation du Domaine Public Maritime

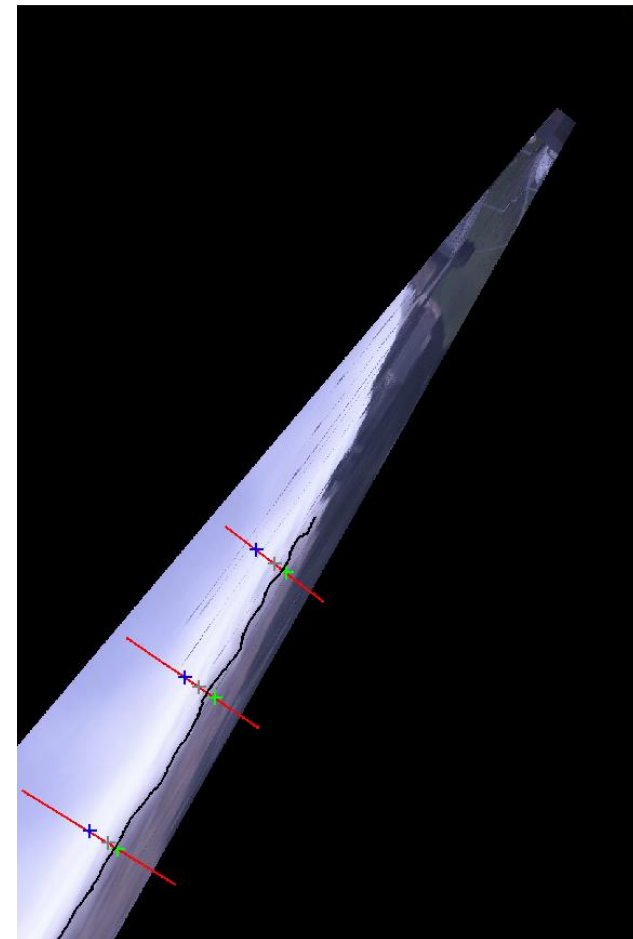
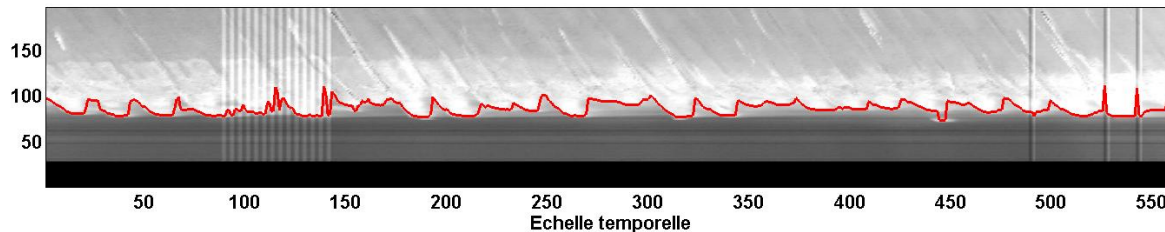
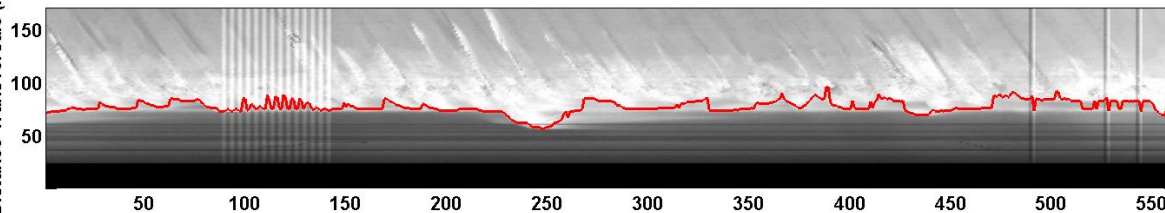
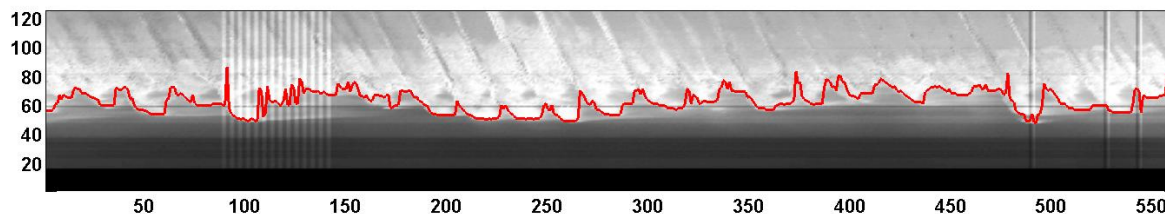
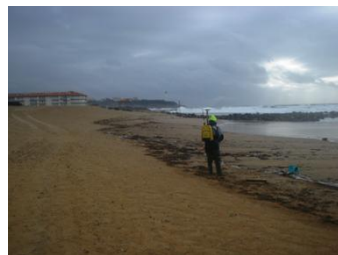
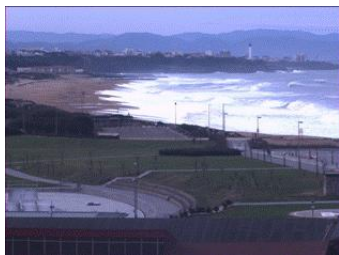
Le DPM naturel est constitué :

- du sol et du sous-sol de la mer, compris entre la limite haute du rivage, c'est-à-dire celles des plus hautes mers en l'absence de perturbations météorologiques exceptionnelles, et la limite, côté large, de la mer territoriale,
- des lais (parcelles dont la mer s'est définitivement retirée) et relais (dépôts alluvionnaires) de la mer



