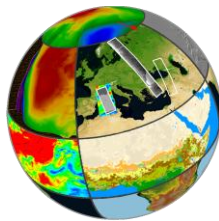


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<http://www.visioterra.fr>

<http://www-igm.univ-mlv.fr/~riazano/>



PROJECT DIRECTOR

Engineering of Information Systems Processing of Earth Observation Data

PROFESSIONAL EXPERIENCE

Director

VisioTerra

Since May 2004 : I have founded a company specialised in Scientific Consulting for Earth Observation.

My experience in Earth Observation domain enables me to perform studies for data quality control, conception of new added value products, assessment of prototypes. Together with my teaching skills, I have produced various books, manuals, papers, reports and communication documents targeted toward a wide public.

Director

GAEL Consultant

July 1992 to March 2004 : I have founded a company specialised in the development of software to process Earth observation data.

Through prestigious customers, GAEL Consultant is recognised for implementing cartography applications, developing orbital models, managing heterogeneous data, promoting new image processing techniques...

General manager of GAEL Consultant, I have also carried out commercial and technical duties.

Professor

University of Marne La Vallée / ENSG / University Paris VI

Since March 1993 : Lecturer promoted Associated Professor on March 2002. Half-time employment. Responsible for the follow-up of company trainees. Referee for the Validation of Professional Experience (VAE).

Teaching: "Image processing", "Fusion of heterogeneous data", "GIS and geodesy", "Graphical interfaces", "Algorithmic".

Research: Follow-up of PhD students and trainees of the Master "Geographic Information Systems". Participation on thesis examination boards.

Project Manager

TELESPAZIO

June 1990 to June 1992 : During two years involvement in the Italian company Telespazio S.p.A., I have been responsible for the two following projects :

- **I-PAF Q.A.** : Manager of Quality Assurance activities for the development of the I-PAF system in charge of ERS-1 image reception at Matera station. I published the "Quality Assurance Plan" compliant with ESA and IEEE standards.
- **TELIMAGO** : Manager of the TELIMAGO project, a system for image processing. Development of a multi-language platform based on X11/R4 and Motif 1.2 to integrate algorithms processing RADAR images.

Computer sciences teacher

University of Villetaneuse

October 1985 to June 1990 : In charge of lectures for continuing education for DUT degree course at IUT of Villetaneuse.

Engineer**CISI Ingénierie**

March 1986 to May 1990 : Engineer promoted Project Manager in Image Processing, member of the “Expert Club” of CISI group. In particular I carried out the following activities:

- **CP-IMAGE** : development, documentation and maintenance of CP-IMAGE software of image processing. User training.
- **Expertise** : Response to invitation to tenders, edition or validation of specification documents.
- **Customer Assistance** : Elf Aquitaine, CFP-TOTAL, IFP, CHS, CEA, COGEMA...

Engineering trainee**SFENA**

April to June 1985 : Trainee of DEA. Subject: "Synthesis of images to support aerial navigation".

Analyst-Programmer**G-CAM**

July 1984 to November 1985 : Starting as a Programmer and then promoted as Analyst-Programmer in the company G-CAM (subsidiary of the “Caisse des Dépôts”), I have been involved in projects of property and banks.

Teacher (primary school and secondary school)**Éducation Nationale**

October 1978 to June 1984 : After having received an education at “Ecole Normale”, I obtained the Certificate of Pedagogic Aptitude enabling to teach children of the Primary School. From the diploma obtained during the evening classes, I was promoted Professor of Mathematics and Physics obtaining the Certificate of Pedagogic Aptitude for Secondary Schools.

EDUCATION

1989	Ph.D. in “ <i>Physical methods in remote sensing</i> ”, Paris 7 University. Subject of the thesis “ <i>Automatic extraction and analysis of networks from digital elevation models – Contribution to analysis of remote sensing images</i> ”.
1985	Diploma of advanced studies (DEA), Paris 6 University “ <i>Algorithmic processing of information</i> ”, module “ <i>Pattern recognition</i> ” University Paris 6.
1984	Master in Computer Sciences, Paris 6 University. Options : “ <i>Artificial Intelligence</i> ”, “ <i>Micro-computer system</i> ”, “ <i>Operating Systems</i> ”, and “ <i>Computer Sciences for Management</i> ”.
1983	Bachelor degree in Computer Sciences, University Paris 6.

LANGUAGE SKILLS

English :	Three months training, intensive professional practice.
Italian :	Two years in Italy (Rome) and professional practice.
German :	School knowledge (seven years) and linguistic journeys.
Spanish:	School knowledge (four years) and linguistic journeys.

PUBLICATIONS

June	2025	“ <i>The Capabilities of Optical and C-Band Radar Satellite Data to Detect and Understand Faba Bean Phenology over a 6-Year Period</i> ”, Remote Sens. 2025, 17(11), 1933; https://doi.org/10.3390/rs17111933
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October 2024 *"First results of the surface water ocean topography (SWOT) observations to rivers elevation profiles in the Cuvette Centrale of the Congo Basin"* in *Frontiers in Remote Sensing* 5:1466695; <https://doi.org/10.3389/frsen.2024.1466695>.

July 2024 *"A 6-Year Analysis of Sentinel-1, Sentinel-2 and Landsat-8 Over Sunflower Crops and an Experimental Field in Southwestern France"* – IGARSS 2024 - - 2024 IEEE International Geoscience and Remote Sensing Symposium - <https://doi.org/10.1109/IGARSS53475.2024.10640785>

July 2024 *"A near-real-time tropical deforestation monitoring algorithm based on the CuSum change detection method"* – *Frontiers in Remote Sensing* 5:1416550 - <https://doi.org/10.3389/frsen.2024.1416550>

March 2024 *"Best BiCubic Method to Compute the Planimetric Misregistration between Images with Sub-Pixel Accuracy: Application to Digital Elevation Models"* in *ISPRS International Journal of Geo-Information (IJGI)* 2024, 13(3), 96; <https://doi.org/10.3390/ijgi13030096>.

