Titre du projet : Achat d'un logiciel de traitements sismiques 3D

Volet : Formation / Equipement

Porteur du projet : Michel Dietrich

Laboratoires impliqués : ISTerre

Bilan du projet pour l'année/la période

Bilan d'activité *(1 page max)*

Ce projet a été soumis au premier appel d'offres Formation 2011. Il a été financé à hauteur de 35 000 €. Son objectif est de financer pour une durée de 6 ans 20 licences d'utilisation d'un logiciel de traitement de données sismiques 2D et 3D. Sa motivation principale est de transposer au niveau de l'enseignement les évolutions majeures qui sont intervenues en matière d'exploration sismique du sous-sol au cours des 20 dernières années. Durant cette période, l'imagerie sismique 3D a complètement supplanté les anciennes méthodes 2D utilisées pour la prospection industrielle du sous-sol. Les acquisitions de données 3D sont devenues la norme après avoir été des exceptions au début des années 1990. En revanche, cette évolution n'a été que peu suivie en milieu académique : les techniques de traitements 2D y sont encore majoritairement enseignées, en grande partie à cause de la puissance de calcul nécessaire à la manipulation de très grands cubes de données et par manque d'outils de visualisation adaptés à ces jeux de données. Ce projet a donc eu, dès le départ, encore d'autres ambitions : initier les étudiants aux calculs de haute performance, et les former à l'utilisation de logiciels utilisés dans l'industrie pour favoriser leur insertion professionnelle.

Notre choix s'est porté sur le logiciel *Globe Claritas* de GNS Science en Nouvelle Zélande pour différentes raisons : d'une part, parce que ce logiciel est très complet en termes de fonctionnalités et qu'il est efficace en termes de performance, et d'autre part, parce que son utilisation reste simple et qu'il permet de faire le lien avec les programmes *Seismic Unix* utilisés par ailleurs pour d'autres enseignements. Ce logiciel est également de plus en plus utilisé dans l'industrie et en milieu universitaire en raison des avantages mentionnés ci-dessus, et du fait de son développement constant d'un point de vie informatique (*Figure 1*). Installé à la fin de l'année 2012 sur le serveur multiprocesseur (32 coeurs) *nigel* à mémoire partagée (768 Go RAM), qui a en partie également été financé par des crédits Labex OSUG@2020 (projet Labex Formation 2011 de Jean Braun), il a donné toute satisfaction après deux années d'enseignement. Les cours dispensés avec *Globe Claritas* n'ont pour l'instant concerné que la filière M2P *Géosciences : Exploration, Risques*, mais nous prévoyons de les étendre dans le cadre de la nouvelle maquette du Master en cours d'élaboration, en exploitant des fonctionnalités supplémentaires du logiciel.

Le financement de ce projet par le Labex OSUG@2020 a coïncidé avec d'autres réalisations : outre l'acquisition du serveur multiprocesseur *nigel* déjà évoqué plus haut, indispensable pour la puissance de calcul nécessaire au logiciel *Globe Claritas*, nous avons installé le logiciel de visualisation et d'interprétation de données sismiques *OpendTect* qui vient utilement compléter les fonctionnalités de *Globe Claritas* en matière de graphisme (*Figure 2*). L'ensemble de cette configuration logicielle

n'aurait pas pu voir le jour sans la donation de 15 postes de travail par la société Total, qui servent de terminaux au serveur *nigel*. De son côté, le laboratoire ISTerre a fortement contribué à ce projet en mettant à notre disposition une salle informatique dédiée à la formation, en l'équipant entièrement en prises Ethernet et en alimentation électrique (*Figures 3, 4* et *5* et *Annexe 1*).

En conclusion, les différents financements apportés dans le cadre de ce projet nous ont permis d'effectuer un virage important dans l'enseignement des techniques actuelles de traitement et de post-traitement de données sismiques 2D et 3D, pour le plus grand bénéfice de nos étudiants qui pourront faire valoir ces connaissances lors de la recherche de stages et/ou de leur premier emploi.

Illustrations - avec légende et crédit *(à envoyer également séparément)*

Figure 1 : L'Université Joseph Fourier fait maintenant partie des utilisateurs de *Globe Claritas*, aux côtés d'autres universités prestigieuses, de grands groupes pétroliers et de sociétés de services géophysiques (*document Globe Claritas*).
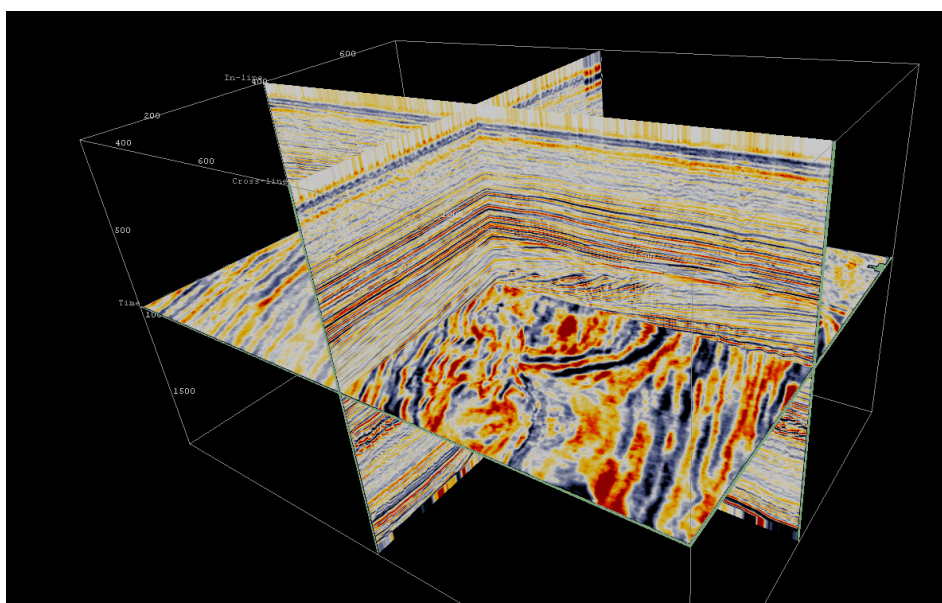