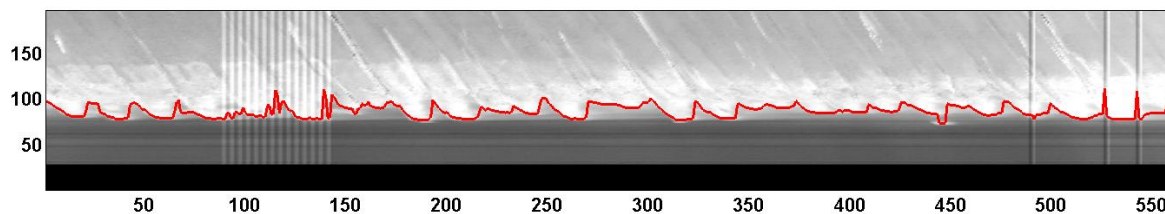
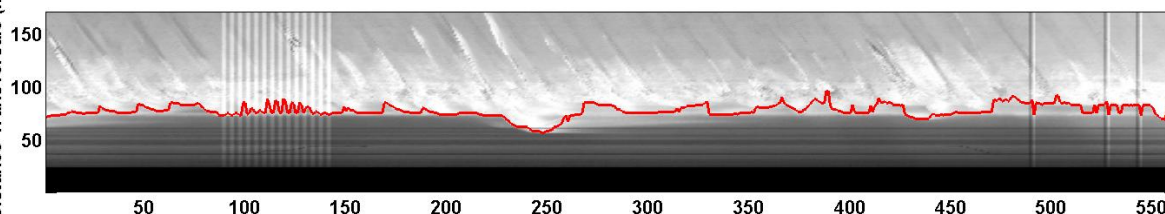
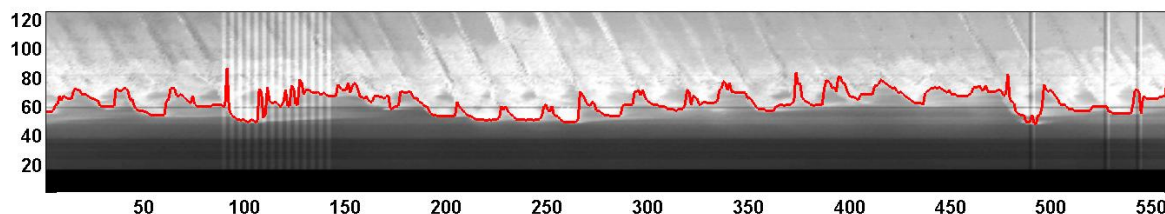
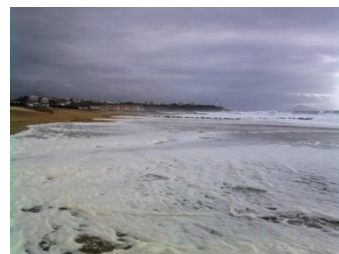
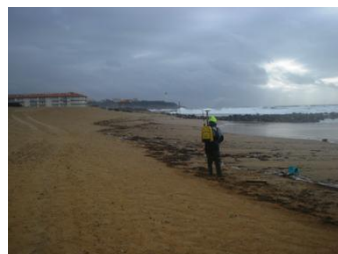


Application : Délimitation du Domaine Public Maritime



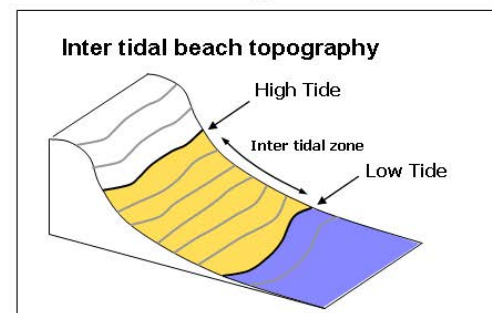
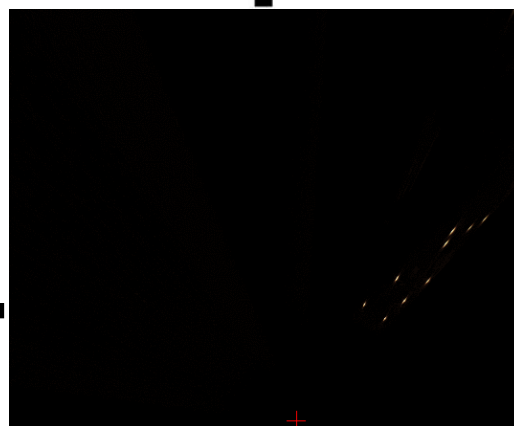
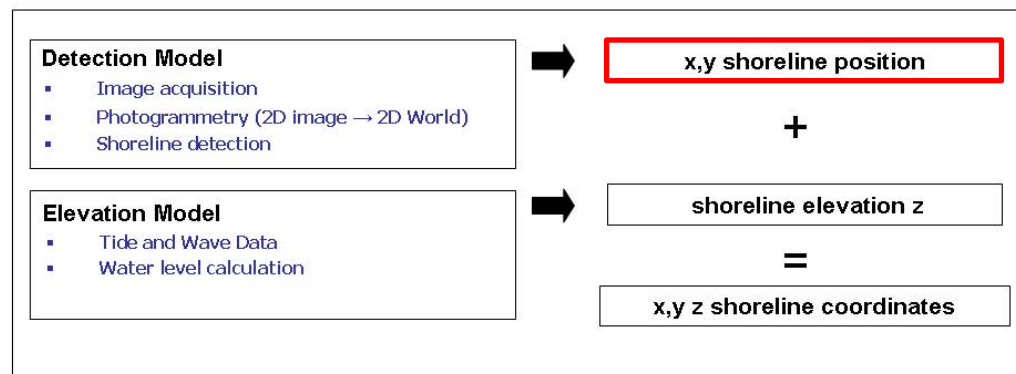
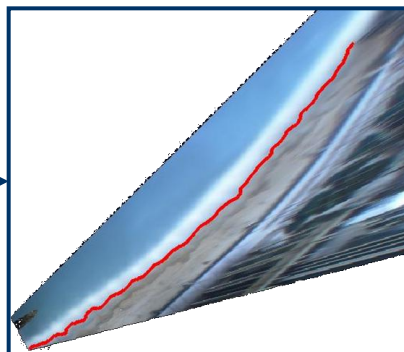
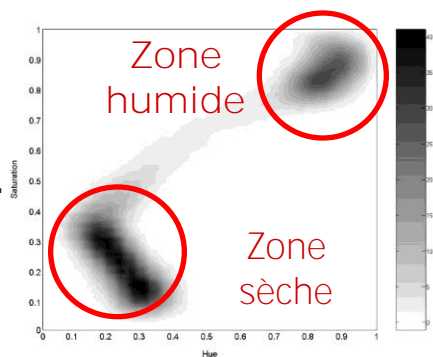
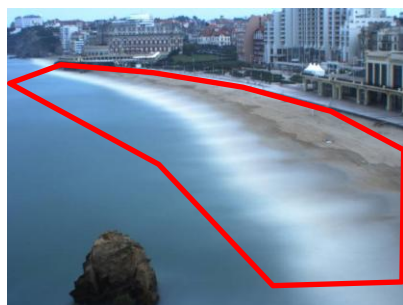