February 2024 *"Novel Approach for Ranking DEMs: Copernicus DEM Improves One Arc Second Open Global Topography"* in *IEEE Transactions on Geoscience and Remote Sensing*, vol. 62, pp. 1-22, 2024, Art no. 4503922, doi: <https://doi.org/10.1109/TGRS.2024.3368015>

February 2024 *"Catchment basin versus Mountain range tessellations from DTMs for islands: Lesvos, Kerguelen, Crete, Cyprus, New-Caledonia, Formosa and Sri Lanka"* - <https://hal.science/hal-04426959v1>

August 2023 *"ReCuSum: A polyvalent method to monitor tropical forest disturbances"*, *ISPRS Journal of Photogrammetry and Remote Sensing* 203 (2023) 358–372, - <https://doi.org/10.1016/j.isprsjprs.2023.08.006>, pdf.

July 2023 *"Interactive presentation of Web platforms: -VtWeb, -DEMIX operations platform, -DEM4S2"*, *Geomorphometry 2023*, Iasi (Romania), pdf

July 2023 *"DEMIX SG3 – "Platforms and processing" - Presentation of studies"*, *Geomorphometry 2023*, Iasi (Romania), pdf

December 2022 Co-direction since October 2019 of Bertrand YGORRA [PhD](#) *"Radar backscatter contribution to tropical forest disturbance monitoring"*, pdf.

October 2022 *"Oil slicks in the Gulf of Guinea – 10 years of Envisat Advanced Synthetic Aperture Radar observations"*, *Earth Syst. Sci. Data*, 14, 4569–4588, 2022, <https://doi.org/10.5194/essd-14-4569-2022>

July 2022 *"Classification and Deforestation Monitoring Using Sentinel-1 C-SAR Images in a Temperate Exploited Pine Forest"*, *IGARSS 2022*, <https://doi.org/10.1109/IGARSS46834.2022.9884389>

July 2022 *"Volume Changes of Lake Bracciano During the Sentinels Acquisition Period"*, *IGARSS 2022*, <https://ieeexplore.ieee.org/document/9884169>

April 2022 *"Planimetric Misregistration Assessment"*, issue 1.1, *Telespazio / ESA*, 215 pages. pdf

October 2021 *"Processing On the Fly Macro Language (POF-ML)"*, *CEOS WGISS#52*, 19 October 2021. pdf, video

September 2021 *"Digital Elevation Models: Terminology and Definitions"*, *Remote Sensing* 2021, 13(18), 358, MDPI, <https://doi.org/10.3390/rs13183581>

September 2021 *"Monitoring loss of tropical forest cover from Sentinel-1 time-series: A CuSum-based approach"*, *Int. J. Appl. Earth Obs. Geoinformation*, <https://doi.org/10.1016/j.jag.2021.102532>

July 2021 *"Copernicus DEMs Quality Assessment Summary"*, issue 1.2, *Telespazio / ESA*, 121 pages. pdf

July 2021 *"Deforestation monitoring using Sentinel-1 SAR images in humid tropical"*, *IGARS 2021*, page. <https://doi.org/10.1109/IGARSS47720.2021.9554698>

June 2021 *"The Digital Elevation Model Intercomparison eXperiment DEMIX, a community-based approach at global DEM benchmarking"*, *Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci.*, XLIII-B4-2021, 395–400, <https://doi.org/10.5194/isprs-archives-XLIII-B4-2021-395-2021> (video)

July 2020 *"Global DEM Quality Assessment Summary"*, issue 1.2, *Telespazio / ESA*, 94 pages. pdf

May 2019 *"Water volume changes in the Bracciano Lake: climate or anthropogenic effect ?"*, *Living Planet Symposium*, Milan, 13-17 May 2019. pdf

May 2018 *"Cartographie du Bassin du Lac Tchad – Construire un espace collaboratif BIOPALT"*, *Regional concertation meeting of BIOPALT project*, 28-31 May 2018 in N'Djamena. pdf

submitted 2018 "*Wind Speed and Instrument Modes Influence on the Detectability of Oil Slicks using SAR Images: a Stochastic Approach*", Remote Sensing of Environment. [pdf](#)

January 2018 "*Estimated location of the seafloor sources of marine natural oil seeps from sea surface outbreaks. Inputs of a new vertical drift model applied to the Gulf of Mexico*", [Elsevier](#), Marine and Petroleum Geology, volume 91, pages 190-201. [pdf](#)

January 2018 "*A statistical approach to preprocess and enhance C-Band SAR images in order to detect automatically marine oil slicks*", [IEEE](#) Trans. Geoscience and Remote Sensing (TGRS). [pdf](#)

October 2017 "*Training session on integrating GIS and remote sensing data into Web portals*", NARA, issue 1 revision 0, 02-06 October 2017 in Colombo (Sri-Lanka). [slides](#)

June 2017 Co-direction since April 2014 of Zhour NAJOUJ [PhD](#) "*Prétraitement optimal des images radar et modélisation des dérives de nappes d'hydrocarbures pour l'aide à la photo-interprétation en exploration pétrolière et surveillance environnementale*", [pdf](#).

May 2017 "*UN Environment / ANDE mission relating to the implementation of the EESI in San-Pedro - Preliminary study*", UNEP, issue 1. rev.1, Roundtable EESI in Abidjan. [presentation](#) [final report](#)

April 2017 "*Haiti Matthew Hurricane damage assessment - Synthesis note*", UNEP, issue 3 revision 4, 12/04/2017, 134 pages. [french](#) [english](#)

November 2015 "*Geomatics Tools (remote sensing and GIS) for the Monitoring & Assessment of the Great Green Wall*", PAGGW Training Workshop – Khartoum, 10-13 November 2015. [pdf](#)

October 2015 "*A link on Sentinel data to discover, track changes, inform, train... citizen and scientists*", "EO Open Science 2.0" workshop, 12-14 October 2015, Frascati (Italy). [slides](#)

July 2015 "*Côte d'Ivoire - Post-Conflict Environment Assessment*", UNEP, Contribution to the study of changes in classified forests, pp. 55-67, [french](#) [english](#).