Figure 2 : Le logiciel *OpendTect* (licence gratuite pour les universités) est un précieux complément à *Globe Claritas* pour la visualisation et l'analyse détaillée de blocs de données sismique 3D. La figure montre trois coupes effectuées dans le bloc F3 situé en Mer du Nord, d'une surface de 380 km^2.

ISTerre Salle 124 – TP Informatique (Novembre 2013)

15 postes de travail **HP xw9400** – Processeur dual-core AMD Opteron 2220x4 (64 bits)
Carte graphique nVIDIA Quadro FX 1700 | 4500 | 4600 | 5500 | 5600 | 5800
4 à 8 Go RAM – 160 à 300 Go HD – Ubuntu 12.04 LTS 64 bits – 2 écrans 17" HP ou Sony

Reliés au serveur **Dell PowerEdge R820** ('nigel') – 4 processeurs Intel Xeon à 8 cœurs
2.6 GHz – GPU nVIDIA Quadro 2000 – 768 Go RAM partagée – 1.7 To HD SAS @
10 000 t/min – 3.4 To HD SAS @ 7 200 t/min – CentOS 6.4 64 bits
Gestionnaire de batch OAR – Environnement scientifique CIMENT – Grille de calcul CIGRI
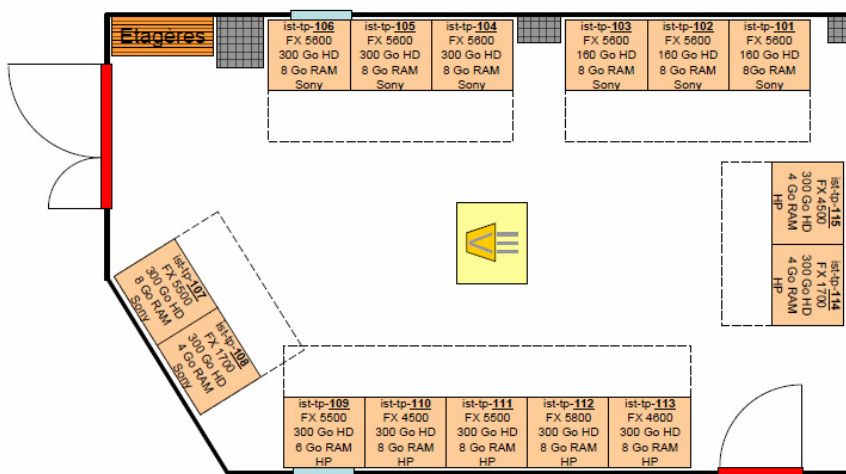
Figure 3 : Configuration de la salle informatique 124 à ISTerre, dédiée à l'initiation de nos étudiants aux calculs de haute performance, et à leur formation à l'utilisation de logiciels utilisés dans l'industrie.

Figure 4 : Inauguration de la salle informatique 124 d'ISTerre le 17 avril 2013 en présence de Sylvie Grimaud et de Bernard Potier représentant la société Total, de Peter Van der Beek, directeur adjoint de l'OSUG chargé de la formation et de Philippe Cardin, directeur d'ISTerre (*photo M. Dietrich*).

Figure 5 : Interprétation de données sismiques par les étudiants de la filière M2P *Géosciences : Exploration, Risques* dans la salle ISTerre 124, sous la supervision de Pascale Huyghe (*photo M. Dietrich*).

Production scientifique *(articles scientifiques, actes de congrès…)*

La vocation de ce projet étant entièrement tournée vers l'enseignement, il n'y a pas eu de publications scientifiques à ce jour. Celles-ci ne sont cependant pas exclues dans le futur pour la présentation de projets réalisés collectivement par les étudiants.

Bilan financier succinct *(avec suivant les cas : co-financements éventuels, équipements achetés, missions, recrutements divers, fonctionnements divers…)*

Une étude de marché des logiciels de traitements sismiques a été réalisée de manière détaillée au premier semestre 2012, conduisant au choix de *Globe Claritas* (*Annexe 2*). Une dotation de 35 000 € du Labex OSUG@2020 a été notifiée le 2 mai 2012. Les procédures de marché ont quelque peu ralenti l'achat des licences du logiciel qui n'est intervenu qu'au mois de novembre 2012 (*Annexe 3*).

