Journée Prospective
10 Juin 2014

SIGMAPHY

UNIVERSITÉ DE GRENOBLE

cnrs Grenoble INP Université Joseph Fourier GRENOBLE UNIVERSITÉ Stendhal GRENOBLE

gipsa-lab

Grenoble | images | parole | signal | automatique | laboratoire

Indicateurs - Bilan

SIGMAPHY	
Nombre C au 30 juin 2014	2
Nbr EC au 30 juin 2014	5
Nbr total d'HdR	3
Nbr de thèses soutenues sur la période	29
Nbr de thèses en cours au 30 juin 2014	23
Durée moyenne de thèses	38,88
Nbr de revues par doctorant	2,64
Nbr de communications par doctorant	5,79
Nbr de thèse en partenariat intra-Gipsa	5
Nbr de thèse en partenariat UGA	7
Nbr de thèse en partenariat national	6
Nbr de thèse en partenariat international	0

J. Mars
B. Nicolas
C. Gervaise

Signal et
Propagation d'ondes

J. Chanussot
M. Dalla Mura
G. Vasile
M. Gay

Télédétection aéroportée
et satellitaire

C. Ioana
J. Mars

Imagerie des
Signaux transitoires

OSUG

Observatoire des Sciences de l'Univers de Grenoble

Faiblesses

- Méthodologies SI très variées
- 1 Enseignant – Non chercheur
- Pas de lien M. Gay – G. Vasile
- Interactions Inter-Axe faibles
- 11 perm. -> 6,5 (Lacoume, Gounon, Faury, B. Nicolas, J. Mars/2)
- Distribution contrats / publis

Menaces

- Axe « Signal-Acoustique » fragilisé : (B. Nicolas, J. Mars)
- Pérennité activité acous. Passive
- Stabilisation non perm.
- Ratio non-perm./perm. Élevé
- Déséquilibre entre thèmes
- Projet de Start-Up

Forces

- Formation de doctorants
- Réseaux loc/nat/internat variés et durables (publics et privés, co-enc.)
- Plateformes expérimentales
- Publications, brevets
- Ambiance sereine de travail

Opportunités

- Lien avec l'OSUG, labex OSUG@2020
- Arrivée possible de I. Zin (MdC LTHE)
- Séjours longs de prof. invités
- Thèmes porteurs (acoustique sous-marine, hyperspectral, environement)
- Recentrage sur 2 thèmes
- Collaborations CHESS et DECODA
- Projet de Start-Up

Equipe centrée sur les objets d'études liés à l'environnement

Axe 1 : Acoustique et Signal pour l'environnement

- Acoustique sous-marine : passage de l'actif vers le passif (C. Gervaise / B. Nicolas)
- Renforcement thème acoustique ultrasonore: interférométrie et imagerie acoustique
- Caractérisation du milieu dynamique par traitement distribué non-stationnaire
- Observation des environnements marins et leurs dynamiques: Passive Acoustics monitoring, Soundscape ecology
- Séparation de sources, machine learning, signatures acoustique, filtrage segm.

Axe 2 : Télédétection aéroportée et satellitaire

- Parcimonie et analyse hyperspectrale, représentations structurées en grande dim.
- Démélange spectral avec sources variables, analyse tensorielle hyperspectrale
- Modélisation interaction ondes électromag. cm / milieu dense neige
- TS polarimétriques SAR satellitaires appliqué à la neige et à la glace
- Assimil. données multi-temp. satellitaires & modèle phy. métamorphisme de la neige
- "Adaptive Waveform" pour les radars à large bande
- traitement multidimensionnel du signal en milieu non-stationnaire :

Equipe SigmaPhy

Responsables : J. Chanussot, B. Nicolas

11 permanents :
5 enseignants chercheurs ENSE3 (2 PR, 3 MCF)
2 chercheurs CNRS (2 CR)
1 Ingénieur de Recherche CNRS
1 Chercheur Chaire CHORUS
1 Professeur Emerite
1 Prag ENSE3

21 Doctorants
4 Post-docs

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Panorama scientifique

Objet d'étude	Application	Méthode
Mers,Océans	Observation de l'environnement	Analyse temps-fréq.
Glacier	Risque naturel	Traitement d'antenne
Neige	Gestion ressource énergétique	Séparation de sources
Montagne	Défense et sécurité	Méthodes à noyaux
Milieu urbain		Apprentissage
Grands ouvrages		Modélisation physique
Variables climatiques		Assimilation
Forêt		Classification, segmentation etc.
Agriculture		
Biologie, biomédical		Instrumentation
Planètes		

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3 THÈMES

Signal et
Propagation d'ondes

Télédétection aéroportée
et satellitaire

Imagerie des
Signaux transitoires

EVOLUTION DES EFFECTIFS 2009-2013

- **Redéfinition du périmètre de l'équipe en 2009**
  - ✓ 11 permanents :
    - ✓ 5 enseignants chercheurs ENSE3 (2 PR, 3 MCF)
    - ✓ 2 chercheurs CNRS (2 CR)
    - ✓ 1 Ingénieur de Recherche CNRS
    - ✓ 1 Chercheur Chaire CHORUS
    - ✓ 1 Professeur Emerite
    - ✓ 1 Prag ENSE3
  - ✓ 21 Doctorants
  - ✓ 4 Post-docs

- **Arrivées / Départs**
  - ✓ Mauro Dalla Mura (Arrivée, MCF ENSE3)
  - ✓ Daniel Baudois (Départ, MCF ENSE3)
  - ✓ Cédric Gervaise (Arrivée, Chaire Chorus)

- **Mobilité :**
  - ✓ Barbara Nicolas, Signal Processing Laboratory, Faro, Portugal (Séjour ERE 1 an)

- **Effectif stable en terme de permanents**

RESPONSABILITÉS

Implications dans les instances locales, nationales et internationales

•Responsable pédagogique de la plate-forme
Images et Signal pour Energie et Environnement (PREDIS / ENSE3)
•Présidence conseil restreint ENSE3.
•Responsabilité de filière SICOM

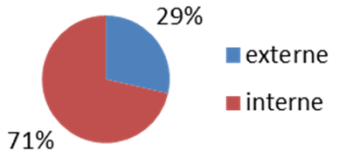
•Comité de Direction OSUG
•Responsable Département DIS

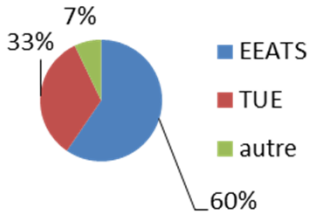
•Membre CNU 61
•Conseil d'administration association GRETSI
•Comité de direction GDR ISIS

•Conseil d'administration IEEE Geoscience and Remote Sensing Society

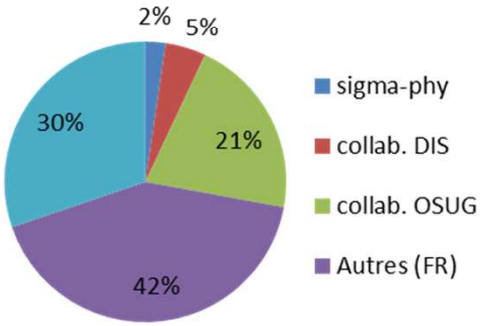
DOCTORANTS 2009-2013

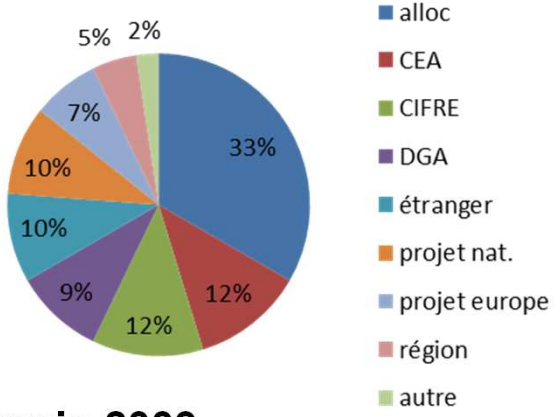
- **Effectifs :**
  - ✓ 21 Thèses en cours
  - ✓ 21 Thèses soutenues sur 2009-2013



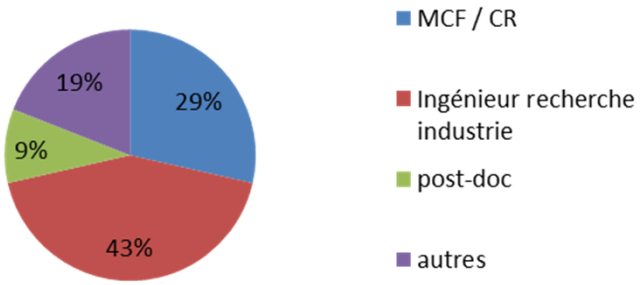


- **Collaborations et financements**





- **Devenir des 21 docteurs qui ont soutenu depuis 2009**



- **Durée moyenne thèse : 37 mois**

FAITS MARQUANTS

❑ Prix et distinctions

✓ Cristal du CNRS, 2012, Michel Gay.

✓ Institut Universitaire de France (IUF, 2012-2017), Jocelyn Chanussot
✓ IEEE Fellow (2012) , Jocelyn Chanussot
"for contributions to data fusion and image processing for remote sensing"
✓ Award Louis Cagniard, Conf. Europ. Ass. Engineers and Geoscientists, J. Mars.

✓ Prix de thèse INP, A. Khan,
✓ Prix de thèse IEEE Biomed, A.S. Montcuquet.

✓ IEEE GRSS 2011 Symposium Best Paper Award
Valero, S.; Salembier, P.; Chanussot, J.
✓ IEEE GRSS 2012 Transactions Prize Paper Award.
Villa, A.; Benediktsson, J.A.; Chanussot, J.; Jutten, C.
✓ IEEE GRSS 2013 Highest Impact Paper Award
Fauvel, M.; Benediktsson, J.A.; Chanussot, J.; Sveinsson, J.
✓ 2ème prix étudiant 2013, (G.Tochon, S. Valero, J. Chanussot, G. Asner)
Journal de la Société Française de Photogrammétrie et Télédétection

✓ 2010 IEEE GRSS Chapter Excellence Award (J. Chanussot)

FAITS MARQUANTS

❑ **Logiciels développés**

- ✓ Autour des traitements SAR
- ✓ Autour de la transformée Temps-Fréquence-Phase

❑ **Brevets déposés (5)**

- ✓ Inspection-localisation par émission-réception d'ondes acoustiques, C. Ioana.
- ✓ Séparation de sources de fluorescence, J. Mars.