March 2015 "*Live-link to ESA big data - A study to enhance the access to ESA and TPM EO products*", ESA, issue 1 revision 0, 19/03/2015, 111 pages. [pdf](#)

March 2014 "*Accessing Earth Observation (EO) and meteorological data for scientists and citizen*", ESA/GWSP/FAO Workshop on EO & Water-Energy-Food Nexus - FAO (Roma). [slides](#)

December 2013 "*ERAIFT - Support géomatique - Etat des lieux pour la réhabilitation du Laboratoire de Géomatique Appliquée et Environnement LAGEOMAPPE*", 104 pages, 40 fig. [pdf](#)

September 2013 "*Enhancing Envisat ASAR WSM segments to detect oil spills in the framework of the "20 years of oil routes"*" – Living planet sympo. 2013, ESA, Edinburgh (Scotland). [paper](#) [slides](#)

June 2013 "*Semantic research and advanced display of large collections of EO data*" – "Big Data From Space" workshop, ESRIN, Frascati (Italy). [slides](#)

December 2011 "*20 years of oil routes*" – GRSG Workshop - Advances in Geological Remote Sensing, 7-9 December 2011, ESA, Frascati (Italy). [slides](#)

November 2011 "*VtAoiWatcher – A platform to access and process free Earth observation data*" – Ramsar COP11 Africa, Ouagadougou, Burkina Faso. [slides](#)

May 2009 "*Contribution of METOP ASCAT for land surface parameters monitoring over Sahel*" – Second EPS / MetOp RAO Workshop, 20-22 May 2009, Barcelona, Spain. [paper](#) [slides](#)

June 2008 "*GOCE Products User Handbook*" – Issue 2.0, 104 pages, 23 figures, 15 equations, document edited for the European Space Agency (ESA-ESRIN). [pdf](#)

April 2006 "*IGAT – Quality of geographic information – Chapter 4: Quality of raster data*" – Ed. HERMES (English edition). [pdf](#)

March 2006 "*The EO CalVal portal*" – Proceedings of the Second Working Meeting on MERIS and AATSR Calibration and Geophysical Validation (MAVT-2006), 20-24 March 2006, ESRIN, Frascati, Italy (ESA SP-615, July 2006). [pdf](#)

October 2005 "*IGAT – Qualité de l'information cartographique – Chapitre 5: Qualité des données matricielles*" – Ed. HERMES (French edition). [pdf](#)

August 2005 "*Recensement des solutions techniques et des acteurs de la recherche dans le domaine du géoréférencement*", 30 pages, document edited for the DGA.

July	2005	" <i>Envisat MERIS Geometry Handbook</i> ", issue 1 revision 5, 115 pages, 67 figures, 10 equations, document edited for the European Space Agency. pdf
October	2004	" <i>Multitemporal MERIS Synthesis – Technical Note</i> ", issue 1 revision 1, 128 pages, 92 figures, document edited for the European Space Agency. pdf
April	2004	" <i>The new Digital Elevation Model from the SRTM: Hydrogeomorphological applications in the Ohrid region</i> " – BALWOIS conference on Water observation and information system for decision support – Ohrid, Macedonia – April 25-29 2004. pdf
March	2004	" <i>SPOT Vegetation / Envisat MERIS – Complementarity and Comparison</i> " – International SPOT 4/5 VEGETATION Users Conference – Antwerp, Belgium – March 24-26 2004. pdf
April	2002	" <i>Preserving cartographic quality in DTM interpolation from contour lines</i> ", ISPRS Journal of Photogrammetry and Remote Sensing, Vol. 56 (3) (2002) pp. 210-220. pdf
March	2002	" <i>Contrôle qualité des scènes Landsat 7 Image 2000</i> ", 85 pages, 74 figures, document edited for the Joint Research Centre of the European Commission. pdf
January	2002	" <i>SPOT 123-4-5 Geometry Handbook</i> ", 82 pages, 35 figures, 32 equations, document edited for SPOT IMAGE and validated by CNES. pdf
July	2001	" <i>Scientific Support - Technical Note - Comparison of ESA/USGS Landsat ETM+ Fast Format products</i> ", 65 pages, 28 figures, document edited for ESA-ESRIN. pdf
January	1999	" <i>Le problème des courbes intercalaires dans la construction d'un MNT maillé à partir de courbes de niveau</i> " in Bulletin SFPT n°153, pp.32-34. pdf
April	1994	" <i>Synthetic aperture radar (SAR) data quality analysis on an open image processing system</i> ", Proc. Vol. 2178, Visual Data Exploration and Analysis; IS&T/SPIE 1994 Int. Symp. on Electronic Imaging: Science and Technology, 1994, San Jose, CA, USA, https://doi.org/10.1117/12.172077 , pdf .
May	1992	" <i>A Combined Algorithm for Automated Drainage Network Extraction</i> " in Water Resources Research, vol.28, n°5, pp.1293-1302. pdf
January	1992	" <i>Extraction et analyse automatiques d'un réseau hiérarchisé de talwegs. Application à un Modèle Numérique de Terrain dérivé d'un couple stéréoscopique SPOT</i> " in International Journal of Remote Sensing, vol.13, n°2, pp.337-364. pdf
January	1990	" <i>Parametrisable skeletonization of binary and multi-level images</i> " in Pattern Recognition Letters, vol.11, pp.25-33. pdf
June	1988	" <i>Ridges and Valleys lines extraction from Digital Terrain Model</i> " in International Journal of Remote Sensing, vol.9, n°6, pp.1175-1183. pdf
May	1987	" <i>Nouveaux algorithmes pour l'extraction de lignes de crêtes. Application aux Modèles Numériques de Terrain</i> " in proceedings of MARI. pdf

MISCELLANEOUS

Born on July 5th, 1960 in Provins (77, France).