Selon les termes du contrat de licence, celui-ci est valable pour 20 licences étudiants et enseignants. Son coût initial est de 24 000 USD (payés 18 070 € en décembre 2012) incluant deux années de maintenance. Le coût de la maintenance annuelle est de 4 000 USD.

Le reliquat actuel des crédits alloués est de 35 000 – 18 070 = 16 930 €. Ce reliquat nous permettra de régler 4 années supplémentaires de maintenance du logiciel comme envisagé initialement dans notre plan à 6 ans, voire une 5ème année suivant le taux de change USD / Euro.

Annexes si besoin ou lien sur des sites existants et pérennes jusqu'à la fin du Labex (2020)

- o *Annexe 1* : Présentation de la salle informatique 124 d'ISTerre le jour de son inauguration (M. Dietrich, 17 avril 2013).

- o *Annexe 2* : Tableau de comparaison des logiciels de traitements sismiques (M. Dietrich).

- o *Annexe 3* : Accord de licence académique du logiciel *Globe Claritas* (08/11/2012)

La salle de TP informatique d'ISTerre

Kamil Adoum, Hafid Bouchafa, Jean Braun, Romain Brossier, Michel Dietrich, Mai-Linh Doan, Marie-Pierre Doin, Patrick Fulconis, Pascale Huyghe, Mélanie Noury, Erwan Pathier, Anne Socquet, Peter Van der Beek, Jean Virieux

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Le projet de salle informatique pour les étudiants

- Initier les étudiants aux calculs de haute performance en milieu académique, avant leur entrée dans le monde professionnel
    - Achat d'un serveur multiprocesseur à mémoire partagée

- Les former à des logiciels utilisés dans l'industrie
    - Sous la forme de travaux pratiques et de projets en petits groupes

- Sous la supervision d'enseignants-chercheurs situés à proximité
    - Salle située dans les locaux d'ISTerre plutôt que PhITEM

Situation actuelle (2012)

- Retards dans l'enseignement des méthodes de traitement de données sismiques 3D en milieu académique, car ces enseignements nécessitent :
  - des moyens de calculs importants
  - des logiciels de traitement appropriés
- Besoins importants en personnel chez les opérateurs concernés (compagnies de services géophysiques, compagnies pétrolières et gazières) pour faire face aux départs massifs, durant la décénnie actuelle, des personnels spécialisés de ces entreprises.

ISTerre Salle 124
Agencement permettant 15 à 17 postes de travail dans une salle de 32 m^2.
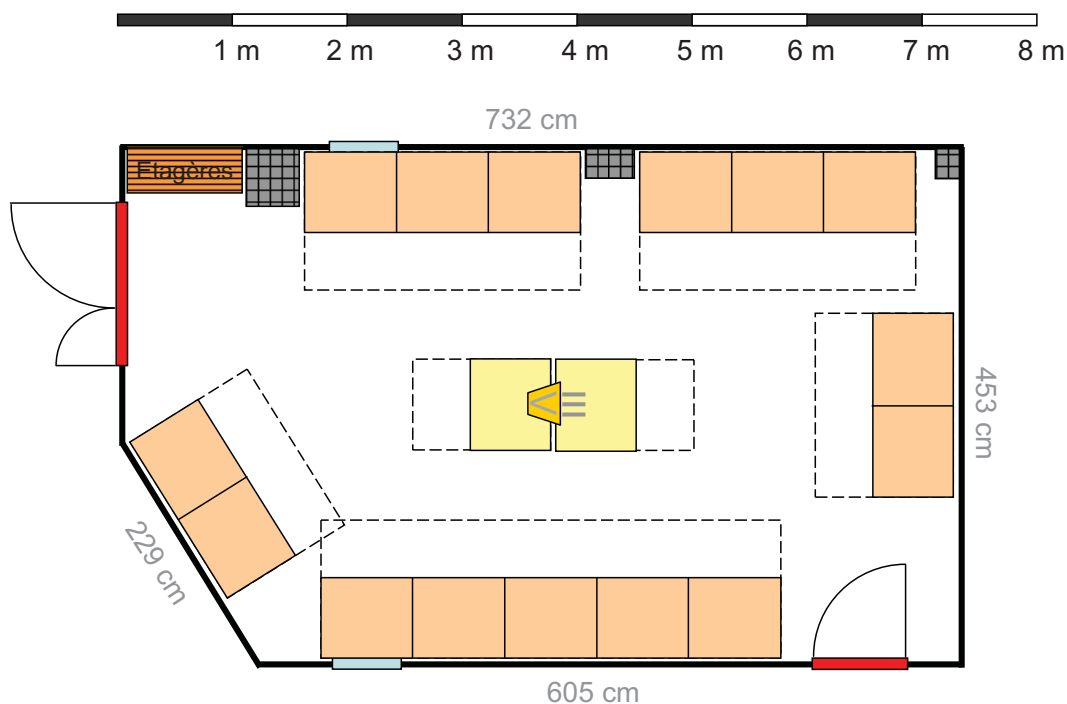
Salle 124

Salle 124

Choix d'un serveur de calcul multiprocesseur

- Retour en force des machines multiprocesseurs à **mémoire partagée**.
- Constituent une alternative intéressante aux clusters de PC à mémoire distribuée.
- Puissance de calcul et mémoire importantes, coûts en baisse.
- Puissance électrique limitée à 2800 W pour le modèle ci-contre.