❑ **Ouvrages**

- ✓ Chap. dans Wireless Communications over Rapidly Time-Varying Channel, C. Ioana
- ✓ Multivariate image processing, Ch. Collet, J. Chanussot and K. Chehdi, Wiley, USA, 2010
- ✓ Optical remote sensing - Advances in Signal Processing and Exploitation techniques, S. Prasad, L.M. Bruce and J. Chanussot, Springer, Germany, 2011

❑**Création d'entreprise** CYBERIO (incubation GRAIN)

FAITS MARQUANTS

❑ **Organisation de conférences**

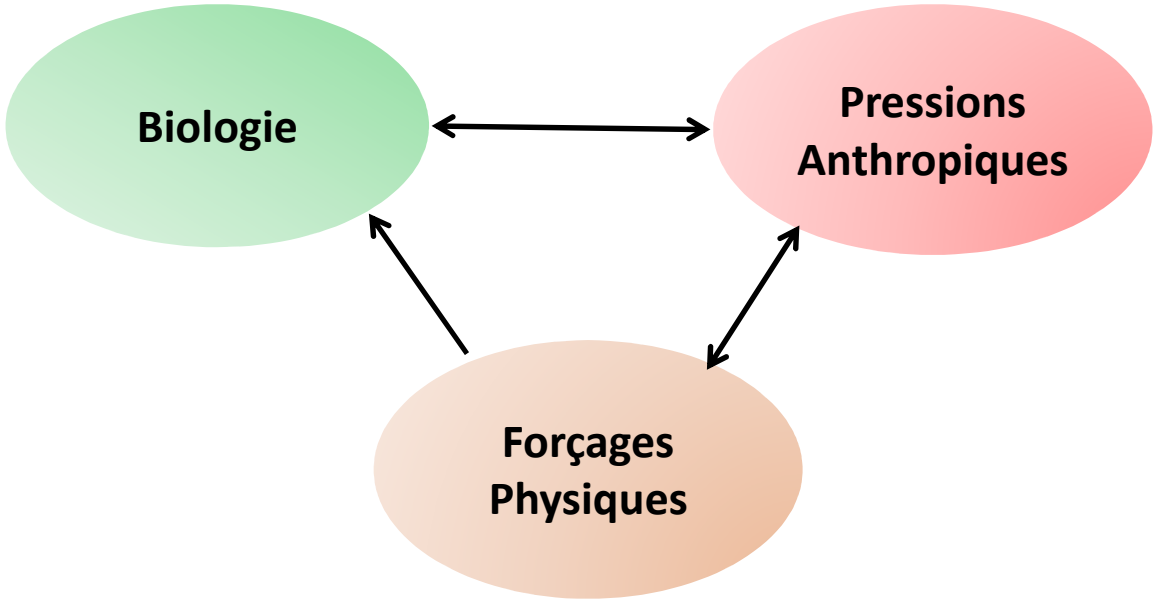
- ✓ Workshops : Sérénade, Ecole des Houches, IEEE Communications, IEEE MLSP
- ✓ IEEE GRSS Workshop on Hyperspectral Image and Signal Processing: Evolution in Remote Sensing (WHISPERS)
- ✓ Ecole doctorants : ETASM (Bucarest), école d'été hyperspectrale
- ✓ Sessions spéciales : GRETSI 2011, IEEE ICASSP 2010, ASILOMAR 2010, IEEE IGARSS…

❑ **Activités éditoriales**

- ✓ numéros spéciaux pour
  - ✓ IEEE Signal Processing Magazine
  - ✓ IEEE Journal of Selected Topics in Signal Processing
  - ✓ Springer Journal of Signal Processing Systems
  - ✓ Proceedings of the IEEE
  - ✓ IEEE Transactions on Geoscience and Remote Sensing (2)
  - ✓ Traitement du Signal
- ✓ Editeur en Chef, IEEE Journal of Selected Topics on Applied Earth Observations and Remote Sensing (JSTARS) [nouveau facteur d'impact: 2.874]

CHAIRE CHORUS (2013-2018)

Un écosystème génère un paysage acoustique qui peut être exploité



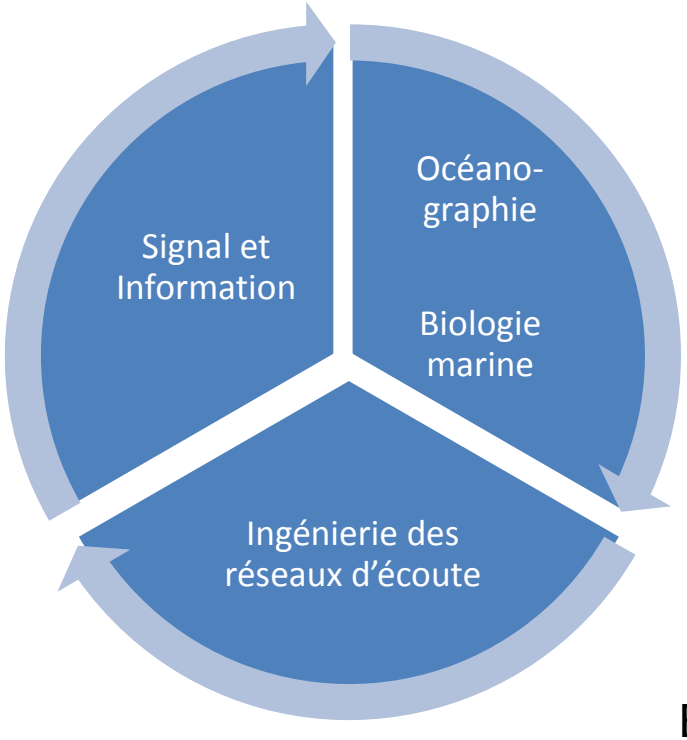
Chaire de la Fondation Grenoble INP

CHAIRE CHORUS (2013-2018)