Application : Délimitation du Domaine Public Maritime



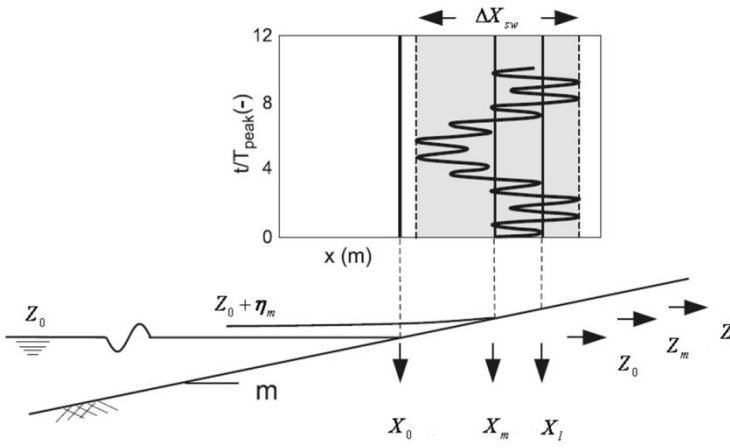


Application : Topographie Intertidale



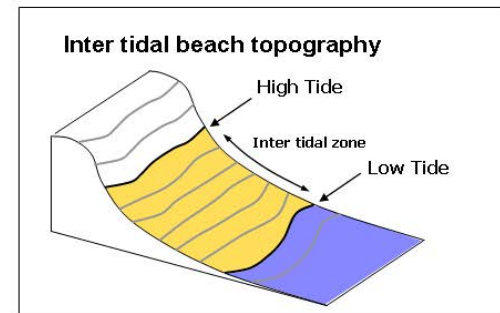
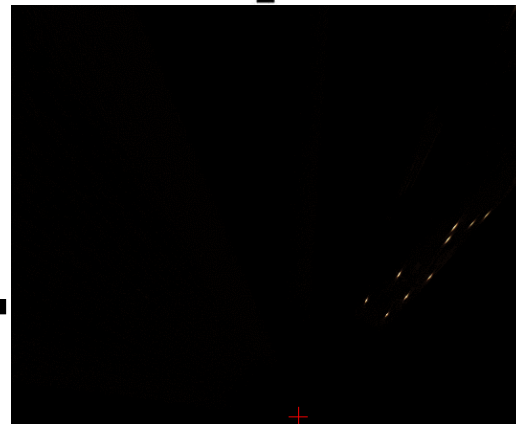
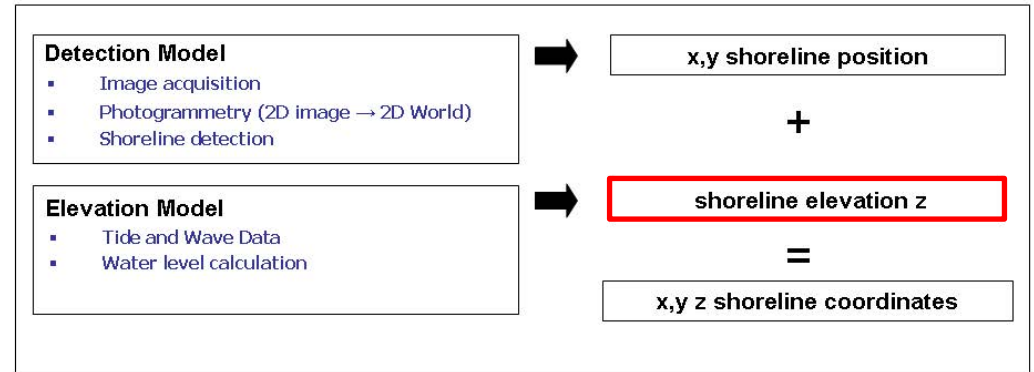


Application : Topographie Intertidale



Aarninkhof et al. 2003

$$Z_l = Z_0 + \eta_m + K_{sw} \frac{\eta_{sw}}{2}$$





Application : Topographie Intertidale

Modèle d'élévation : Setup

$$\eta_m = 0.45 * \xi_0 * H_0$$

Holman et Sallenger (1985)

Modèle d'élévation : Swash

$$\eta_{sw} = \sqrt{R_{ig}^2 + R_{ss}^2}$$

→ Sea Swell Swash
 Holman et Sallenger (1985)
 → Infragravity Swash
 Ruessink et al. (1998)

$$\left\{ \begin{array}{l} \frac{R_{ss}}{H_0} = 0.69\xi_0 - 0.19 \quad \text{Pour } \xi_0 > 0,275 \\ \frac{R_{ss}}{H_0} = 0 \quad \text{Pour } \xi_0 < 0,275 \end{array} \right.$$

$$\frac{R_{ig}}{H_0} = 0.65 \tanh(3.38\xi_0)$$

H_0 : hauteur significative de la houle au large

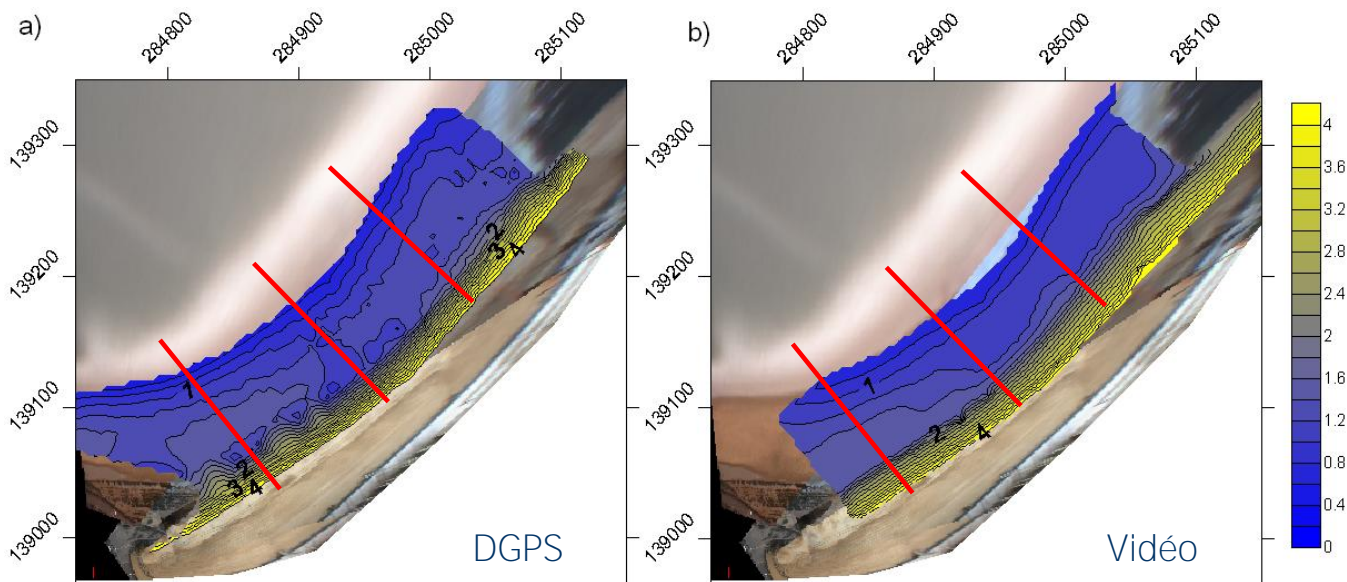
ξ_0 : Nombre d'Irribaren

$$\xi_0 = \frac{m}{\left(\frac{H_0}{L_0}\right)^{\frac{1}{2}}}$$

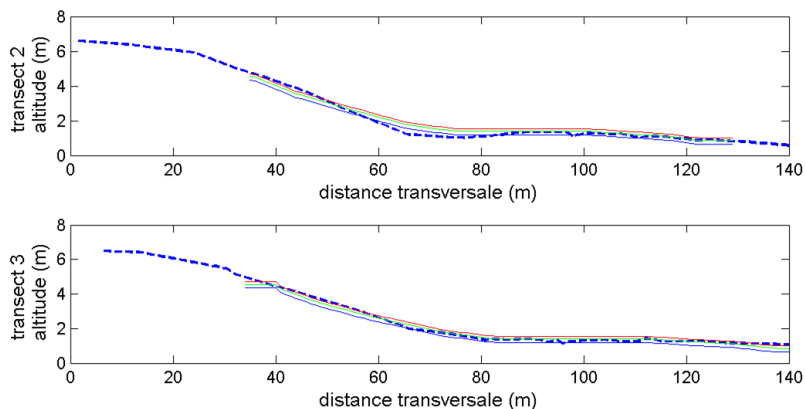
H_0 : Données WW3 / L_0 : Données WW3 / m : Mesure vidéo