Serveur Multi Processeurs 8 sockets

Jusqu'à :
8 CPUs, 80 cœurs Intel Xeon série E7-8800
2 TO DDR3 ECC Reg
24 disques durs 2,5"
10 x PCI-E 2.0
Support 4 GPU

Caractéristiques :
Intel 82576 Dual Port Gigabit Ethernet LAN
4 x PCIE-2.0 x16 + 2 x PCIE2.0 x8
ou 10 x PCIE2.0 x8
IPMI 2.0 + KVM sur port réseau dédié
Ventilateurs Hot Swap régulés
Double alimentation redondante 2800 W

Super High Performance Computing
HPC - Virtualisation - Bases de données - Finance - Oil & Gas - Ingénierie - Recherche

Jusqu'au 31 août - Le serveur configuré Alineos :
OS Linux (Debian - CentOS - Red Hat) installé / optimisé - (Win2008 R2 en option)
8 x Intel Xeon Westmere 8870 - 80 cœurs de calcul
2 x 300 GO SAS 15 krpm en Raid 1
512 GO DDR3 : 44 990 € HT - 1 TO DDR3 : 59 990 € HT

Equipements informatiques

- Serveur Dell PowerEdge R820
  - 4 processeurs à 8 cœurs, soit 32 cœurs de calcul
  - 768 Go de mémoire RAM
  - Carte graphique GPU NVIDIA Quadro 2000
  - 1,7 To de disques SAS à 10 000 t/min
  - 3,4 To de disques SAS à 7 200 t/min
  - Système d'exploitation Linux CentOS 6.4
  - Gestionnaire de batchs OAR
  - Environnement scientifique CIMENT
  - Fait partie de la grille de calcul grenbloise CIGRI
  - Machine hébergée dans les locaux du Département de Chimie Moléculaire

Equipements informatiques

- 20 stations de travail HP xw9400 offertes par Total
  - Processeurs AMD Operon 2,8 GHz avec bonne carte graphique nVIDIA
  - 8 Go de mémoire RAM
  - 300 Go d'espace disque, par PC
  - Système d'exploitation Linux Ubuntu 12.04
  - Incluant deux écrans par poste de travail
- 20 moniteurs 17" Sony SDM6S73
- 20 moniteurs 17" HP 1702
  - Egalement fournis par Total

En remerciement du soutien de

Le LabEx OSUG@2020 est financé par le programme
d'Investissements d'Avenir lancé par l'Etat
et mis en oeuvre par l'ANR

TP étudiant en salle 124

TP étudiant en salle 124

Enseignements décembre 2012 à février 2013

- Traitements sismiques
  - Public : étudiants M2P GER
  - Logiciel : Globe Claritas
- Interprétation sismique
  - Public : étudiants M2P GER
  - Logiciel : OpendTect
- Visualisation de données
  - Public : étudiants L3 Pro PPRS
  - Logiciel : gOcad
- Interférométrie radar satellitaire
  - Public : étudiants M2R STE
  - Logiciels : ROI-pac, mdx, Google Earth
- Modélisation des processus géologiques (thermochronologie, évolution des reliefs)

Traitements sismiques

- Initier les étudiants des filières mentionnées précédemment aux outils modernes de traitements des données sismiques 3D, qui comportent plusieurs aspects distincts :
  - d'une part **l'apprentissage des techniques de traitements proprement dites**, d'un point de vue théorique et pratique,
  - d'autre part la **conduite de projets de traitements intégrés** qui suppose une maîtrise de l'outil logiciel et de ses compléments (scripts de traitements).

- Des post-traitements permettent des interprétations de nature **géomécanique**, **pétrophysique** ou **stratigraphique** (OpendTect)

- L'intégration de **données acquises dans des puits de forage** ouvrira des perspectives supplémentaires de traitements et d'interprétation de données.

Représentations 2D et 3D de données sismiques

Coupe verticale
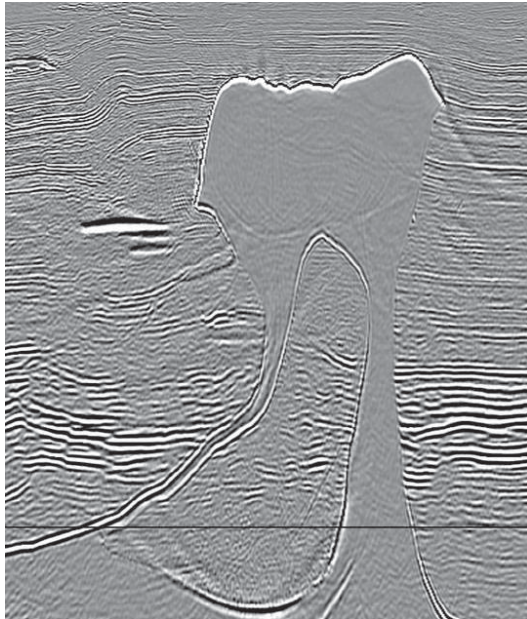
Coupe horizontale

Document CGGVeritas

Document IFP

Jeux de données pour la formation

Line 6 - BroadSeis

AmpRec_L18_SEGIN_BR_23 (ID:141)