Des sons à la connaissance environnementale

Nouvelle discipline de recherche appliquée : l'écologie des paysages acoustiques

Des outils multi-disciplinaires fondamentaux



Applications : réponses à des questions sociétales

- Trafic maritime
- Arctique
- Ecologie Benthique

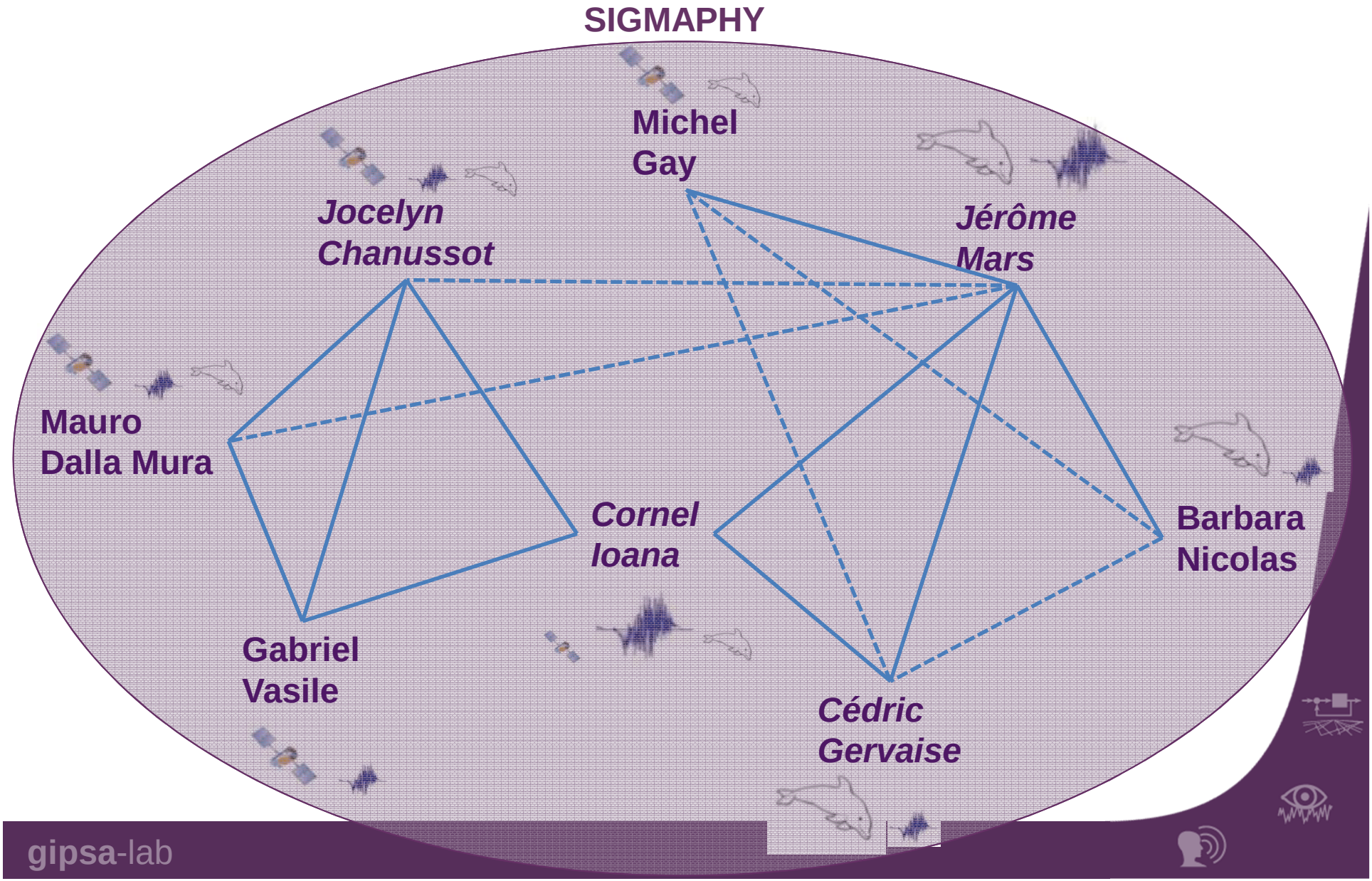
Equipe et Projets

L. Di Iorio, C. Gervaise, J. Mars
IUEM (L. Chauvaud)–
SHOM (Y. Stéphan)
Pêches et Océans, Canada (Y. Simard)

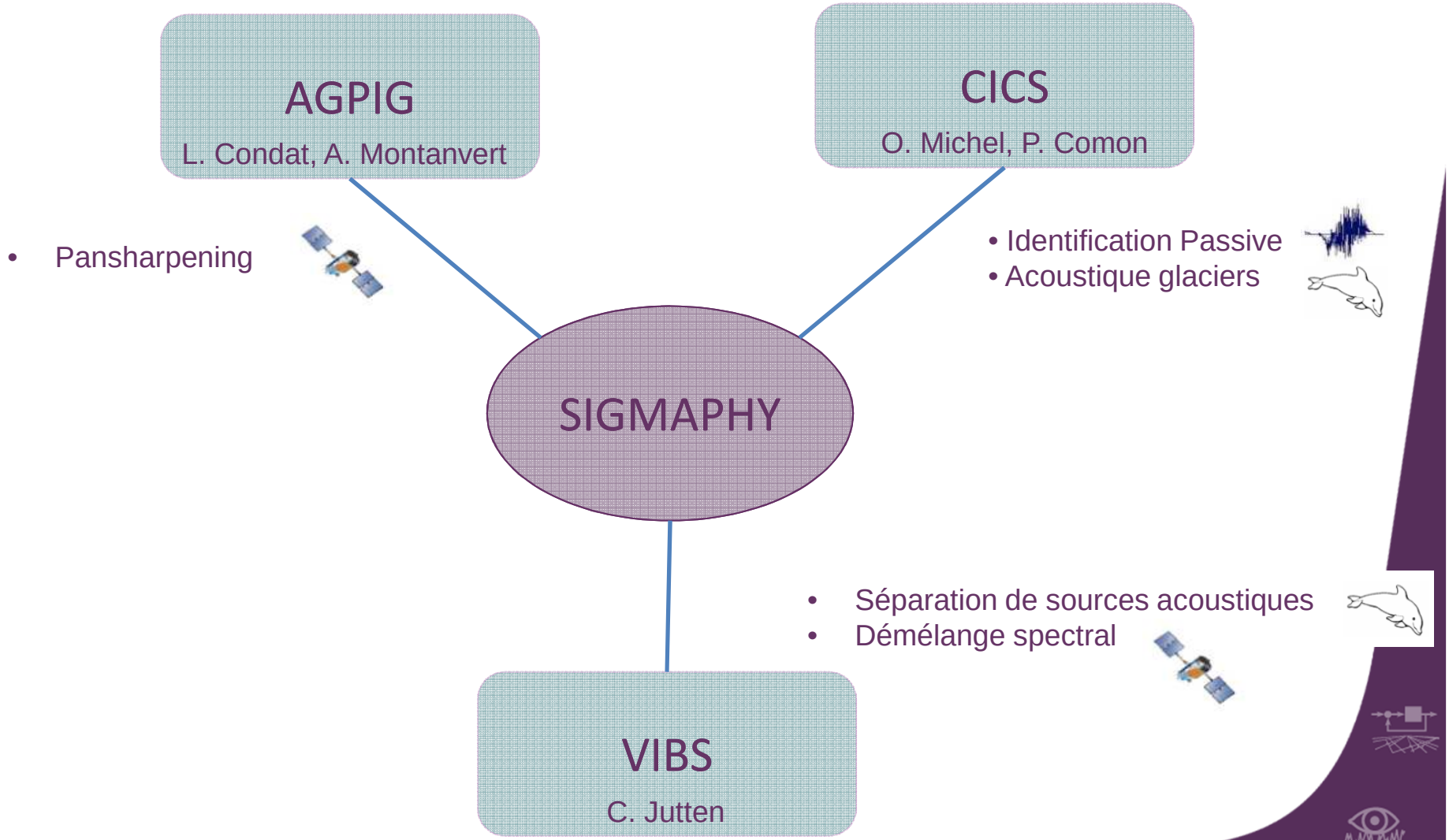
1 Postdoc en cours
4 PhD en cours
2 PhD + 1 Postdoc en 09/13

ANR ASTRID MER CALME (2013-2015)
EDF CIH (2013-2015)
France Energie Marine (2013-2015)

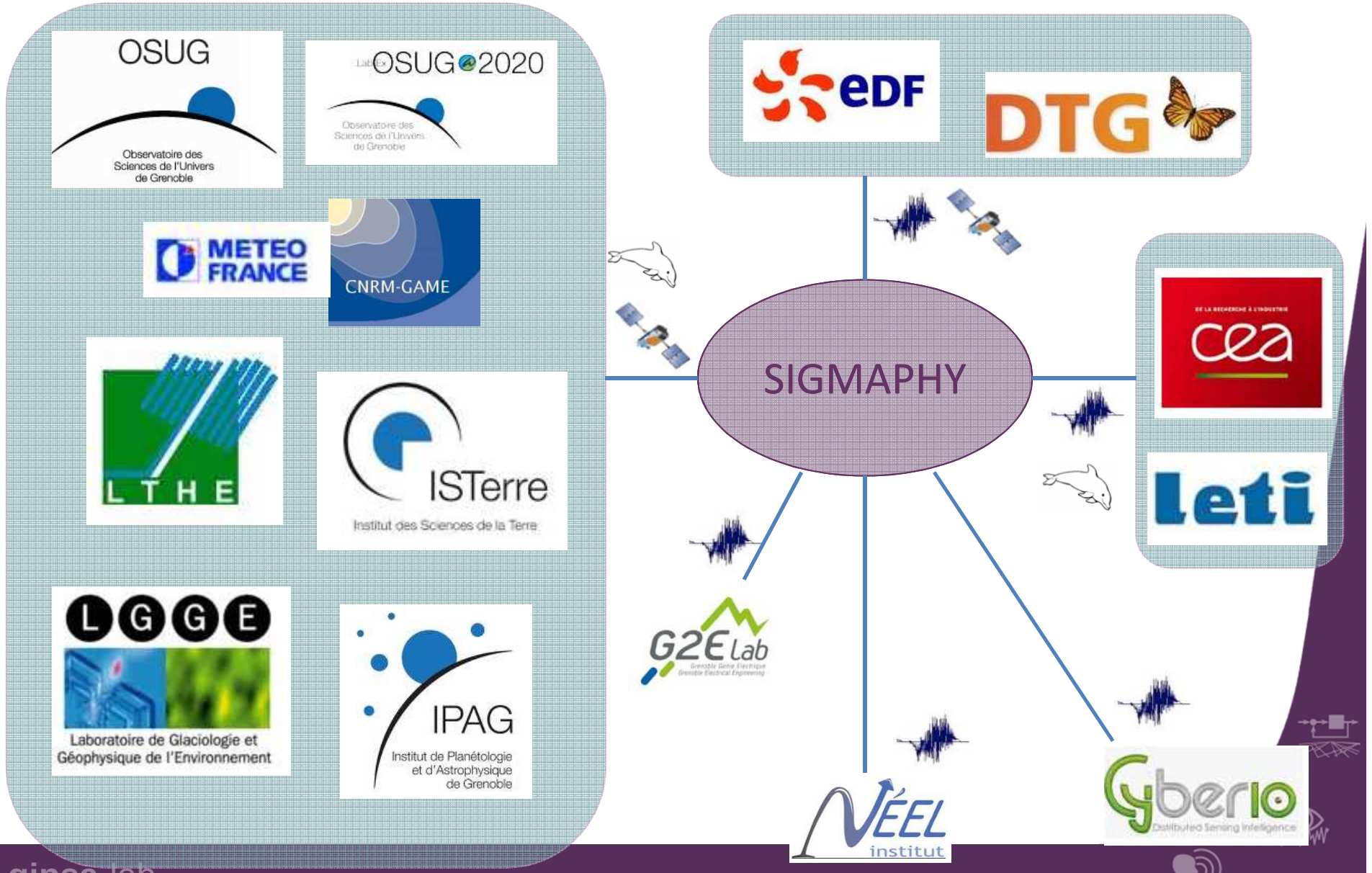
COLLABORATIONS INTERNES



COLLABORATIONS DIS



COLLABORATIONS GRENOBLE



COLLABORATIONS FRANCE

- **85% des publications en collaboration avec un partenaire national**

- **Implications dans les projets :**
  - ✓ **Région**
  - ✓ **ANR (y compris JC)**
  - ✓ **Entreprises**

- **Partenaires principaux – Nombre de publications > 10 entre 2010-2012**
  - ✓ Laboratoire franco-singapourien de recherche en électromagnétisme et radars (22)
  - ✓ Institut des Sciences de la Terre (20)
  - ✓ Institut d'Electronique et de Télécommunications de Rennes (19)
  - ✓ CEA LETI - Laboratoire d'Electronique et des Technologies de l'Information (14)
  - ✓ EDF R&D (14)
  - ✓ LISTIC - Laboratoire d'Info., Systèmes, Trait. de l'Information et de la Connaissance (13)
  - ✓ SHOM - Service Hydrographique et Océanographique de la Marine (10)

COLLABORATIONS INTERNATIONALES

- **50% des publications en collaboration internationale**
- **Politique volontariste de collaboration internationale pour les doctorants**
- **Accueil de chercheurs invités (CNRS, Grenoble INP, sabbatiques)**
- **Implication dans des projets / réseaux européens, ANR International**
- **Partenaires principaux – Nombre de publications > 5 entre 2010-2012**
  - ✓ University of Iceland (35)
  - ✓ ATM - Military Technical Academy , Romania (11)
  - ✓ UPC - Universitat Politècnica de Catalunya, Spain (11)
  - ✓ NASA Goddard Space Flight Center, USA (8)
  - ✓ University of Trento, Italy (6)

3 THÈMES

Signal et Propagation d'ondes

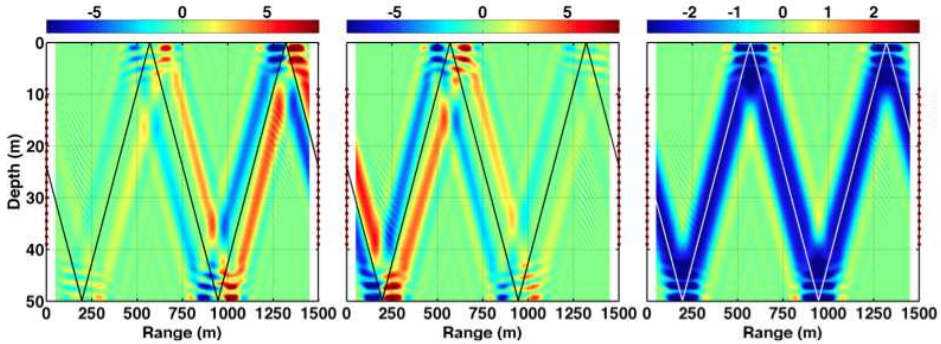
Télédétection aéroportée et satellitaire

Imagerie des Signaux transitoires

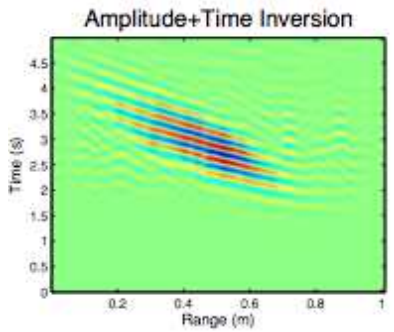
SENSITIVITY KERNELS FOR OCEAN ACOUSTIC TOMOGRAPHY

- **Topic**
  - ✓Sound speed variation estimation
  - ✓Source Array and Receiver Array
  - ✓Related topics : surface estimation, source localization

- **Methods and results**
  - ✓Modeling of the direct problem
  - ✓Inversion to image of a thermal plume, of a gravity wave



Sensitivity Kernels



Surface wave inversion
In an ultrasonic tank

- **Perspectives**
  - ✓Perform tomography using angles on real data
  - ✓Understand non linear behaviors in surface experiment