Application : Topographie Intertidale



VS





Application : Topographie Intertidale



VS

ERMS (m)

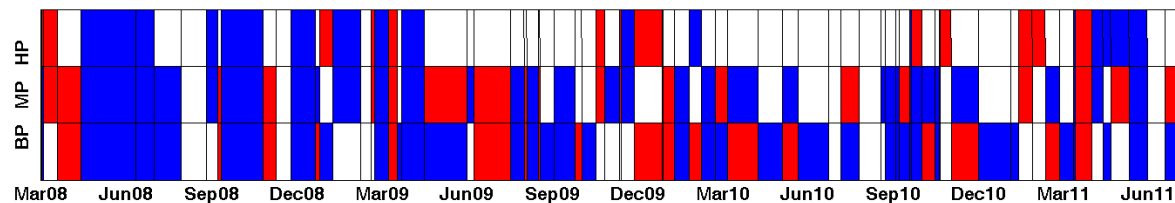
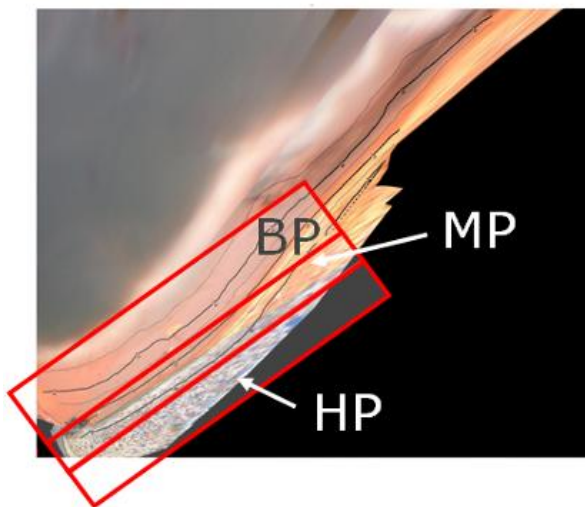
Adour	VVF	Grande Plage	CdB	Milady	Ilbarritz
0.67	0.46	0.49	0.29	0.52	0.46

JNGC Sables d'Olonne 2010 (*Dailloux et al., 2010*)





Application : Topographie Intertidale

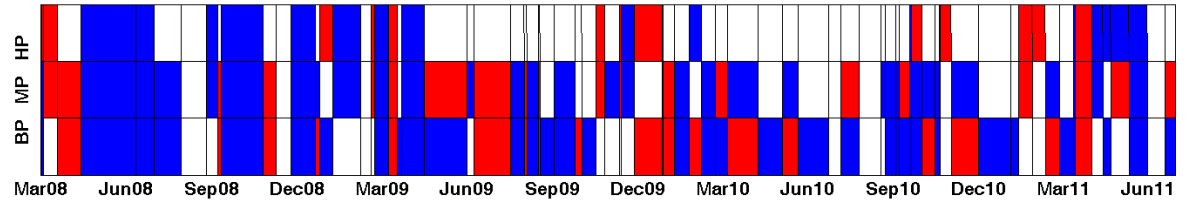
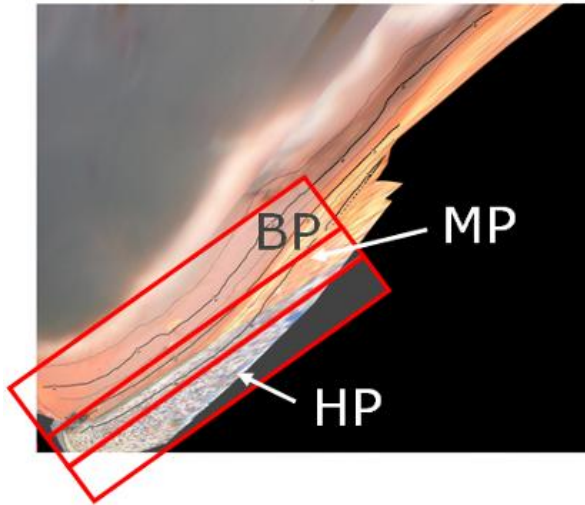


- ☑ Alternance de phases d' Erosion / Accrétion
- ☑ Déséquilibre en haut de haut de plage
- ☑ Nécessité d'intervention de reprofilage
 - ☑ Ensablement de la promenade
 - ☑ Obturation des déversoirs d'Orage
 - ☑ Affleurement rocheux
 - ☑ « Utilisation » balnéaire de la plage





Application : Topographie Intertidale

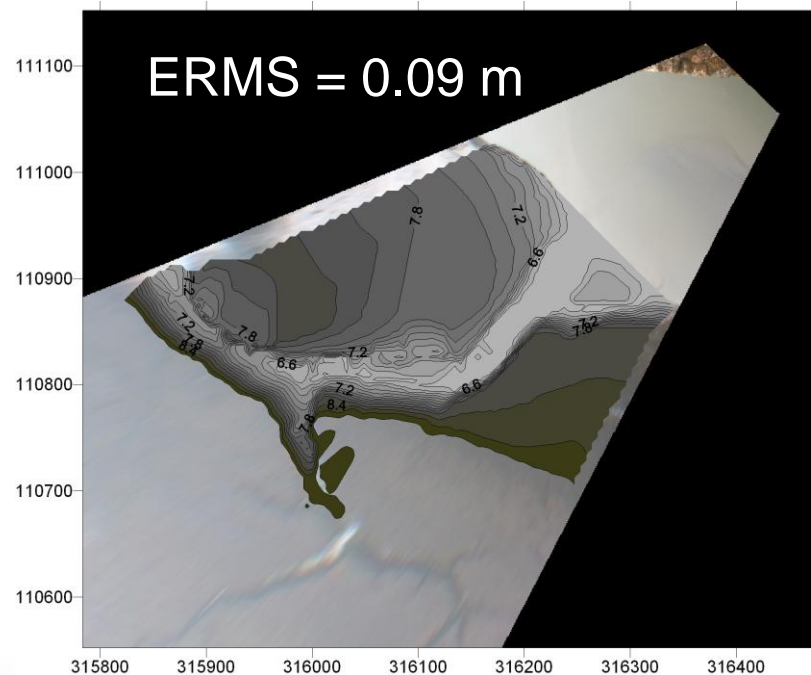
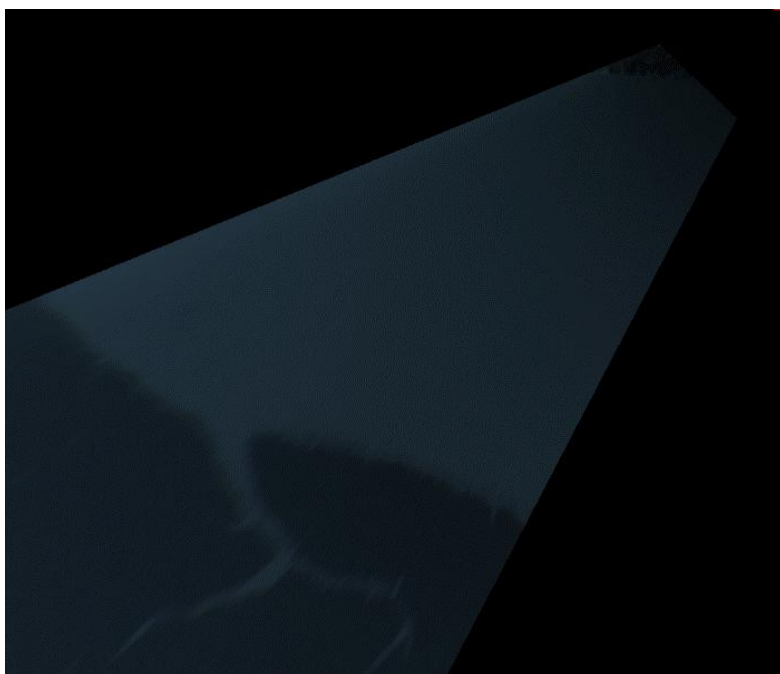
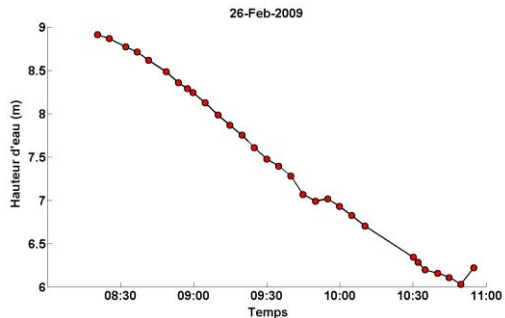