Married, father of five children.

French nationality.

Passions : Chess and diving.

PROJECTS

I have managed the following projects:

Software development

- GERNAC** **Gestion de l'Eau et Ressources Naturelles en Afrique Centrale (Water and Natural Resources Management in Central Africa) - Geoservices platform of support to river navigation, deforestation, and floodings monitoring in Central Africa** - As part of the GMES & Africa program, VisioTerra supported AfEOS for the development of a smartphone App, indicators, dashboards, periodic bulletins and configured a datacentre for the Commission Internationale du Bassin du Congo-Oubangui-Sangha (CICOS).
- DEM4S2** **Digital Elevation Model for Sentinel-2** - Edition of the DEM used for the orthorectification of Sentinel-2 tiles to enable users to visualise in 3D catchment areas, terrain roughness, ridge and talweg lines... and also to assess the influence of relief on the quality and rendering of Sentinel-2 HR optical images.
- CAFWS** **Geoservices platform of deforestation, active fires and burnt areas monitoring in Central Africa** - As part of the GMES & Africa program, VisioTerra supported AfEOS for the development of a smartphone App, indicators, dashboards, periodic bulletins and configured a datacentre for the Gabonese Agency for Space Studies and Observation (AGEOS).
- DEMIX Operation Platform** **DEM supply and testing platform** - Development of a distribution platform for Digital Elevation Model (DEM) tiles and criteria tests as part of the "DEM Intercomparison eXercise (DEMIX)" project. This platform allows users to choose the Digital Terrain Model (DTM) or Surface Model (DSM) best suited to their needs.
- MISBAR** **Geoservices platform of agriculture and irrigation monitoring in North Africa** - As part of the GMES & Africa program, VisioTerra supported AfEOS for the development of indicators, dashboards, periodic bulletins and configured a datacentre for the Sahara and Sahel Observatory (OSS).
- FLEGT Watch** **Monitoring of deforestation in Central and West Africa** – Service of automatic detection of forest cover changes from Sentinel-1 radar data, notification to observers and support to in-situ controls.
- VtEolex** **Earth Observation Local Explorer**– A standalone application exploring local disks to recognize, locate and extract metadata from satellite products. The catalogue thus produced makes it possible to manage the copies to other media for distribution purposes.
- VtProbaV** **Automatic detection of fires and burnt areas** – Service of automatic detection of fires and burnt areas from image data of the Proba-V satellite.
- HEDAVI** **HEritage DAta Visualisation** – Hosted service of visualisation and sharing of heritage data (ERS and Envisat satellites) and third party missions (Landsat) data acquired by the European Space Agency (ESA).
- VtGsep** **Goce Swarm Exploration Platform** – Client-server system enabling to browse, visualise, share, export and choose the rendering of the gravimetric measurements of the Goce satellite and the geomagnetism measurements of the three satellites of the Swarm constellation.
- VtWeb** **Advanced solution of visualisation and processing of Web data** – Client-server system enabling to browse the free data of the Web, to visualise them in 2D/3D in all the navigators, to process them on-the-fly, to share and export the selected data.
- WMU, U. Ruhuna, U. Iceland...** **PACe - Whale Web portal** – Leading a consortium of research institutes for "Assessing cetacean populations and important cetacean habitats in Bay of Bengal and Icelandic shelf large marine ecosystems". Production of a virtual globe for this project.

<i>VtCryoSat</i>	Platform to access the CryoSat data – Client-server system enabling to browse, visualise, share, export and choose the rendering of data acquired by the altimeter on-board the CryoSat satellite of ESA.
<i>VtGoce</i>	Virtual globe to compare and combine surfaces – Tool enabling to compare and combine altimetry surfaces. Application to the geoids produced by the GOCE satellite.
<i>VtAoiWatcher</i>	Near real-time monitoring – Tool monitoring areas of interest and providing with near real-time images that are processed on the flight.
<i>VtGeomorpho</i>	Morpho-structural analysis – Production of serial profiles and wrapping surfaces from various altimetry models.
<i>VtExpotKMZ</i>	Export of “super-layers” – Production of KMZ “super-layers” for the Google Earth display of for an e-mail controlling the size of the product.
<i>VtEscape</i>	Surface parameters – Tool producing spacemaps containing physical parameters of the Earth surface: -atmosphere (wind fields, pressures, clouds...), -ocean (sea surface temperatures, currents, salinity...), -lands (reflectance, land-use, moisture...).
<i>GATE</i>	Global Access TEledetection – Exchange and visualization platform making use of virtual globes (<i>Google Earth</i> and/or <i>World Wind</i>).
<i>VtAoiBuilder</i>	Area Of Interest builder – Development of a tool to create areas of interest of various types: <i>-bounding box, -disk, -corridor, -polygon</i> .
<i>VtAoiCatcher</i>	Acquisition prediction – Development of a tool enabling to select the missions / instruments observing a particular area of interest for a given period.
<i>VtTileGrabber</i>	Virtual Globe Capture – Development of a tool enabling the capture of the layers displayed along a session of navigation in a virtual globe. Production of a geocoded mosaic of the observed tiles.
<i>VtSatelliteTracker</i>	Orbit propagation and virtual globes – Development of a Web tool to display in virtual globes the satellite models, propagated orbits, instrument viewing vectors, and on-ground swaths.
<i>TOTAL</i>	Radar methodology – Development of accurate orthorectification techniques, setting of back-scattering models depending on land cover, and processing of speckle noise.