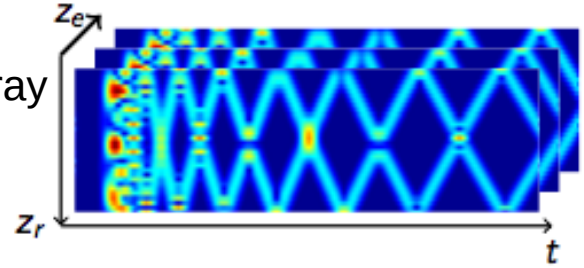
ANR
TOTS

B. Nicolas, J. Mars
I. Iturbe, C. Marandet, G. Le Touzé, L. Bonneau, F. Aulanier

ARRAY PROCESSING FOR OCEAN ACOUSTIC TOMOGRAPHY

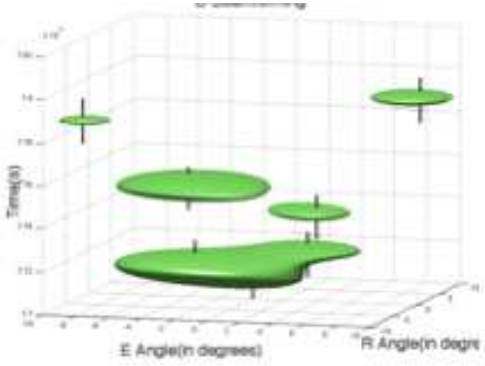
❑ Topic

- ✓Acoustic Arrival Separation on a source/receiver array
- ✓High resolution in time and angle
- ✓Estimation using a Single Realization

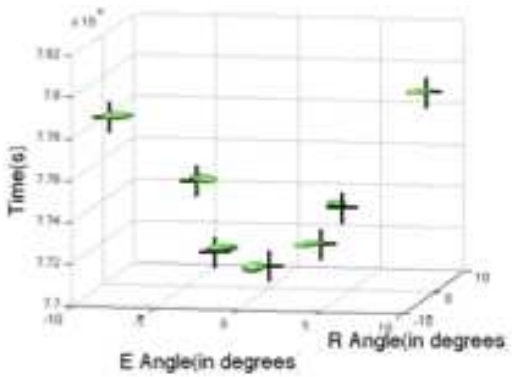


❑ Methods and results

- ✓Classical Array processing : Double Beamforming
- ✓High Resolution Methods: Double MUSICAL



Double Beamforming



Double MUSICAL

❑ Perspectives

- ✓Introduce High Resolution Array processing in Tomography

ANR

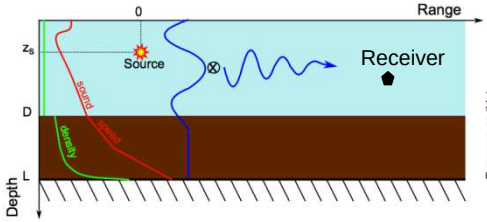
TOTS

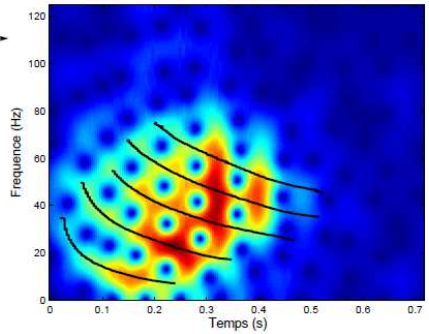
ISTerre
Institut des Sciences de la Terre

B. Nicolas, J. Mars
I. Iturbe, G. Le Touzé, L. Jiang

ULTRA LOW FREQUENCY UNDERWATER ACOUSTICS

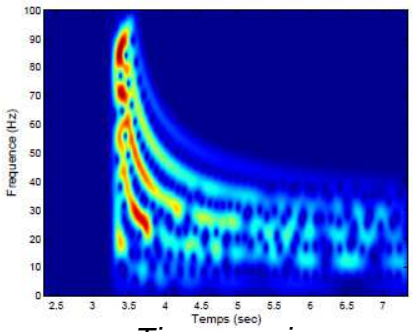
- **Topic**
  - ✓Modal propagation in shallow water
  - ✓Single receiver
  - ✓Multicomponent & dispersive signals





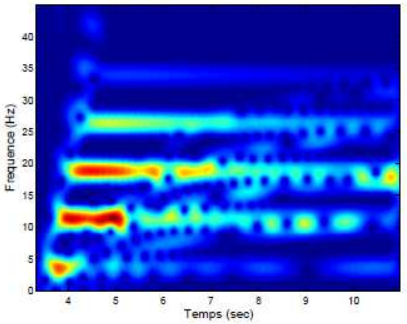
North Sea data

- **Methods and results**
  - ✓Time and frequency warping, physics-based TFR
  - ✓Source localization & environment characterization



Time warping

Time warping ⇒



Compression in frequency

- **Perspectives**
  - ✓Waveguide invariant-based time-frequency representations
    - → power class TFRs

B. Nicolas, J. Mars
J. Bonnel, M. Lopatka

THALES UNDERWATER SYSTEMS

ENSTA Bretagne

DGA

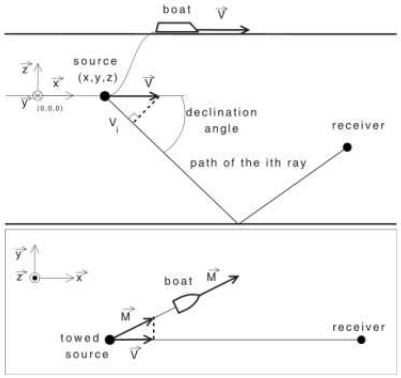
PASSIVE OCEANOGRAPHIC TOMOGRAPHY WITH « OPPORTUNITY SOURCES »

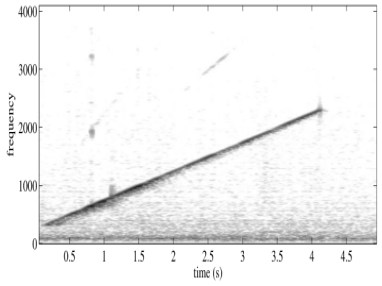
❑ Topic

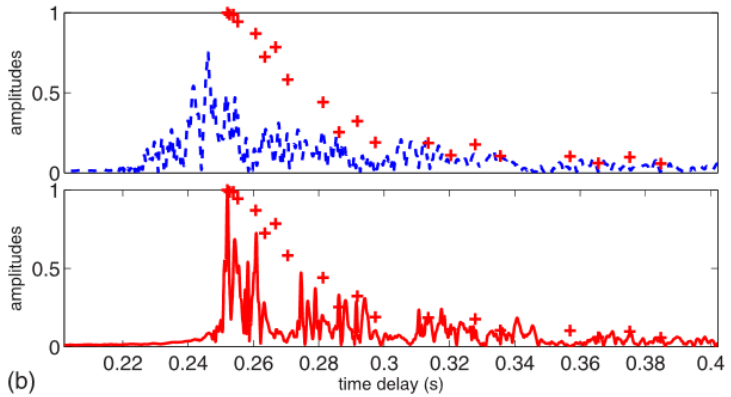
✓Single emitter : Blind estimation of the Impulse Response of the underwater channel
✓Spread emitters : Geoacoustics inversion with ambient noise

❑ Methods and results

✓Source motion estimation and compensation
✓Inversion schemes with dolphins whistles, noise of a single ship, a shipping lane







❑ Perspectives

✓Long term tomography (~year) with shipping noise
✓Inversion with ambient noise only

N. Josso, C. Ioana, C. Gervaise, J. Mars & Y. Stéphan, JASA 2009, 2010

C. Gervaise, J. Mars
N. Josso, A. Barazzutti

Pêche et Océan, Canada

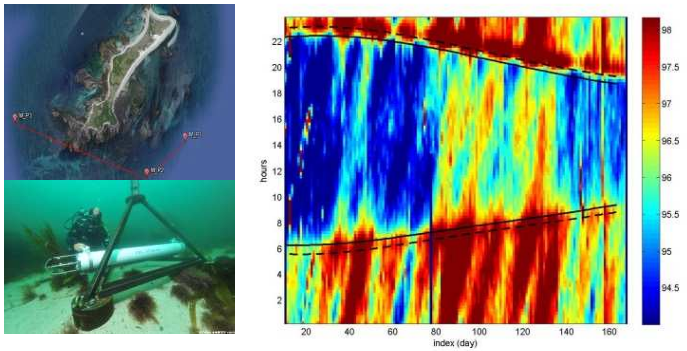
MONITORING MARINE ECOSYSTEMS WITH PASSIVE ACOUSTICS

❑ Topic

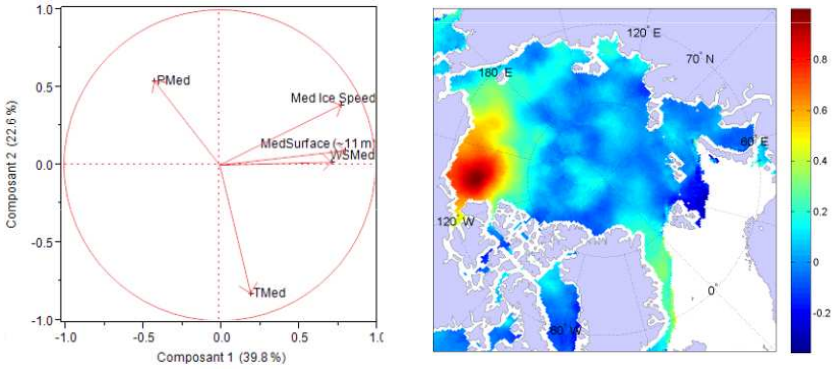
- ✓Large data base (~1 year ~ 2 T.O)
- ✓Assess environmental descriptors from acoustics raw data
- ✓Application to coastal and arctic environments – anthropogenic pressures & climate change

❑ Methods and results

- ✓Time-frequency (spectrogram) segmentation
- ✓Statistical analysis of long term time series



Separating ambient noise from ocean noise for ecological analysis and noise impact evaluation – C. Gervaise, L. Di Iorio, JASA 2013



Under-ice ambient noise in Eastern Beaufort Sea, Canadian Arctic, and relation with environmental forcing,
B. Kinda, Y. Simard, C. Gervaise, J. Mars, L. Fortier, JASA 2013

❑ Perspectives

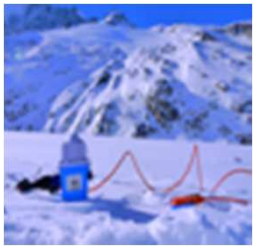
- ✓Assessment of Environmental status of marine environment
- ✓Program for long term monitoring of Iroise sea (3 years), arctic (12 years)

C. Gervaise, L. Di Iorio, J. Mars
B. Kinda, O. Le Bot, D. Mathias, 2 PhD in 09/2013

chorus
Exploring underwater soundscapes

IUEM
Pêche et Océan, Canada
ANR ASTRID 'MER CALME'
France Energie Marine 'Benthoscope'

ACOUSTIC BEHAVIOR OF A GLACIER

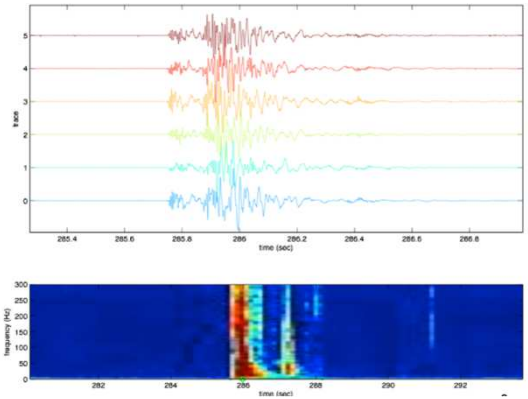


❑ Topic

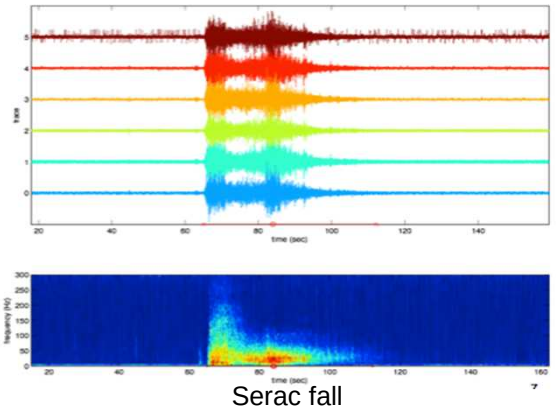
- ✓ Multiple acoustics sources (serac fall, runoff, water pocket…)
- ✓ Multicomponents sensors
- ✓ Localization of the sensor network using ambiant noise

❑ Methods and results

- ✓ Two experiments in the Argentiere Glacier with 3-components sensors and 2 arrays
- ✓ Identification of classical events



Shallow Icequake



Serac fall

❑ Perspectives

- ✓ Multimodal field measurement (Acoustic, GPS)
- ✓ Algorithm for joint source position and propagation speed estimation.