- ☑ Alternance de phases d' **Erosion** / **Accrétion**
- ☑ Déséquilibre en haut de haut de plage
- ☑ Nécessité d'intervention de reprofilages
- ☑ Gestion proactive des reprofilages



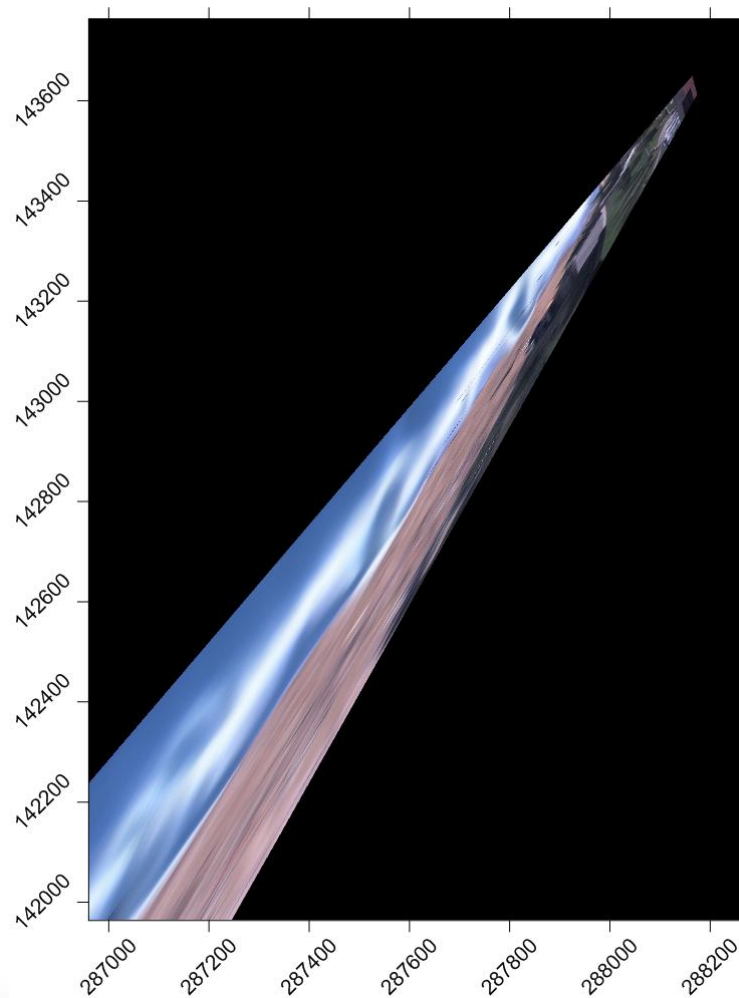


Application : Topographie Intertidale



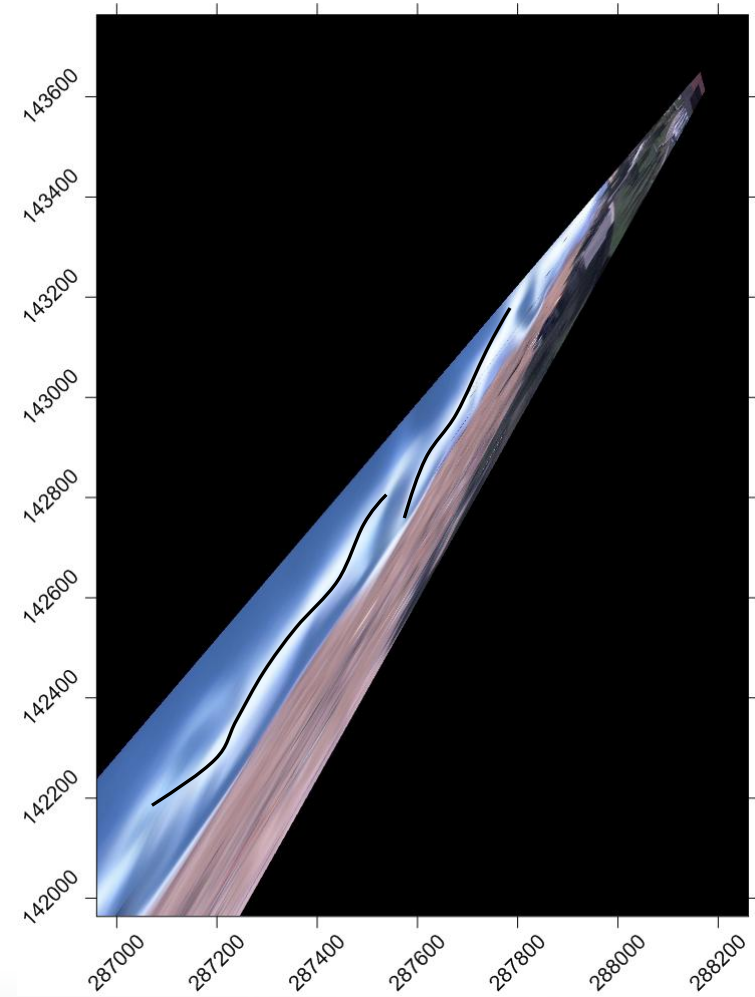


Application : Morphologies sédimentaire – Sécurité des zones de bain