Cartographic production

<i>EPIC du Mont-Saint-Michel</i>	Monitoring of sedimentation in the Bay of Mont-Saint-Michel (BSM) - Cartography of channels and silting in the BSM at low tide using Sentinel-2 optical satellite images and Sentinel-1 radar images to preserve the island nature of Mont-Sant-Michel.
<i>U.E. / Agreco</i>	B4Life / B4Life Crisis - Cartography of conservation landscapes (areas to be protected and their environment) throughout Africa as part of the European " <i>Biodiversity for Life (B4Life)</i> " facility and " <i>B4Life Crisis</i> " facility for countries in crisis.
<i>Everimpact</i>	Carbon stocks in Japanese forests - Calculation of vegetation and leaf indices in Japanese forests and diachronic analysis of carbon stock changes.
<i>MEDD C.I. / WB / Agreco</i>	EESS / PAGIL Ivory Coast - Strategic Environmental and Social Assessment (EES in French) of the Ivorian Coastal Development and Integrated Management Plan (PAGIL). Climate evolution and diachronic mapping of forest cover, floods, marine pollutions, coastline.
<i>E.U. / Agreco</i>	Priority Landscape for conservation (PLC) – Support Program for the Preservation of Forest Ecosystems in West Africa (PAPFor). Production of maps of 6 landscapes and study of the evolution of land use and deforestation, in the M ^t Nimba PPC.

<i>UNEP / OBSCOM</i>	Urban growth in Ivory Coast – Production of LU/LC classification spacemaps and statistics to monitor the urban growth of the cities of Abidjan and Bouake in Ivory Coast.
<i>Dobbin International / OBSCOM</i>	LU/LC of Mozambique – Production of LU/LC classification spacemaps of 5 provinces of Mozambique from Landsat scenes and field data. Production of radar scenes. Orthorectification of SPOT scenes.
<i>Rio Tinto / OBSCOM</i>	Production of LU/LC maps in Guinea – Geocoding and processing of Landsat, Radar and digital elevation models (DEM) to produce Land Use / Land Cover (LU/LC) maps from field data and supervised classifications.
<i>AFCA</i>	Coffee detection in Mukono (Uganda) - Detection of coffee plantations by classification in Uganda's Mukono district using Sentinel-2 multispectral data.
<i>TOTAL</i>	Massive production of radar geocoded data – Geocoding and processing of radar segments and scenes to make easier the photo-interpretation of hydrocarbon slicks over the sea.
<i>TOTAL</i>	World / Africa / South Africa posters – Production and processing of three posters (diameter 5m and 7m) displayed on the TOTAL stand at the AAPG 2008 workshop in Cape Town (South Africa).
<i>TOTAL</i>	World poster – Production and processing of a 5x10m poster displayed on the TOTAL stand at the EAGE 2008 workshop in Rome.
<i>WCS / OBSCOM</i>	Afghanistan eastern complex forest mapping – Production of a SPOT-5 / SPOT-4 mosaic over Afghanistan. Assessment and processing of SRTM defects.
<i>UNEP</i>	OPTEC Gaza – Processing, control and preparation of data for the inventory of land cover in Gaza Band.
<i>Gaz de France</i>	Landsat ETM+ Libya – Processing, production and restitution of Landsat ETM+ spacemaps for the photo-interpretation of structural geology.
<i>TOTAL</i>	JERS Colombia – Geocoding, pre-processing and quality control of 38 JERS-scenes.
<i>Morocco Marble Exploration</i>	Envisat ASAR + Landsat ETM+ synthesis – Geocoding and merging of RADAR and optical images to support photo-interpretation for the detection of marble veins in Moroccan Atlas.

Studies

<i>ESA</i>	COPEX-DCC – Study and comparison of lossy compression with very high ratio (> x50) applied to Copernicus Sentinel and ERA5 products. Assessment of the quality losses by classical methods (RMSE, PSNR, SSIM, LPIPS) and thematic (biogeophysical indicators, classification, segmentation...).
<i>E.U. / Agreco</i>	Transhumance, security and conservation in Central Africa - Bibliographic analysis, production of transhumance maps and development of geoservice prototypes for the (1) automatic detection by AI of transhumance paths from Sentinel-2 images, (2) restitution of conflict risks, (3) demarcation and status of pastures, (4) mapping of precipitation averages and anomalies.
<i>Paul Sabatier University</i>	Six (6) years of satellite observations of agricultural areas in south-west France - Calculation of biophysical parameters for hundreds of plots around the Auradé and Lamasquère sites using Sentinel-1 radar and Sentinel-2 / Landsat optical data from 2016 to 2020 to characterise phenological cycles, trends, good development or crop stress.
<i>MNHN</i>	Forest degradation in the “Parc Marin des Mangroves (PMM)” - Combined use of Sentinel-1 radar and Sentinel-2 optical data to map areas of deforestation and forest degradation in the conserved area of the PMM in Democratic Republic of Congo (DRC).
<i>ESA</i>	Quality assessment of Copernicus DEMs – Analysis of the three Copernicus Digital Elevation Models (EEA-10, GLO-30 and GLO-90). Comparison of GLO-30 with SRTM, ASTER GDEM and ALOS World 3D global DEMs. Altimetric accuracy

computed from LiDAR data: ICESat-1, ICESat-2 ("Terrain only" and "Terrain with canopy"), GEDI ("Lowest mode » and "Highest return"). Statistical measurement of the influence of land use.