Document CGGVeritas
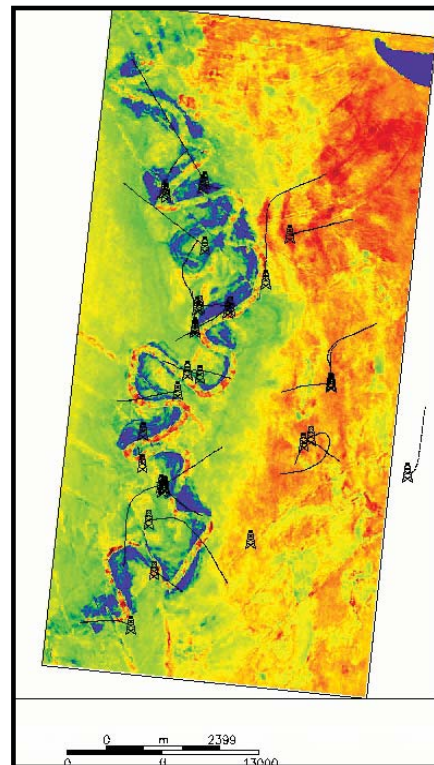
Line 6 - Conventional

AmpRec_L18_SEGIN_CV_24 (ID:142)
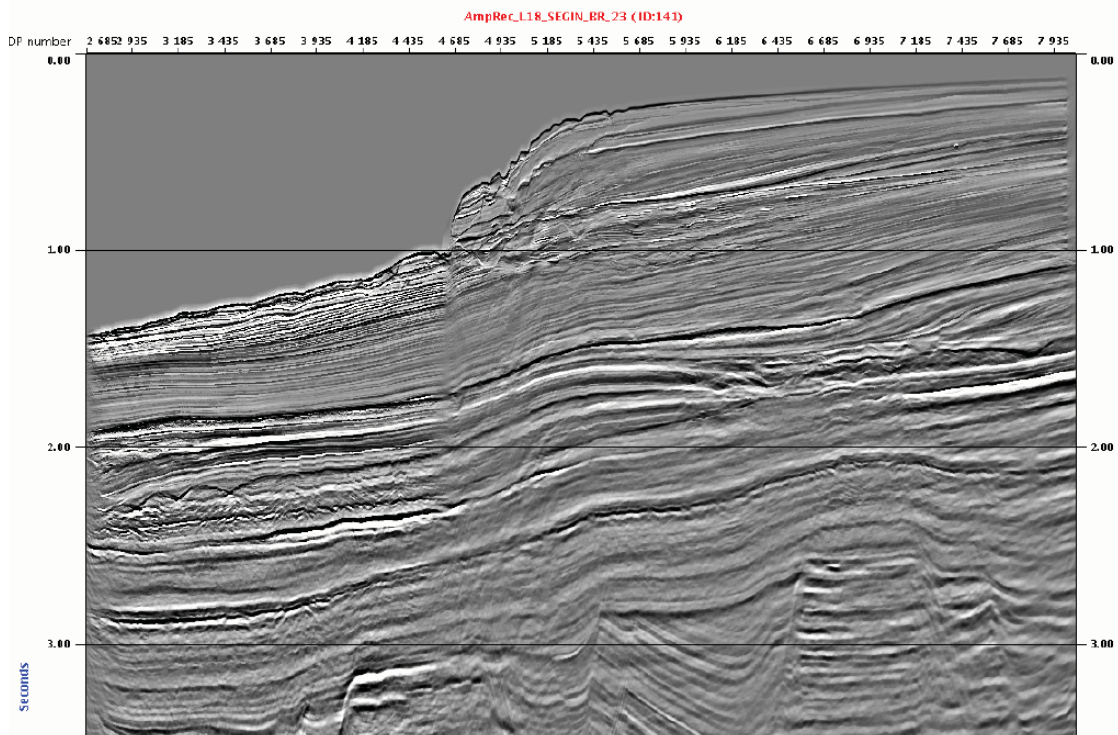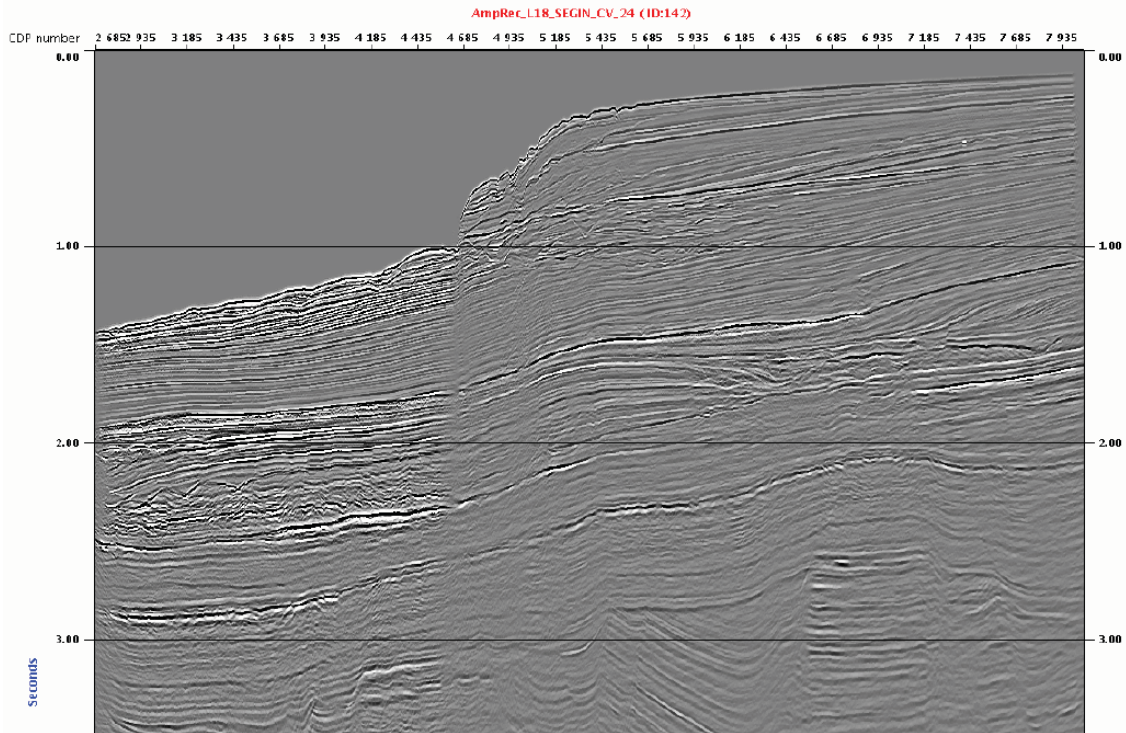
17 avril 2013