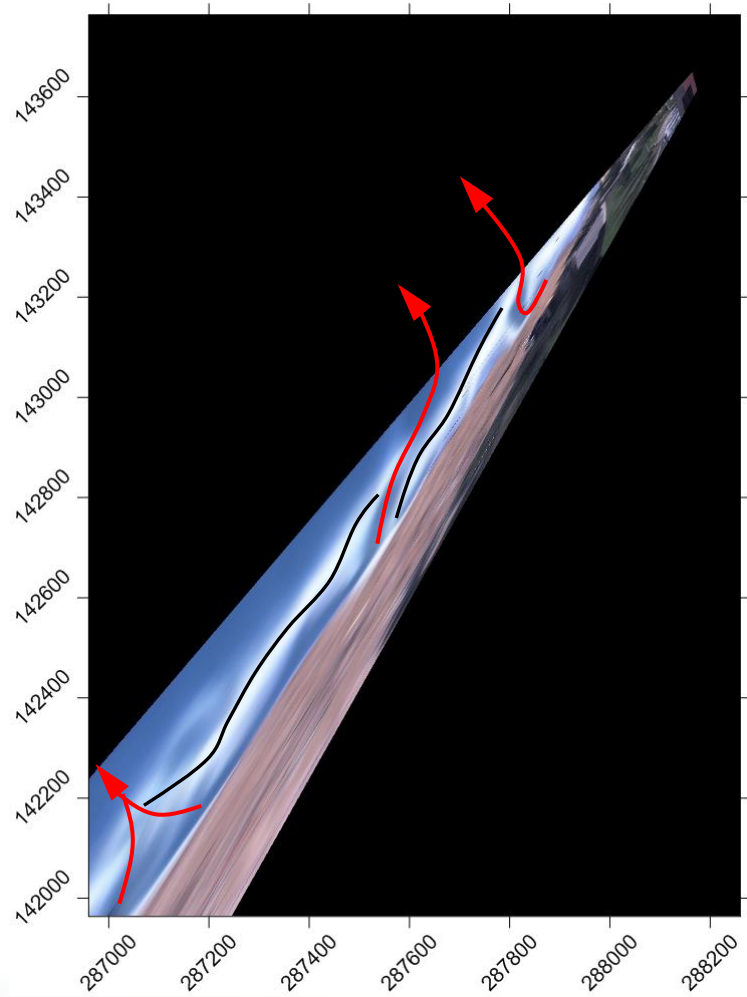


Application : Morphologies sédimentaire – Sécurité des zones de bain



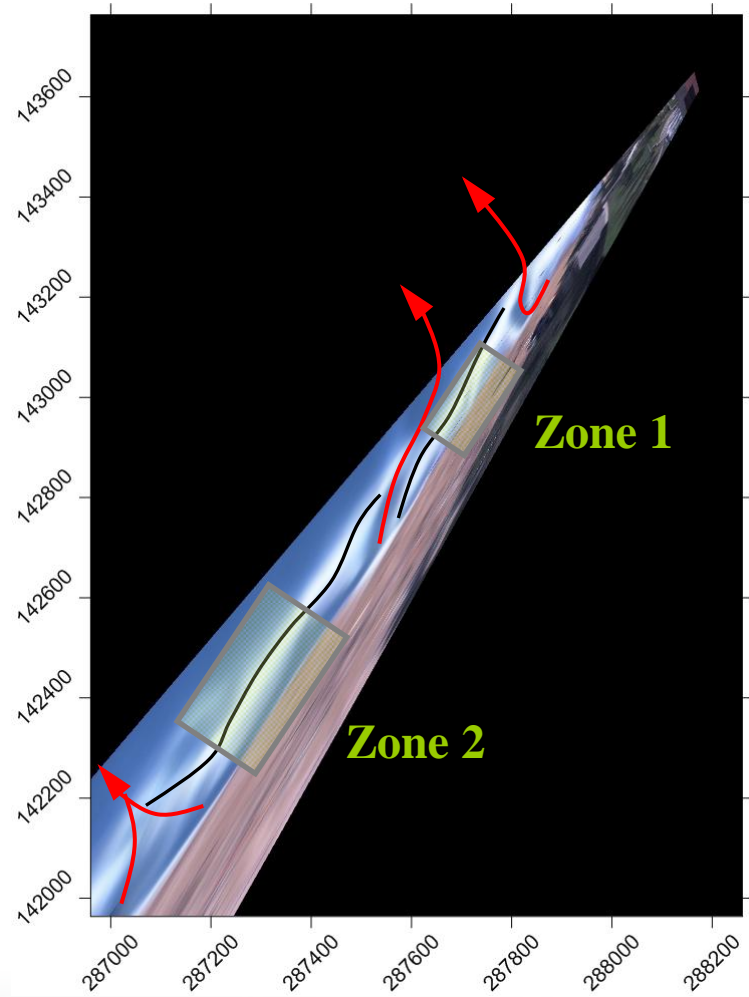


Application : Morphologies sédimentaire – Sécurité des zones de bain



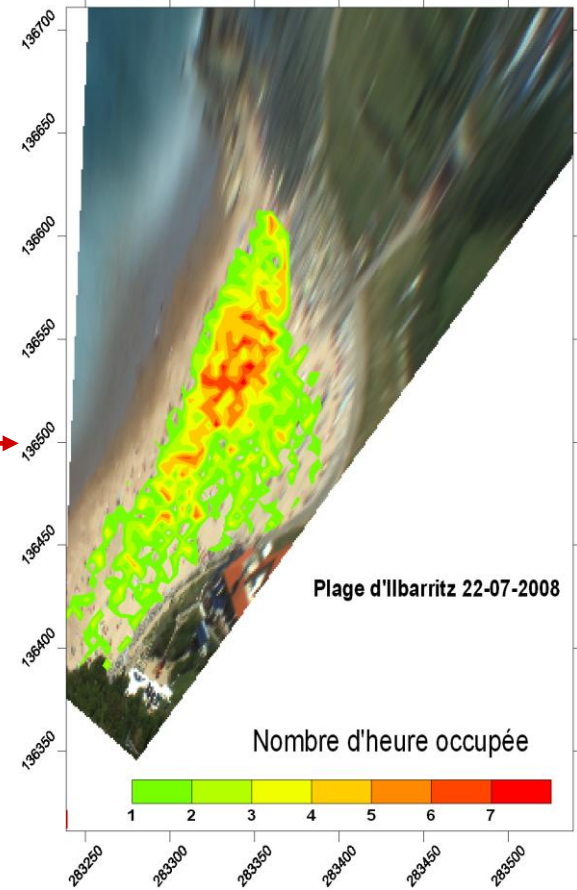
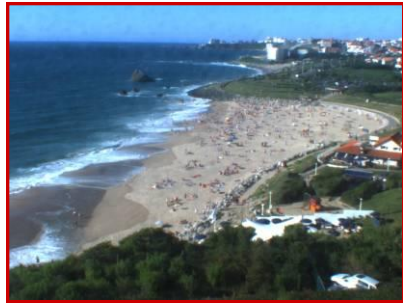