- VisioTerra* **10 years of oils in Guinea Gulf** – Detection, classification and analysis of oil slicks observed by ASAR radar instrument in WSM mode onboard Envisat from 2002 to 2012. Oil slicks are classified according to whether they have a natural (oil seepages) or anthropogenic origin (oil spills from platforms or deballasting from ships).
- ESA* **Quality assessment of global DEMs** – Analysis and comparison of three Digital Elevation Models (DEM) SRTM, ASTER GDEM and ALOS World 3D. Altimetric accuracy compared to ICESat-1 LiDAR data, on-the-fly computation of slopes, azimuths, curvatures and analysis of the correlation with altimetric RMSE, impact of accuracy orthorectification.
- Tropenbos International* **Study of deforestation and mining in Bafwasende (DRC)** – Monitoring of land-use / land-cover from 20 year (2000, 2005, 2010, 2015 et 2019) from Landsat-7, Landsat-8 and Sentinel-2 satellite data. Detection of illegal mining sites.
- Tropenbos International* **Study of deforestation in three Forest Reserves in Ghana** – Analysis of forest degradation since 2000 in favour of agroforestry within forest reserves (out of “admitted farms”) of Tano-Ofin, Sui-River and Krokosua by using radar and optical images.
- APN Benin* **Study of land use dynamics in hunting areas (ZC) and national park (PN) in Benin** - Production of land use maps of the three protected areas ZC Djona, ZC Mekrou and PN W-Benin and their periphery from satellite data since 1998.
- CNES* **SPOT World Heritage Gallery** – Integration of the catalogue of the free SPOT-123/4/5 images in VtWeb. Development of pseudo “natural colours” rendering. Production of a gallery of views.
- Beicip Franlab / SONATRACH* **Geological analysis in Tindouf Basin** – Supply and processing of remote sensing (radar and optical) images on the Tindouf Basin (Algeria). Production of geological maps by photo-interpretation.
- UNEP* **ISEA San-Pedro** – Integrated Strategic Environmental Assessment (ISEA) for the redevelopment of San-Pedro harbour (Ivory Coast). Study of precipitations, flooding simulation, LU/LC spacemaps, study of the coastline evolution, design of a dedicated GIS.
- UNEP* **Vegetation loss after Matthew hurricane in Haiti** – Sentinel-2 data have been used to compute the differences of vegetation indices before and after the Matthew hurricane that occurred on 4 October 2016.
- ESA* **Live-link to ESA Big Data** – Study of the volume and accessibility of the main archives of EO of ESA. Development of a prototype enabling to access and process on-the-fly the three collections -DHuS Sentinel-1, -Envisat ASAR/MERIS, -Landsat-5/7 TM/ETM+.
- ERAIFT* **Capacity building of the geomatics laboratory** – Field survey and reporting for the capacity building of the Geomatics Laboratory of the ERAIFT regional school in Kinshasa, DRC.
- TOTAL* **CryoSat over Arctic** – Study of the potential of satellite data to monitor the environment in very cold areas.
- TOTAL* **Radar / optic coupling** – Development and validation of methods to retrieve the optical signature of hydrocarbons from slicks detected by radar.
- TOTAL* **Detection of offshore wind fields from radar images** – Development and validation of methods to detect wind fields at the surface of the sea from radar images.
- TOTAL* **Oil seeps detection** – Development and validation of methods to detect offshore oil seeps from wide field radar images.

<i>TOTAL</i>	E.O. Portal – Edition of Intranet pages specialised in Earth Observation (EO) defining the missions, instruments, programmes, events, agenda, spatial agencies, organisations... together with associated courses.
<i>REMA / World Bank</i>	REMA Biodiversity Information System (RBIS) – Rwanda Environment Management Authority (REMA) – Support for the management of the RBIS from the invitation to tender up to the software development, data organization and trainings.
<i>TOTAL</i>	Multitemporal study of flooded areas – Analysis of the yearly cycle within the period 2006-2009. Classification of marsh zones and detection of anomalies due to anthropogenic activities.
<i>TOTAL</i>	Coastal erosion of Mandji peninsula – Compilation and accurate geocoding of optic and radar data (satellite and aerial photographs) acquired along the last 35 years. Photo-interpretation of coastal lines and development of tools to quantify erosions / accretions.
<i>SIARCE / AIR</i>	Audit of the SIGNE GIS – Assessment of the functionalities, document, manpower and computer resources of the GIS for the management of the Essonne basin. Editing of recommendations for the system extension.
<i>ESA-ESRIN</i>	GOCE L1b Products User Handbook – Editing of a second version of the handbook describing the acquisition physics, the algorithms, and the products of the gravimeter and positioning instruments on board GOCE.
<i>ESA / Brockmann Consult</i>	CAL/VAL Portal – Generic description of missions and instruments using the SensorML language to support Calibration / Validation activities performed by the CEOS group.
<i>TOTAL</i>	Study of Google Earth – Study, training and demonstrations of Google Earth for the fulfilment of business requirements in the domains of oil exploration, environment management and infrastructures.
<i>ESA-ESRIN</i>	MERIS Product Handbook – Enhancement and correction of the MERIS product handbook introducing FAQ, applications and level 3 descriptions.
<i>DGA / Générale d'Infographie</i>	Georeferencing study – Inventory of technical solutions and research actors in the field of georeferencing.
<i>ESA-ESTEC</i>	MERIS Geometry handbook – This handbook details the viewing geometry and provides algorithms and programs to orthorectify MERIS images from elevation ancillary data or external DEM(s).
<i>ESA-ESTEC</i>	DEM Quality assessment – Elevations found in ACE (ERS-1/2 Altimetry Corrected Elevations) and in SRTM30 are compared and assessed using external elevation values. Visual inspections results are also reported within a technical note.
<i>SPOT IMAGE</i>	Scientific editing of DIMAP format – Enhancement of DIMAP documentation by providing explanations, equations and figures of the viewing model. HTML pages (397 items) are automatically generated from XML schemas and style sheets.
<i>ESA-ESRIN / CNES</i>	SPOT Vegetation / Envisat MERIS – Complementarity and comparison – Analysis of radiometry and geometry performances of both instruments. Paper presented on 2 nd SPOT Vegetation Workshop (Antwerp, 12-14 March 2004).