Document CGGVeritas

17

GLOBE *Claritas*

Connect. Build. Grow.

Selection of existing clients:

HiSeis

TOTAL

Université Joseph Fourier GRENOBLE

Imperial College London

SeaBird Exploration

THE UNIVERSITY of TULSA

OMV

Durham University

TULLOW OIL plc

TERREX SEISMIC
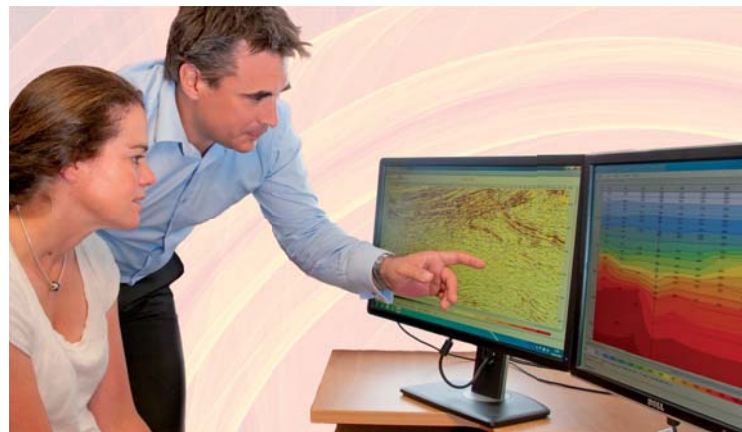
Connect
- Professional and enthusiastic Helpdesk
- Industry experienced experts
- Tutorials, Examples, Data
- Client driven development

Build
- Run your own code in parallel
- Licensing based on processing capacity
- Build your own specialized work-flows

Grow
- Scalable parallel processing
- Licensing that scales with your business
- Tutorials and regular training cycles
- Tier structure for multi-core/CPU use

"With the assistance of the team we have managed to integrate GLOBE Claritas software seamlessly into our proprietary in house solution. This has given us a scalable and fully supported Pre-Processing framework, which has allowed us to focus our efforts on developing our own specialised technology."

TOTAL S.A.

GLOBE Claritas Supported Operating Systems

GLOBE Claritas is supported on a wide range of operating systems, including:
* Linux (RHEL6, UBUNTU 12.04)   * Windows 7 (x86, x86_64 in 32 bit mode)

www.globeclaritas.com

www.globeclaritas.com

Interprétation sismique

- Pointé d'horizons d'une campagne sismique 3D (stratigraphie sismique), et manipulation des données

- Utilisation des forages (well-to-seismic tie)

- Manipulation d'outils de traitements 3D (stratal slicing)

- Calcul d'attributs sismiques (filtres, bright spot, pendages, réseaux de neurones, …)