Application : Morphologies sédimentaire – Sécurité des zones de bain



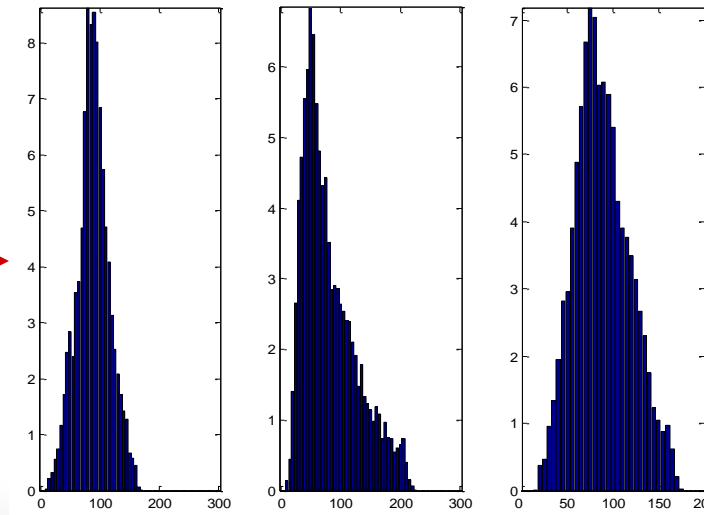
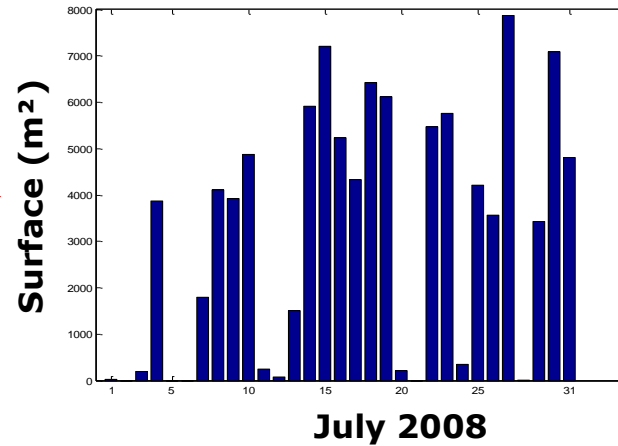
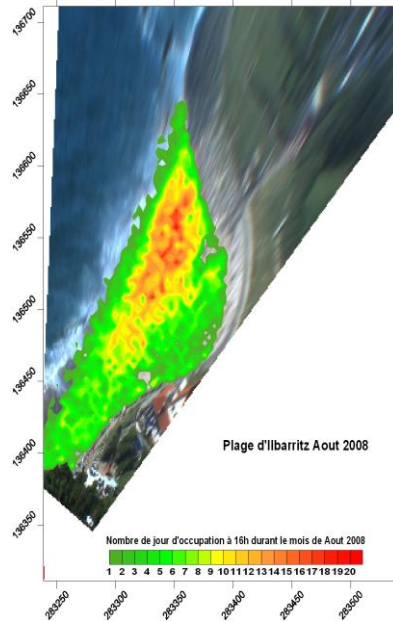


Application : Fréquentation de plage



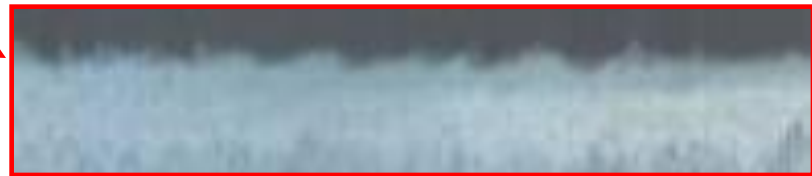
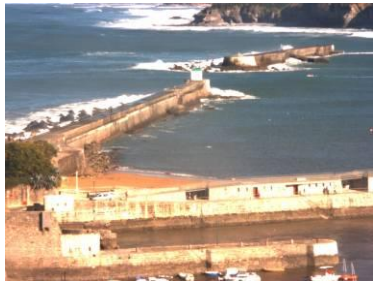


Application : Fréquentation de plage





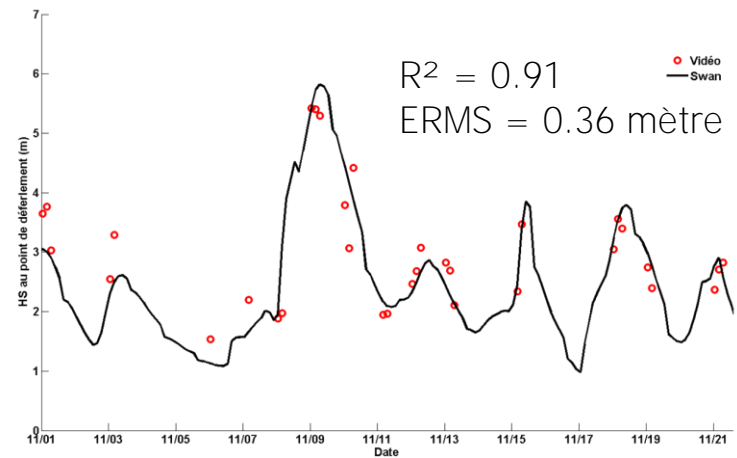
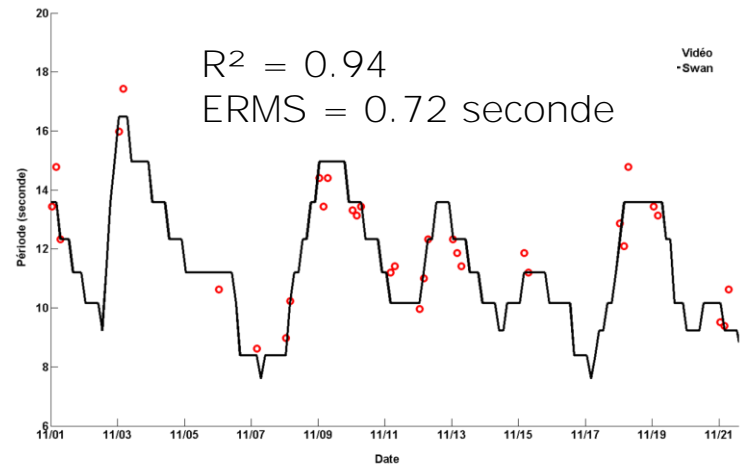
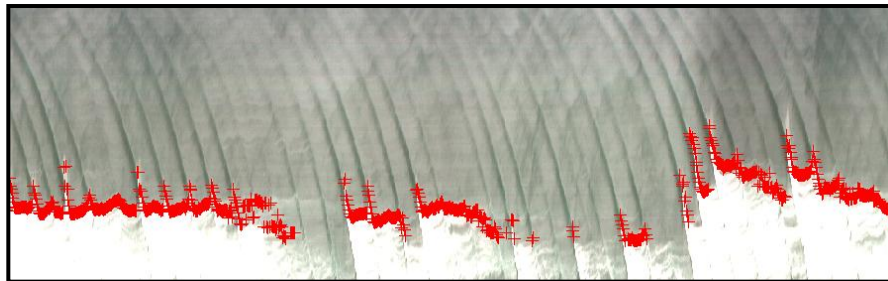
Application : Houlographe vidéo