Training

<i>Abidjan (Ivory Coast), Yaoundé / Douala (Cameroon), Kumasi (Ghana), Kisangani (DRC), Yangambi (DRC), Kinshasa (DRC)</i>	Forest monitoring – Photo-interpretation of radar and optical data to detect forest cover changes and deforestation.
<i>AfriGEOSS (Sunyani, Ghana)</i>	Access and processing tools for Sentinel data – <i>Envisat with HEDAVI, Sentinel with VtWeb, Thematic studies, Use of SNAP, Use of Google Earth Engine.</i>
<i>NARA (Colombo, Sri-Lanka)</i>	Integrating GIS and remote sensing data into Web portals – Training in the use of VtPace, an environmental monitoring application for blue whales. Presentation of Copernicus and Sentinel data applied to the Sri Lankan context.

- Douala University (Cameroun)* **Remote sensing and image processing** – Knowledge control and bringing up to standard in the framework of “Open and remote trainings” (project FOAD of AUF).
- INP (Gabon)* **Spatial geometry algorithms** – Ecole du Cadastre of the Institut National de Cartographie (INC) in Libreville. Reminders of geodesy and spatial mechanics. Detailed presentation of algorithms for the geocoding and orthorectification of optic and radar Earth observation images.
- UNEP* **Remote sensing and GIS for hazard mapping** – Advanced training and ArcGIS practice to setup a “Hazard mapping” GIS, to process optical and Radar images, digital elevation models, and to produce thematic maps by the Forestry Department of Myanmar.
- TOTAL* **“Image processing” and “Georeferencing” trainings** – “Image processing”: physics, instruments, pseudo-colour and colour composites, LUT transform, filtering, fusion. – “Georeferencing”: geodesy, coordinates reference systems, spatial mechanics, image products, optical and radar orthorectification.
- Algerian Universities* **Geometry of remote sensing images** – Communication in the universities of Constantine and M’Sila. Processing of Landsat scenes in the region of Constantine.
- PDVSA / BEICIP* **Remote Sensing Training applied to Oil Exploration** – Training of PDVA’s managers for the acquisition, processing and interpretation of Earth observation data.
- ESA / Palestinian Universities* **Remote Sensing Training and GIS in Palestine** – In collaboration with the University of Marne-la-Vallée and with the support of the European Space Agency, VisioTerra has built a GIS of Palestine that has been presented to the universities of Al-Quds, Naplouse and Hebron.

Communication

- ESA* **Sentinel Vision** – Daily edition of “Stories” (“Sentinel of the Day” and “Event Sheets”) showing the potential of Sentinel-1/2/3 images and altimeter data. Design of thematic galleries.
- University Paris-Est* **“Université à Tous Âges”** – Presentation of the latest developments and applications in Earth Observation domain to citizen outside the university.
- Cité des Sciences* **“Objective Earth”** – Presentation during the “Week of the science” of the best-of Earth observation images. Explanation of the acquisition techniques, data processing and applications.
- Bandit Manchot* **E-commerce website setting up** - Graphic elaboration, shop window, goods database, shopping basket, special offers, customers accounts, orders, quick browsing... from Oscommerce.
- ICE* **Communication support** - Elaboration of the graphic charter, company presentation leaflet and partners business cards.
- LAPIDEM* **Google Earth website** - Presentation of the architecture projects within dynamic web pages and display of the projects in the Google Earth virtual globe.

Various projects managed at GAEL Consultant

- ESA-ESRIN* **MERIS synthesis March-April 2003** - Composition of acquisitions by the MERIS instrument of the Envisat satellite. This 1-km synthesis processed 10 TB from 1242 segments (more than 600 GB).
- Spacebel / European Commission* **EOLES / RealCup** – Development and integration of the RealCup system enabling the processing of Envisat / MERIS data in near real-time: less than 3 hours from the telemetry to customised products ready for use in GIS.
- JRC* **Landsat mosaic of Europe** – Composition of a mosaic of the 15 countries of Europe from more than 300 scenes Landsat ETM+. Study and correction of the misregistrations between the various national projections.

<i>EADS / EUMETSAT</i>	U-MARF V2 – Development and integration of generic engines for metadata extraction, quick-look generation and generic translation able to manage more than 250 product formats.
<i>EADS / ESA-ESRIN</i>	ADAR, Advanced Data Archive – Specification of an archive management system handling petabytes of heterogeneous data. Development of a prototype implementing most of ADAR requirements.
<i>ESA-ESRIN</i>	AMALFI – ASAR, MERIS, AATSR labelling Facility Inspection. Development of an integrated system enabling to control Envisat products before their dissemination to end-users, -record and analyse quality control results, -monitor quality control activities in a networked environment.
<i>SPOT IMAGE</i>	SPOT Geometry Handbook has been issued by GAEL Consultant’s specialists. This document describes the instruments, geometry, correction algorithms, formats and ancillary data of SPOT-123, SPOT-4 and SPOT-5 missions.
<i>Gaz de France</i>	Mosaic Landsat ETM PAN+VNIR/SWIR - Geocoding of Landsat ETM+ scenes from a constellation of geodesic points matching the oil wells in Southern Algeria. Merging of panchromatic and multispectral bands using wavelet transforms.
<i>ESA-ESRIN</i>	Development of Envisat LVLO Analysis and Product Comparison Tool for the qualification of the instruments processing facilities (IPF) during SODAP (Switch On and data Acquisition Phase) and calibration / validation phases.
<i>JRC - SAI</i>	Quality control of Image 2000 Landsat ETM+ scenes. Radiometry and geometry checking performed from maps and GPS acquisition. Delivery of HTML quality control reports.
<i>EURIMAGE</i>	Orthorectification and PAN+VIS merging of Landsat ETM+ scenes of France. Scenes were used to build 3D views of Tour de France 2001 on a Web site.
<i>ESA-ESRIN</i>	Support and maintenance for the quality control of Landsat scenes acquired over Europe. Scientific support, definition of quality control procedures, software upgrades and processing of rejected products.
<i>JRC - SAI</i>	IRS WiFS orthorectification. Delivery of multi-temporal space maps and mosaicking to identify burned areas over Europe.
<i>SPOT IMAGE</i>	Evolutive maintenance of QUISS system for the quality control of SPOT scenes produced by direct receiving stations.
<i>Agence de l’Eau Seine-Normandie</i>	Classification of Landsat 7 ETM+ scenes and qualification of procedures by comparative analysis with Landsat 5 TM and SPOT XS classifications.
<i>GlobeExplorer</i>	Delivery of aerial photos mosaics of various French cities for distribution through an electronic portal.
<i>ONIC</i>	Orthorectification of SPOT, Landsat TM and IRS-1C scenes and specific processing of these images to favour the agricultural inventory. Orthorectification of Landsat 7 ETM+ images within non-covered zones.
<i>GEOSYS</i>	Delivery of orthorectified scenes Landsat and SPOT according to particular projections of various countries.
<i>Sierra Productions</i>	Delivery of orthorectified Landsat 7 ETM+ mosaics used as a texture for the presentation of the “Tour de France 2000” on a Web site.
<i>ESA-ESRIN</i>	Study of baseband archive formats (FRED, MDPS, Gerald, Vexcel...) used in receiving stations. Development of a new format for the interchange of archives (CEOS ICF).
<i>CGG-TOPNAV</i>	Delivery of spacemaps SPOT P+XS, Landsat TM and ETM+. Support for the photo-interpretation assisted by computer using the software INTERP developed by GAEL Consultant.
<i>Telespazio</i>	High accuracy georeferencing of Landsat TM scenes (full, mini, quarter) for a perfect superimposition of less than 1 pixel (30 meters) between multi-temporal images.