M.Gay, B. Nicolas, C. Gervaise

Collaboration CICS (Michel, Comon)
Financement PEPS CNRS et
Labex OSUG@2020.

3 THÈMES

Signal et
Propagation d'ondes

Télédétection aéroportée et satellitaire

Imagerie des
Signaux transitoires

ASSIMILATION OF SAR DATA FOR WATER RESOURCE & RISK

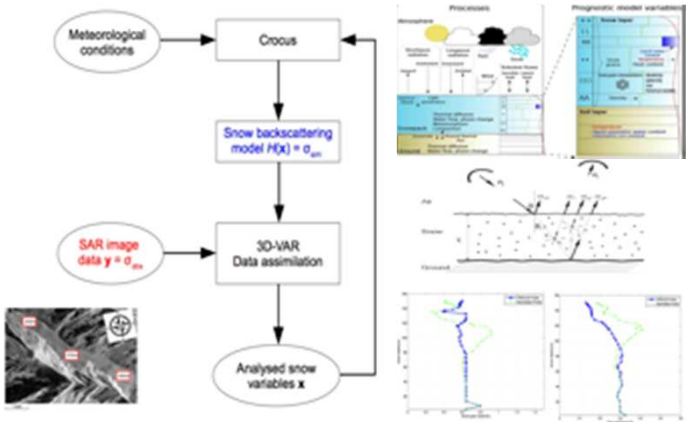
Topic

- ✓Analysis of snowpack structure from SAR data.
- ✓Localization of multiple source acoustic in glacier (runoff, water pocket…)

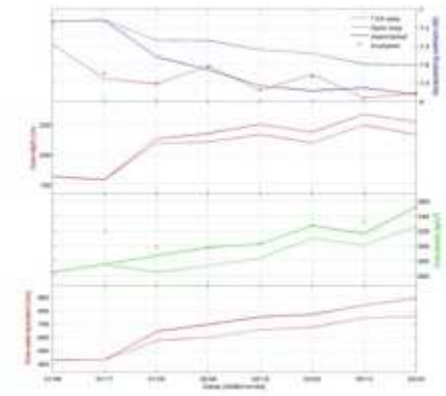
Field measurements on glacier

Methods and results

- ✓3D-Var approach with multilayer electromagnetic backscattering model and physical snowpack model.
- ✓Algorithm for joint source position and propagation speed estimation.



Global scheme of assimilation algorithm



Temporal modification of snowpack stratigraphy and derivation of parameters on stability, SWE…

Perspectives

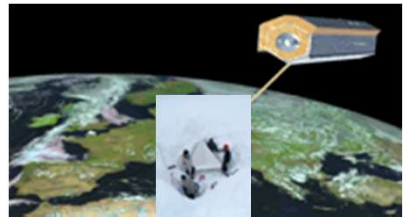
- ✓Algorithm evaluation based on GB-SAR and in-situ measurements
- ✓Large scale assimilation on the Alps and Antarctic.
- ✓Multimodal field measurement and SP method (acoustics, SAR, GPS)

M.Gay, B. Nicolas, C. Gervaise, O.Michel, P. Comon,
X. Phan (Phd).

Europeen Project GlaRiskAlp, TOSCA (CNES), Mastodon (CNRS)
Projets PEPS, Labex-OSUG.

IMAGE PROCESSING FOR SYNTHETIC APERTURE RADAR

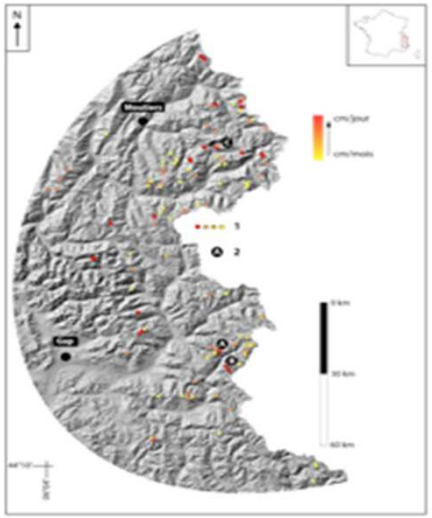
- **Topic**
  - ✓Information extraction from:
    SAR image to ground displacement monitoring
    displacement measurements to geophysical knowledge
    electromagnetic response to ground characteristics



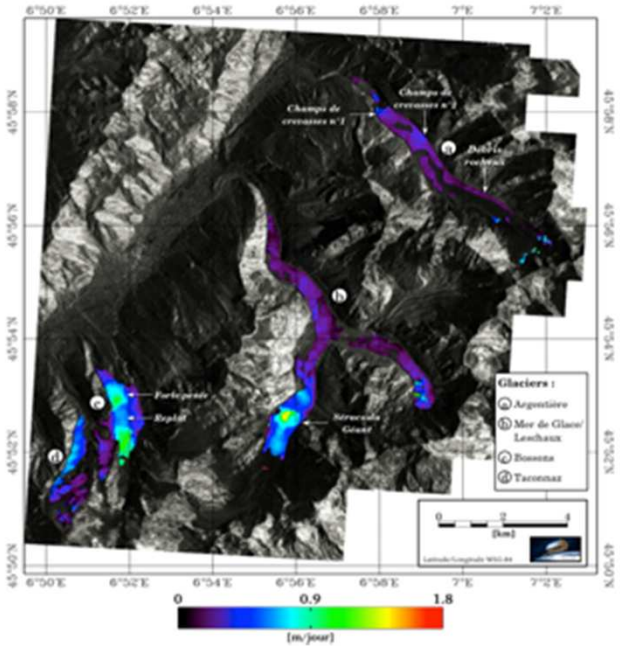
Plateform « Mont-Blanc »,test site.

- **Methods and results (SAR image Height Resolution)**
  - ✓New offset/texture tracking, procedures
  - ✓Interferometric phase analysis

Inventory of Rockglacier movement detected by D-InSAR in french Alps using ERS, TerraSAR-X data.



EFIDIR-Tools (GPL)



Multi-temporel velocity (2D-3D) fields on glaciers in Mont-Blanc area.

- **Perspectives**
  - ✓Multi-temporel analysis SAR data on glaciers
  - ✓Fusion optic and SAR image for monitoring rock glacier.

M.Gay
L. Bombrun, O. Harant, T. Echelard (Phd)
gipsa-lab

ANR EFIDIR : Masse de données et Connaissanc
IETR-UdR1, LTCI-ENST, *LISTIC-UdS*, LG-ENS, IsTerre-UGA
Europeen Project PERMANET : 14 partners

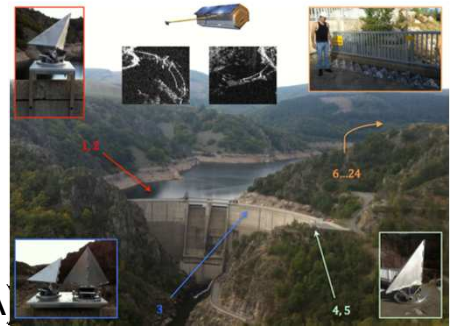
RADAR INFRASTRUCTURE MONITORING FOR ENERGY

❑ Topic

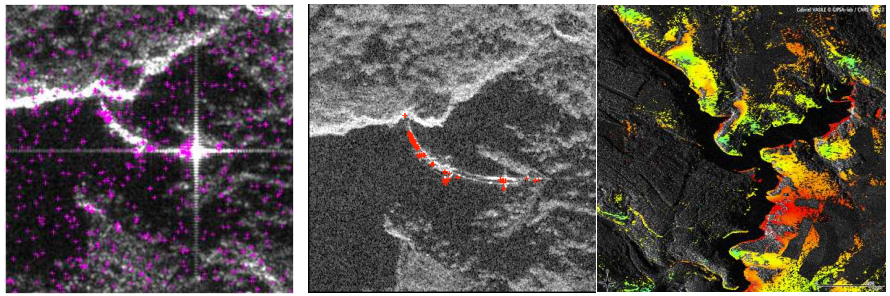
- ✓Millimeter 3D displacement measurements
- ✓4D spaceborne Synthetic Aperture Radar tomography

❑ Methods and results

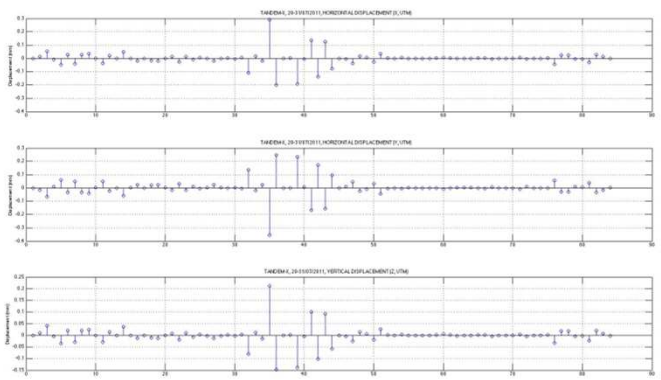
- ✓Time-frequency-space detection and tracking
- ✓Multidimensional time series statistical analysis (VARMA)
- ✓Ground-based FMCW radar for imaging infrastructure



GIPSA-lab / EDF Puylaurent platform



Puylaurent dam, TerraSAR-X satelite, 2011 (amplitude image in the background): permanent scatterers detection, stable scatterers detection, radar slant range interferometric phase



Puylaurent dam, TanDEM-X data, 2011: measured displacement in UTM system

❑ Perspectives

- ✓Confidence intervals for the spaceborne derived displacement measures
- ✓Ground-based FMCW radar vs. LIDAR comparison

G. Vasile, C. Ioana
A. Anghel (Phd)

Projets Carnot Énergies du Futur & TanDEM-X science
EDF DTG, EDF R&D, ONERA, DLR, Univ. POLITEHNICA Buc.