Coût Stockage < 2.5 Mo
Transfert quasi-instantané

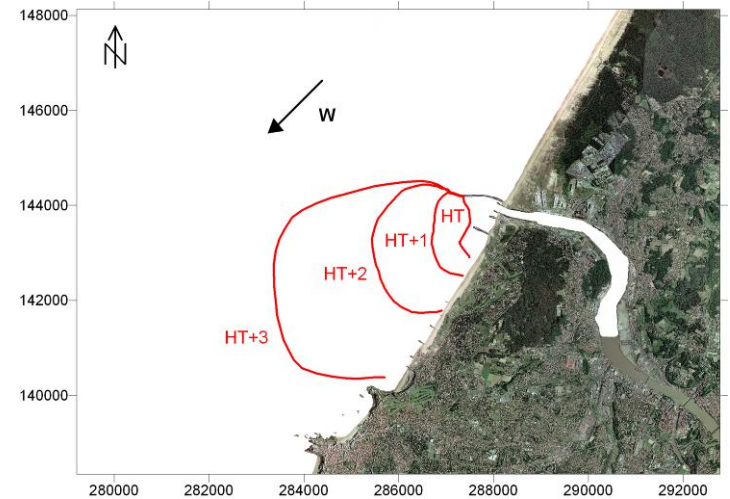


Application : Houlographe vidéo





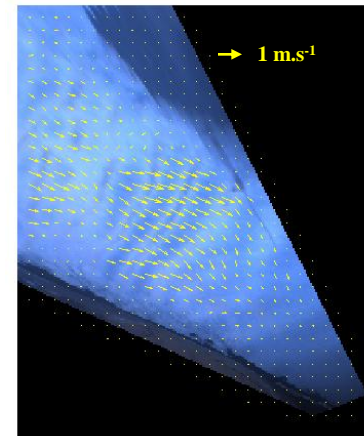
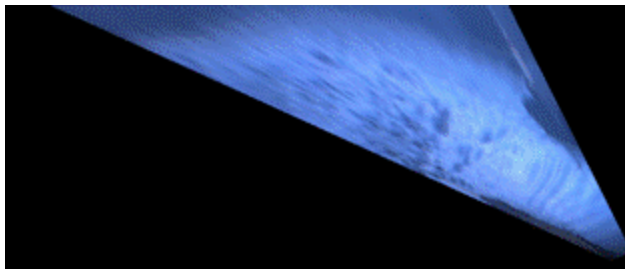
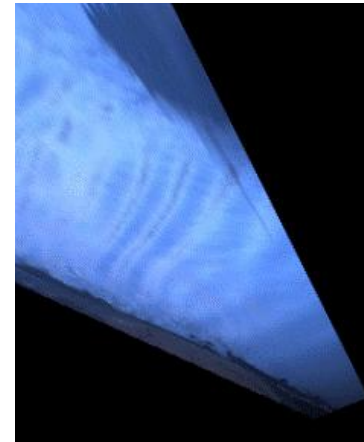
Application : Suivi de panaches turbides



📖 **Thèse de Doctorat** : Suivi du Panache de l'Adour (*Dailloux, 2008*)



Application : Mesure des courants de surface





Conclusion

Les +

- ☑ Les systèmes vidéo fournissent de l'information quantitative à haute fréquence
- ☑ Large spectre **d'application / compréhension des processus**
- ☑ Coût relativement faible
 - ☑ 25 à 30 k€ : équipements / installations / licences
 - ☑ 3 à 5 k€ / an : réseaux, archivage, maintenance
- ☑ Bonne précision en 2D

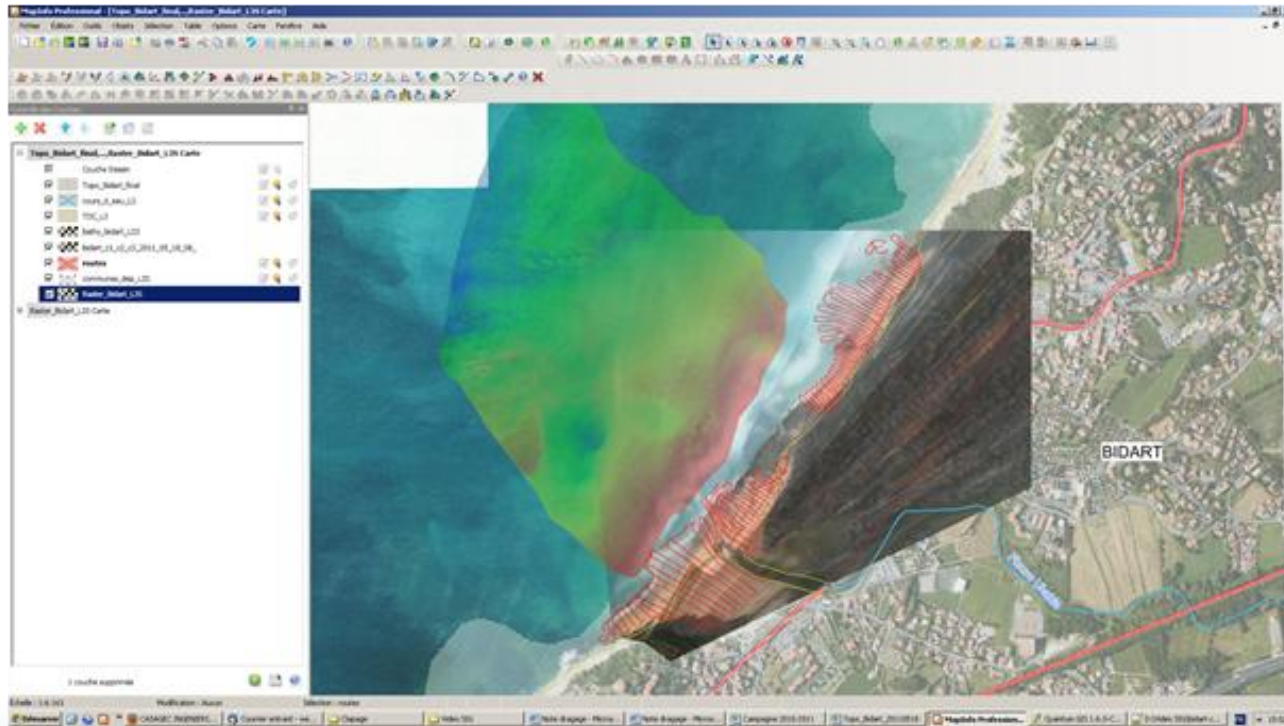
Les -

- ☑ Manque de précision en z
- ☑ Nécessité de points hauts
- ☑ Emprise limitée (max 4 km)
- ☑ Utilisation encore « confinée » à la communauté scientifique



Perspectives

- ❑ Intégration d'un capteur de pression
- ❑ Elargissement du spectre des applications
- ❑ Ouvrir l'utilisation des systèmes vidéo hors communauté scientifique
- ❑ Interopérabilité avec les Systèmes d'Information Géographiques



Suivi Vidéo du littoral

Didier Rihouey