<i>ESA-ESRIN</i>	Development of an application for the quality control of Envisat satellite / MERIS instrument . Delivery of software development environment allowing the Customer to add his own tests.
<i>Telespazio</i>	Development and tuning of the production chain and quality control procedures in the framework of MARS project . On-site assistance for the start of orthorectification process.
<i>ESA-ESRIN</i>	On-site assistance performed by one of our engineers, specialist of ERS-SAR image processing. Editing of quality control reports gathered from on-board recorded data.
<i>Telespazio</i>	Study of the IRS-1C data: location accuracy, orthorectification and radiometry. Editing of a "IRS-1C Data Quality" report.
<i>ESA-ESRIN</i>	Upgrade of QUISS software for the quality control of Landsat 4/5 TM and Landsat 7 ETM+ products . Installation of QUISS at the stations of Fucino, Kiruna, Neustrelitz and Maspalomas.
<i>Agence de l'Eau Seine-Normandie</i>	Assembly of a mosaic of 56 SPOT panchromatic scenes orthorectified and colorized from a mosaic of Landsat TM scenes.
<i>ESA-ESRIN</i>	Development of a Web site showing the latest data acquired by the ERS scatterometer and the evolution during the last three days by display of derived images.
<i>FAO - Telespazio</i>	Development of the production chain and set up of procedures for the generation of space maps over Africa. Analysis of the anomalies of Landsat 5 trajectory.
<i>ESA-ESRIN</i>	Tools for the import and visualization of ERS scatterometer data. Generation of streamlines and derived products from wind vector fields.
<i>France 2 - Geosys</i>	Assembly of a complete mosaic of France from Landsat TM data (more than 44 scenes). This mosaic serves as texture for meteorological presentations at the French TV through 3-D animations.
<i>RAI 1 – Telespazio</i>	Realization of a complete mosaic of Italy from Landsat TM data (more than 38 scenes). This mosaic serves as texture for meteorological presentations at the Italian TV.
<i>ESA-ESRIN</i>	Quality analysis of images produced by MMBS and MUIS Internet servers. Editing of "Evaluation of Browse Data Quality in ESRIN On-line Services" report.
<i>SPOT IMAGE</i>	Application QUISS for SPOT images quality control applied to certify scenes produced by the worldwide Direct Receiving Stations.
<i>Elf Aquitaine</i>	Conception of a video film showing a virtual flight over Pyrenees chain from SPOT P, Landsat TM images and a 10 meters DEM.
<i>IMA / GEO</i>	Georeferencing and orthorectification of video images acquired from helicopter missions along high voltage lines. Processing of images from Russian KVR 1000 satellite.
<i>CGG</i>	Detection of coralline reefs and generation of bathymetric curves from " Blues Analysis ".
<i>Nova Telespazio</i>	Application GEOREF / MAPPER for georeferencing and geocoding images into a wide set of map projections. Development of orbital models for the generation of accurate space maps.
<i>ELF Aquitaine</i>	Development of INTERP application, an expert photo-interpretation system using dedicated toolboxes (Geology, Drawing, Cartography...) to be applied to remote sensing and cartographic images. Development of geological quantification tools.
<i>ELICS</i>	Generation of Digital Elevation Models from SONAR bathymetry data . Development of techniques to mosaic DEM swaths.

- Nova Telespazio* Applications **REGIST / MOSAIC** for the radiometric and geometric mosaicking. Application to the generation of space maps in the framework of Africover project (FAO).
- CGG* Processing and rectification of SPOT, Landsat and road cartography images. **Evaluation, modelling and correction of geometric deformations produced by scanners.**
- Fucino Receiving Station* **SPOTCD** system for the formatting, mastering and recording of CD-ROMs containing SPOT scenes.
- Regional Council of Sardinia* Development of SAR software for **meteorological and agricultural monitoring** from ground stations and satellite images (NOAA, Meteosat). Programming of applications using ERDAS Toolkit for communication with ORACLE7 database.
- Nova Telespazio* Development of **SPOTQC** software for quality control of SPOT images received and processed at Fucino station.
- ELF Aquitaine* **Support** for processing of remote sensing images in the visible domain (Landsat, SPOT, NOAA) and Radar (STAR 1, ERS-1). Participation in production of **cartographic products.**
- Telespazio SpA* Development of **SALV** software of vehicles tracking within urban areas using GPS positioning.
- SNEAP* **Maintenance and upgrade of image processing software** for geology and remote sensing. Decoding and visualization of multi-mission and multi-format data.