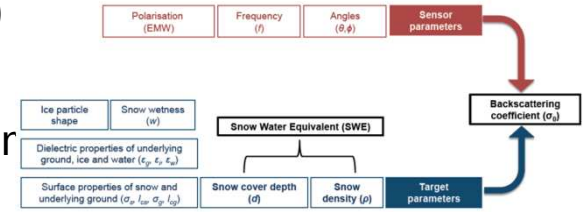
SPACEBORNE REMOTE SENSING FOR HYDROMETEOROLOGY

❑ Topic

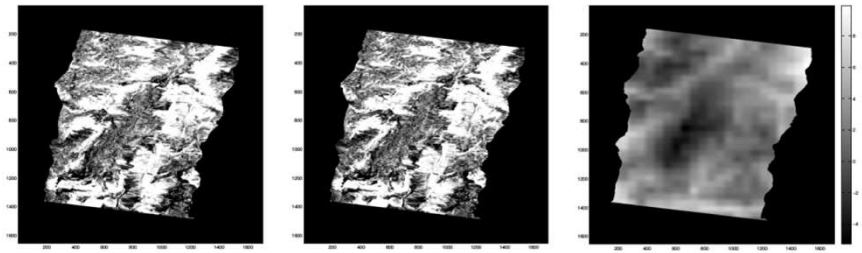
- ✓Synthetic Aperture Radar & multi-spectral image processing
- ✓Exogenous in situ data assimilation (temp., SWE…)

❑ Methods and results

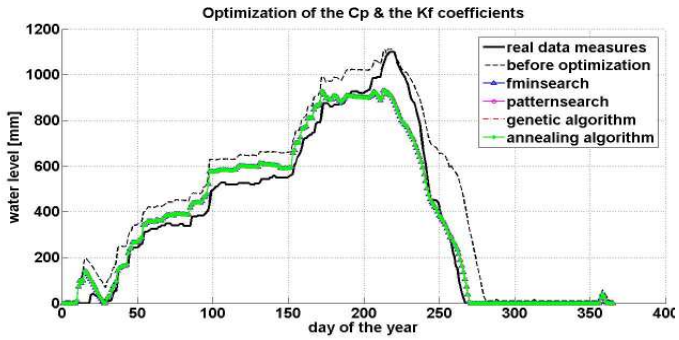
- ✓BSS for polarimetric incoherent target decomposition
- ✓Multivariate change detection with SAR images
- ✓Ground-based FMCW radar for radiative transfer modeling
- ✓Unconstrained nonlinear optimization of a distributed SWE model



Snow cover backscattering coefficient



Comparison with ground level temperature measurements: georeferenced SAR HH/VV wet snow probability map and interpolated ground level temperature map [° C].



Optimization of the c_p and the k_f coefficients of the EDF DTG MORDOR model (snow acc. phase)

❑ Perspectives

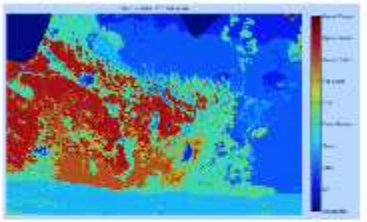
- ✓Quantitative analysis of POLSAR – BSS ICTD for snow inversion
- ✓Ground-based FMCW radar in lab experimentation

G. Vasile, J. Chanussot
N. Besic (Phd)

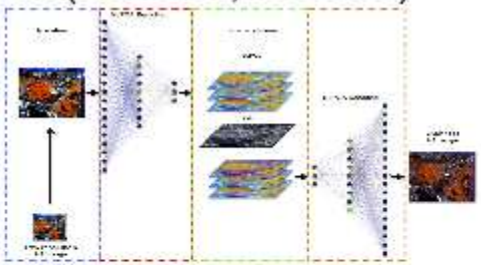
Projets Carnot Énergies du Futur & TerraSAR-X science
EDF DTG, EDF R&D, DLR, LTHE, Univ. de Monténégro

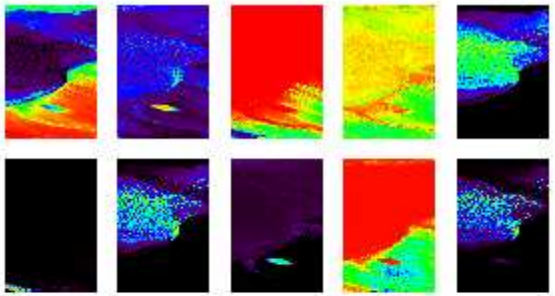
Hyperspectral analysis: sub-pixel level

- Unmixing:
  - ✓ Detection of algae in coastal zones (EDF)
  - ✓ Retrieval of snow coverage (LTHE, LGGE, MeteoFrance)
  - ✓ Spectral unmixing of the terrestrial and Martian surfaces using multiangular hyperspectral images (IPAG)



- Pansharpening:
  - ✓ Development of a comprehensive toolbox for pansharpening and methods based on the estimation of the Point Spread Function (UniSA, IST)
  - ✓ Pansharpening of hyperspectral images using multi-resolution analysis and NLPCA (GREYC, SEECS)
  - ✓



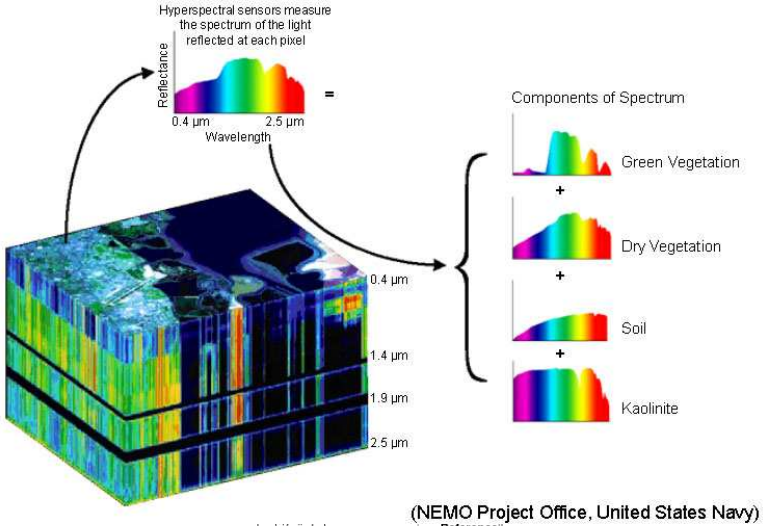


- Super-resolution:
  - ✓ Estimate high-spatial and high-spectral resolution hyperspectral images from the fusion of low-spatial hyperspectral and multispectral images (IST)

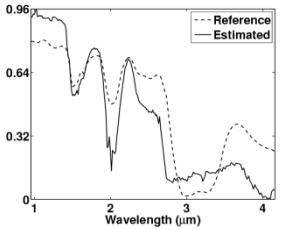
M. Dalla-Mura, J. Chanussot (Permanents)
G. Tochon, G. Licciardi, M.A. Veganzones (Ph.D. & Post Docs)

Sylvain Douté, Jose Bioucas (Partners)

Hyperspectral analysis: sub-pixel level

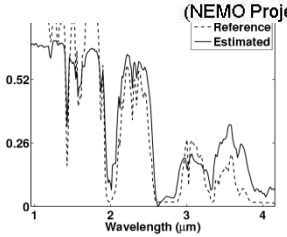


H_20 ice

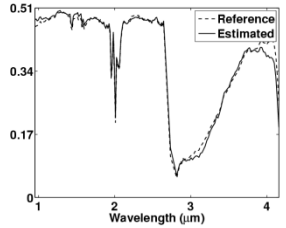


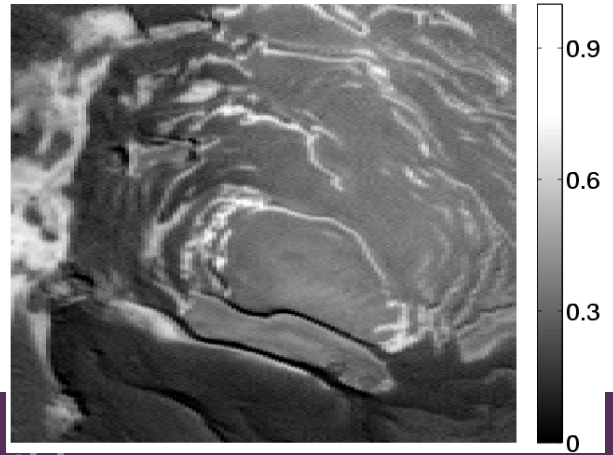
$C0_2$ ice

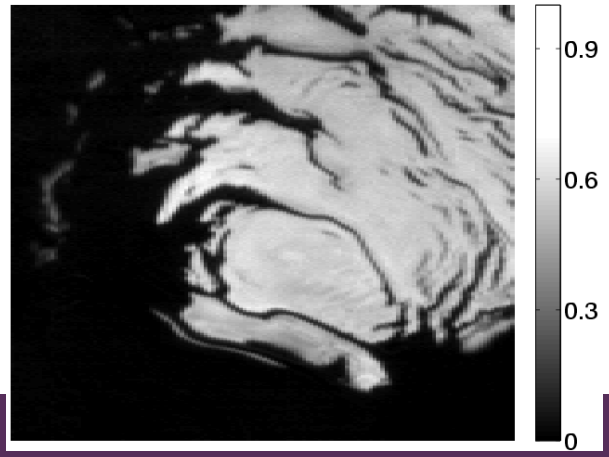
(NEMO Project Office, United States Navy)

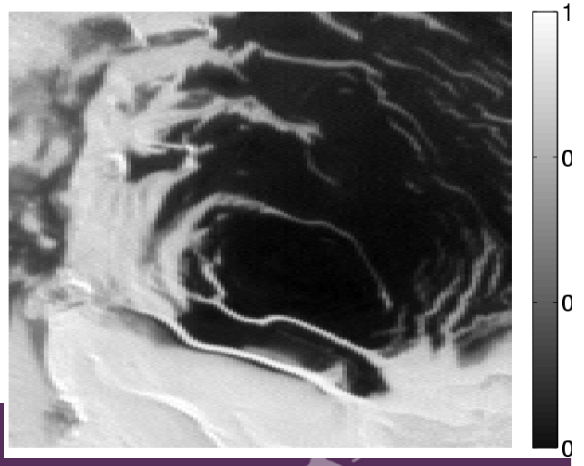


dust





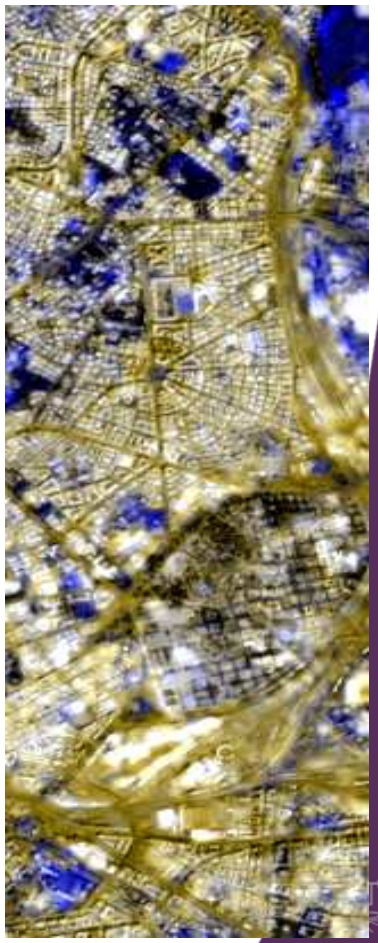




Hyperspectral analysis: sub-pixel level

ALI PAN
10 m spatial resolution
480 nm – 690 nm

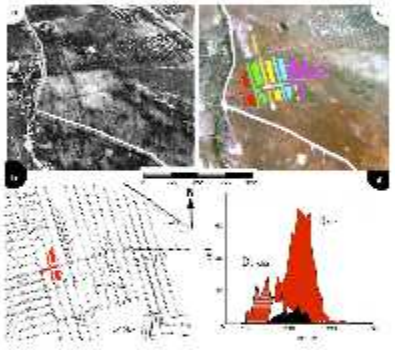
Hyperion
220 (168) Bands
40 m Spatial resolution
400 nm – 2500 nm