OpendTect dans le monde

OpendTect en France

University Joseph Fourier Grenoble - fr
http://isterre.fr

3D seismic survey
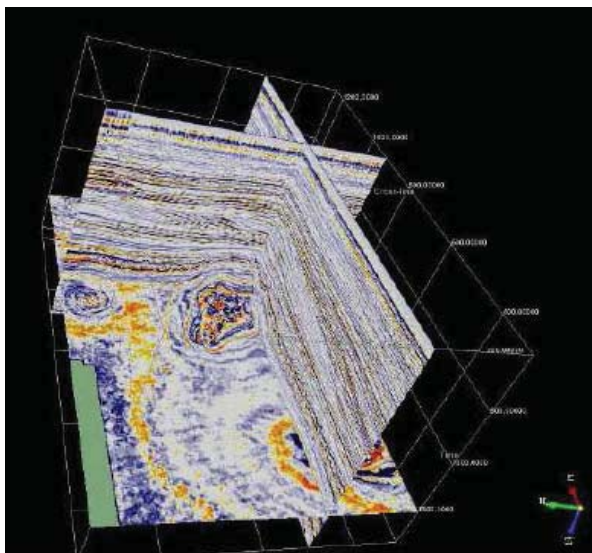
TP d'interprétation sismique

Creating random lines
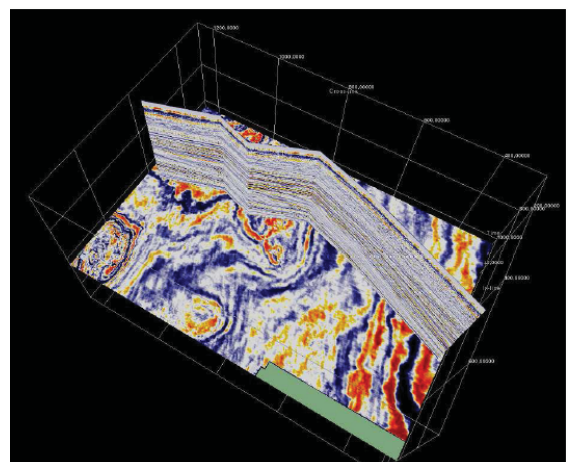
Tying seismic data to wells
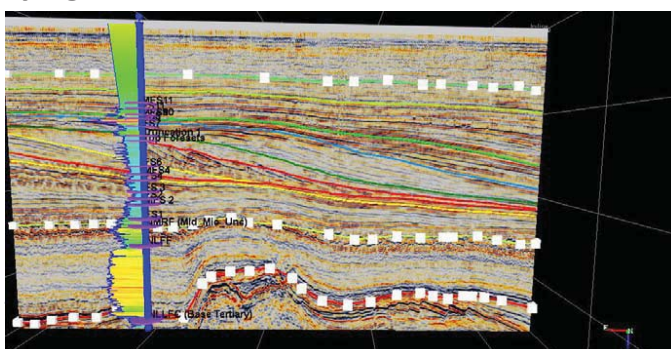
Stratal slicing to investigate the depositional systems

The Eridanos fluvio-deltaic system (North western Europe – Late Cenozoic)

Slice 748

Slice 1000
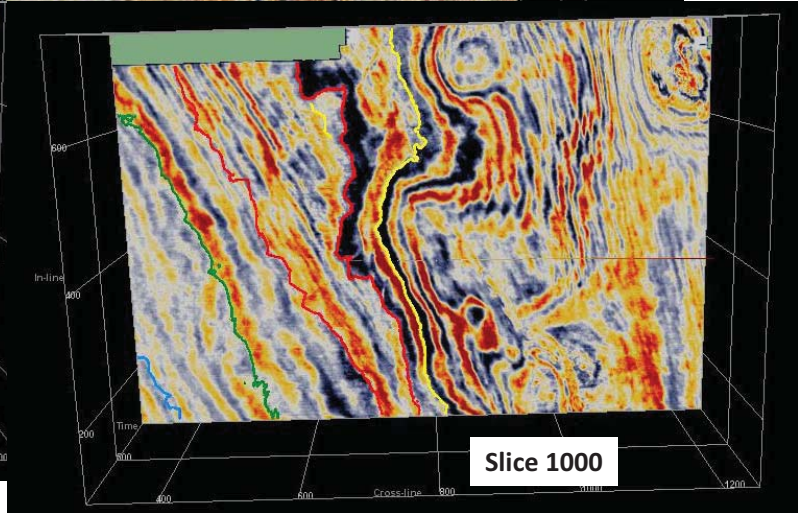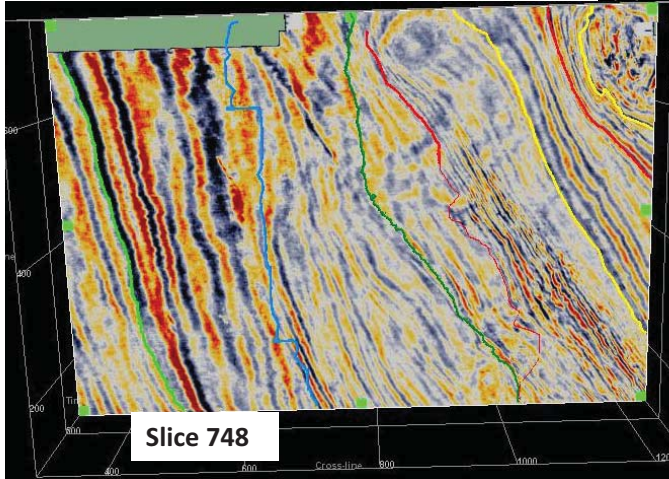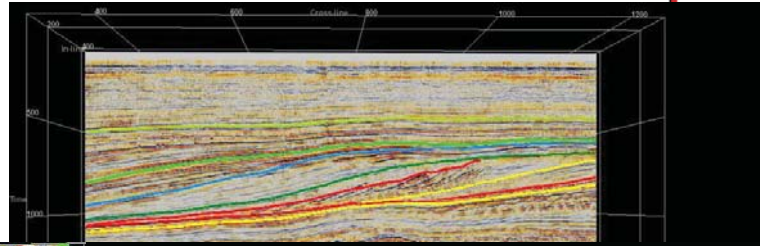
Straight wave-dominated delta front developing into a lobate fluvial dominated delta front as a response of short-term variations in rate of sediment supply and bifurcation of the delta channel network