Hyperspectral analysis: pixel level

- Classification:
  - ✓ Spectral-spatial classification based on sparse representation (IST)
  - ✓ Automatic land cover characterization of photogrammetric aerial image blocks (FBK)

- Anomaly detection:
  - ✓ Detection of buried archaeological structures using hyperspectral images (CNR-IIA)



- Target detection:
  - ✓ Use of robust estimators and SIRV non-Gaussian distributions to enhance hyperspectral target detectors (SONDRA, ONERA)

- CFAR clustering:
  - ✓ Propose novel clustering methods based on CFAR properties of the pairwise distance metric obtained by a statistical hypothesis test (SONDRA, ONERA)

INSTITUTO SUPERIOR TÉCNICO

FONDAZIONE BRUNO KESSLER

CNR-IIA

SONDRA

ONERA

M. Dalla-Mura, J. Chanussot (Permanents)
G. Tochon, G. Licciardi, M.A. Veganzones (Ph.D. & Post Docs)

Rosa Maria Cavalli, Fabio Remondino,
Jean Philippe Ovarlez (Partners)

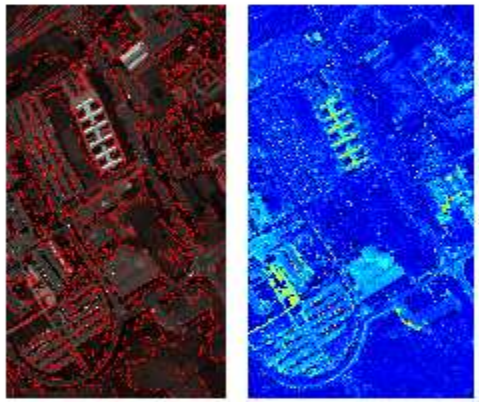
Hyperspectral analysis: pixel level

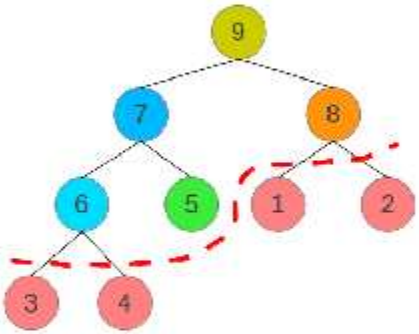
Spectral channels
OA: **71.66**%

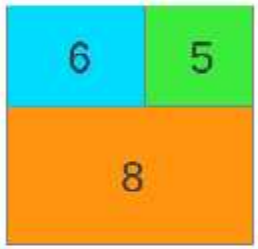
EAPall with DAFE
OA: **96.01**%

Hyperspectral analysis: region level

- Hierarchical representation:
  - ✓ BPT representation of multimodal images (UCLA)
  - ✓ Semi-automatic segmentation and classification of cementitious images (Lafarge)
  - ✓ Unmixing-based BPT representation and segmentation of hyperspectral images (UEX)







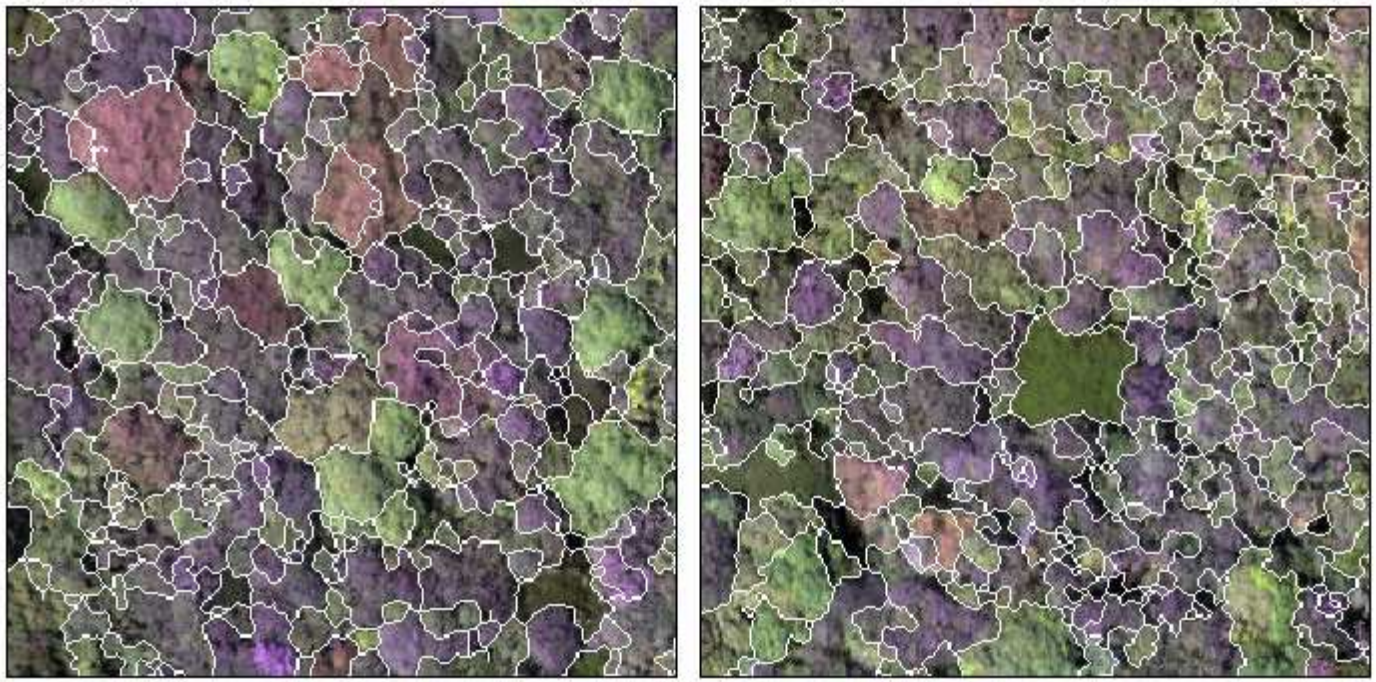
- Image retrieval:
  - ✓ Definition of a Relevance Feedback Content-Based Image Retrieval (RF-CBIR) system for hyperspectral databases (UPV/EHU, DLR)

Universidad del Pais Vasco
Euskal Herriko Unibertsitatea

DLR

M. Dalla-Mura, J. Chanussot (Permanents)
G. Tochon, G. Licciardi, M.A. Veganzones (Ph.D. & Post Docs)
Antonio Plaza, Manuel Graña, Mihai Datcu (Partners)

Hyperspectral analysis: region level



3 THÈMES

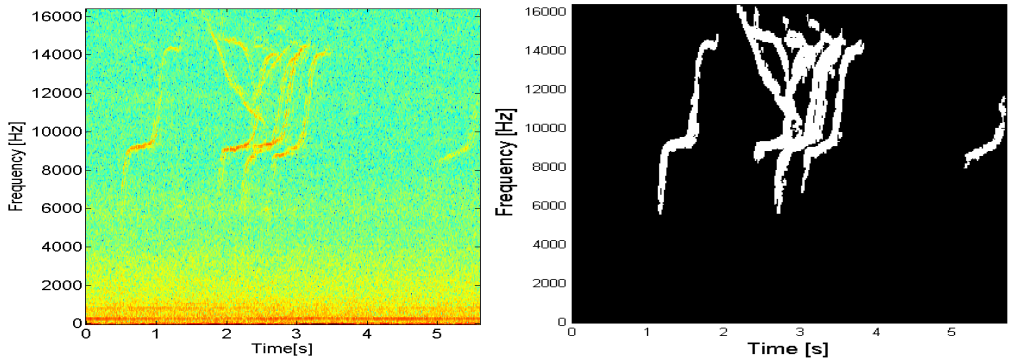
Signal et
Propagation d'ondes

Télédétection aéroportée
et satellitaire

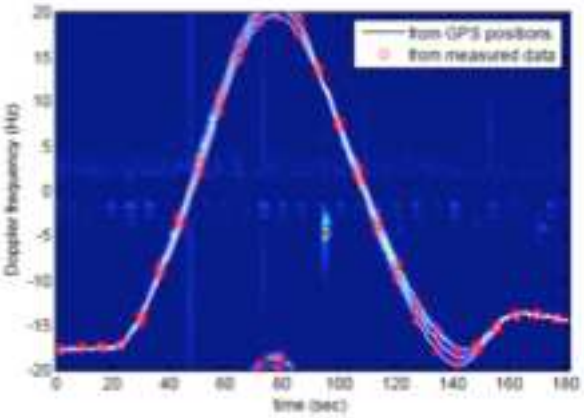
Imagerie des
Signaux transitoires

EXPLOITING TIME-FREQUENCY-PHASE CONTINUITY

- **Topic**
  - ✓Tracking of complex time-frequency structures
- **Methods and results**
  - ✓Time domain: local dictionary design, local filters
  - ✓Local coherence maximization
- **Perspectives**
  - ✓General framework of inferring physical aspects
  - ✓Distributed non-stationnary signal processing



Segmentation of dolphins whistles



Ionospheric Radar

C. Ioana, J. Mars, C. Gervaise (permanents)
N . Josso, I. Candel, F. Dadouchi (Phd)

Monitoring

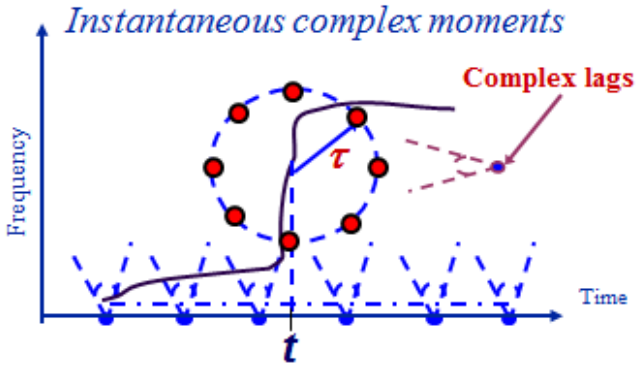
MODE2, CILOE, GREENAR, Smart Hydro

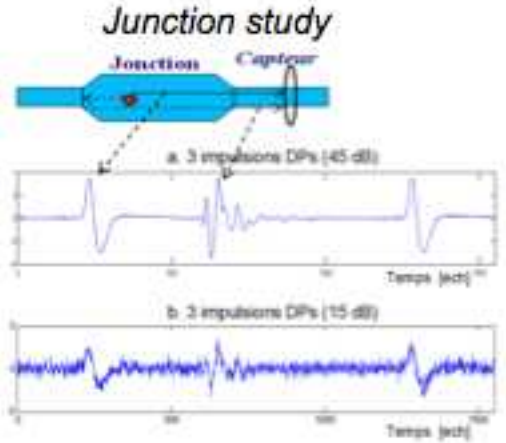
SHOM, EDF, CYBERIO, Villanova University

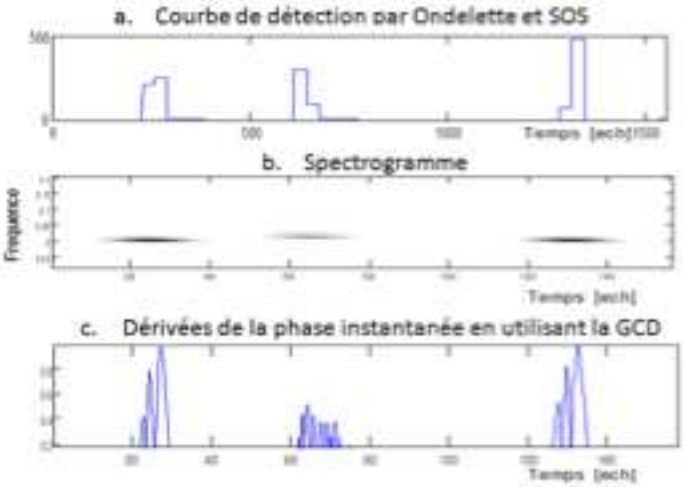
COMPLEX TIME DISTRIBUTIONS

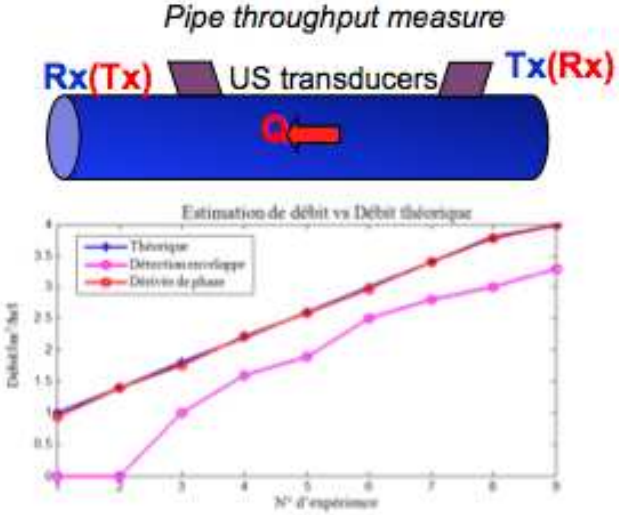
- **Topic**
  - ✓New representation space based on complex-time properties

- **Methods and results**
  - ✓Characterize the transients via the derivative computed from signal samples
  - ✓Multi-lag to deal with multi-component signals









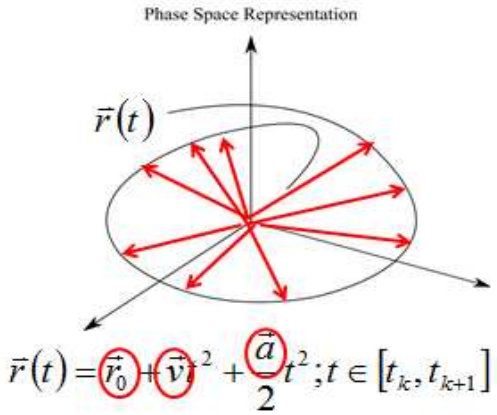
- **Perspectives**
  - ✓Extending to the arbitrary transient types
  - ✓Define the non-parametric multi-resolution analysis

C. Ioana
B. Gottin, C. Bernard,

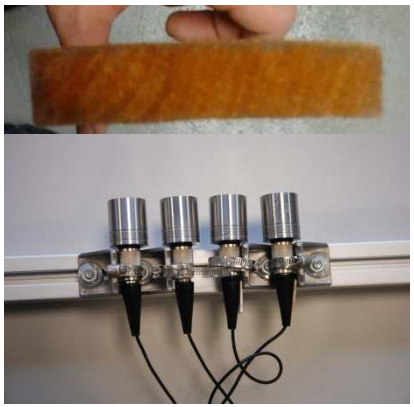
ECO-NET program, PHC Pelikan
Smart Hydro Monitoring

PHASE DIAGRAM-BASED METHODS

- **Topic**
  - ✓Transient characterization as a system state changing
- **Methods and results**
  - ✓Transient descriptors based on phase trajectory
  - ✓Estimation of the relative envelope deformations



Ultrasonic imagery based on envelop deformation



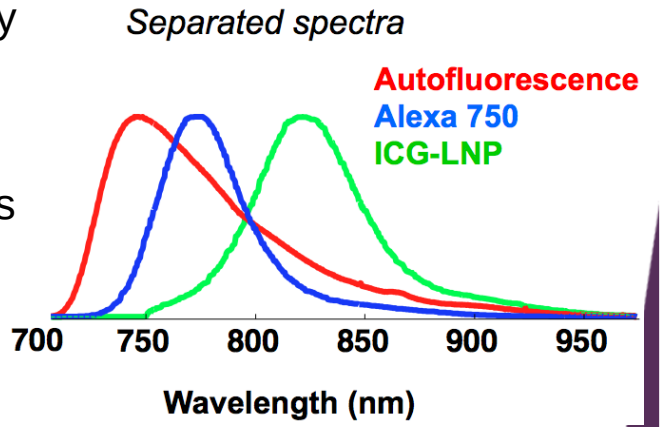
Arc Locator (Carnot project)

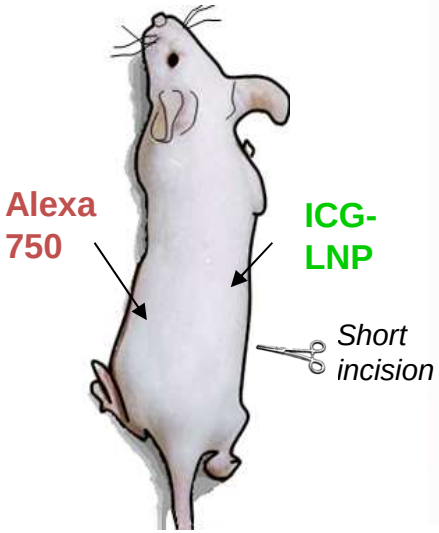
- **Perspectives**
  - ✓Parsimonious representation of transients
  - ✓New concepts for high-resolution imagery in dynamic configurations

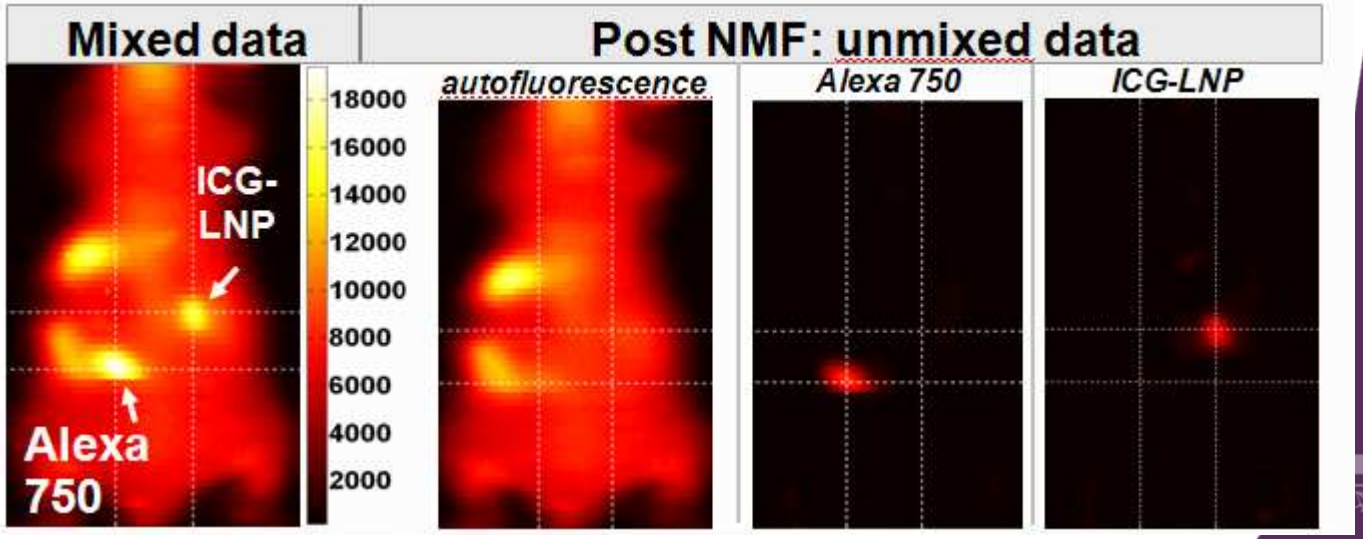
C. Ioana
F. Birleanu, C. Bernard, J. Dahmani

SOURCE SEPARATION ON NON STATIONARY SIGNALS

- **Topic**
  - ✓Source separation on fluorescence and X imagery
- **Methods and results**
  - ✓NMF source separation and other algorithms
  - ✓Allow estimation and separation of marked regions
- **Perspectives**
  - ✓New concepts for high-resolution imagery







J.I. Mars
A.S Montcuquet, F. Fantoni, F. Marticke

Conclusions

- **Une équipe très active … mais qui bénéficie:**
  - ✓ **d'excellents doctorants**
  - ✓ **d'un réseau de collaborateurs internes / national / international**

- **Une équipe avec un spectre large d'activité … mais qui se retrouve sur:**
  - ✓ **des objets d'études communs**
  - ✓ **des méthodes d'analyse**
  - ✓ **des partenariats (OSUG)**
  - ✓ ***un graphe connexe !***

Panorama scientifique

Objet d'étude	Application	Méthode
Mers,Océans	Observation de l'environnement	Analyse temps-fréq.
Glacier	Risque naturel	Traitement d'antenne
Neige	Gestion ressource énergétique	Séparation de sources
Montagne	Défense et sécurité	Méthodes à noyaux
Milieu urbain		Apprentissage
Grands ouvrages		Modélisation physique
Variables climatiques		Assimilation
Forêt		Classification, segmentation etc.
Agriculture		
Biologie, biomédical		Instrumentation
Planètes		

OSUG
Observatoire des Sciences de l'Univers de Grenoble