1. Energy attribute of the in-line #250:

Detection and visualization of bright-spot

3D view of the detected bright-spot anomaly
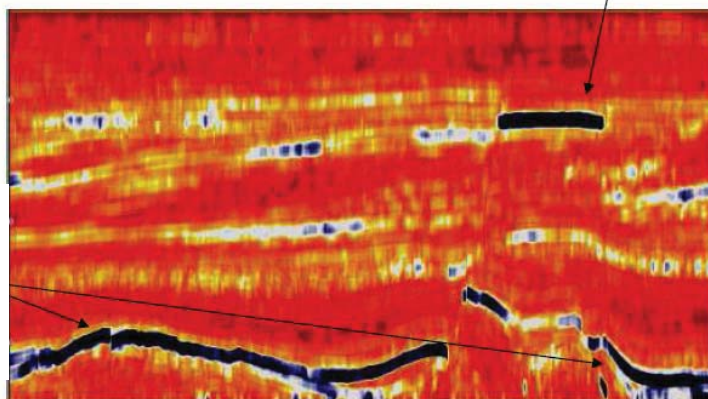
Application de l'interférométrie radar satellitaire à l'étude d'un séisme

Seismicity of Iran and Vicinity
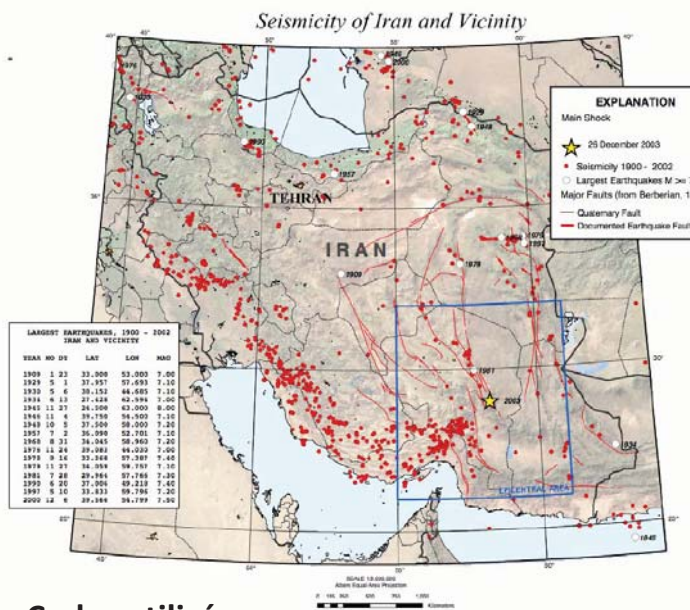
Séisme de Bam (Iran, Mw=6.5, 26 Décembre 2003)
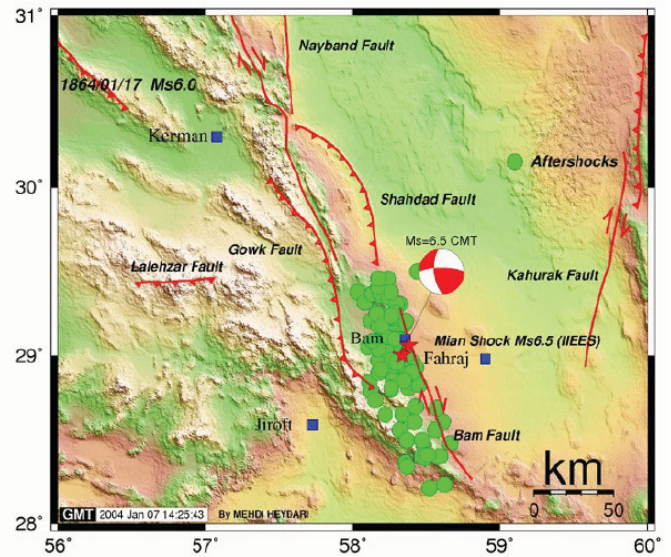
Codes utilisés:

Mesure des déplacements: ROI-Pac (programmes en fortran et C, contrôlés par des scripts perl), installés et compilés sur le serveur Nigel.

Visualisation des images: programme mdx (code en C), et Google Earth

Comparaison observation/modélisation avec des modèles directs : codes matlab.

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Les grandes étapes du traitements

Image brute acquise avant le séisme

Couple d'images focalisées
Résolution :20m*20m

Image brute acquise après le séisme

Interférogramme non corrigé de la topographie

MNT et Orbites

MNT en géométrie radar

Interférogramme corrigé

Interférogramme déroulé
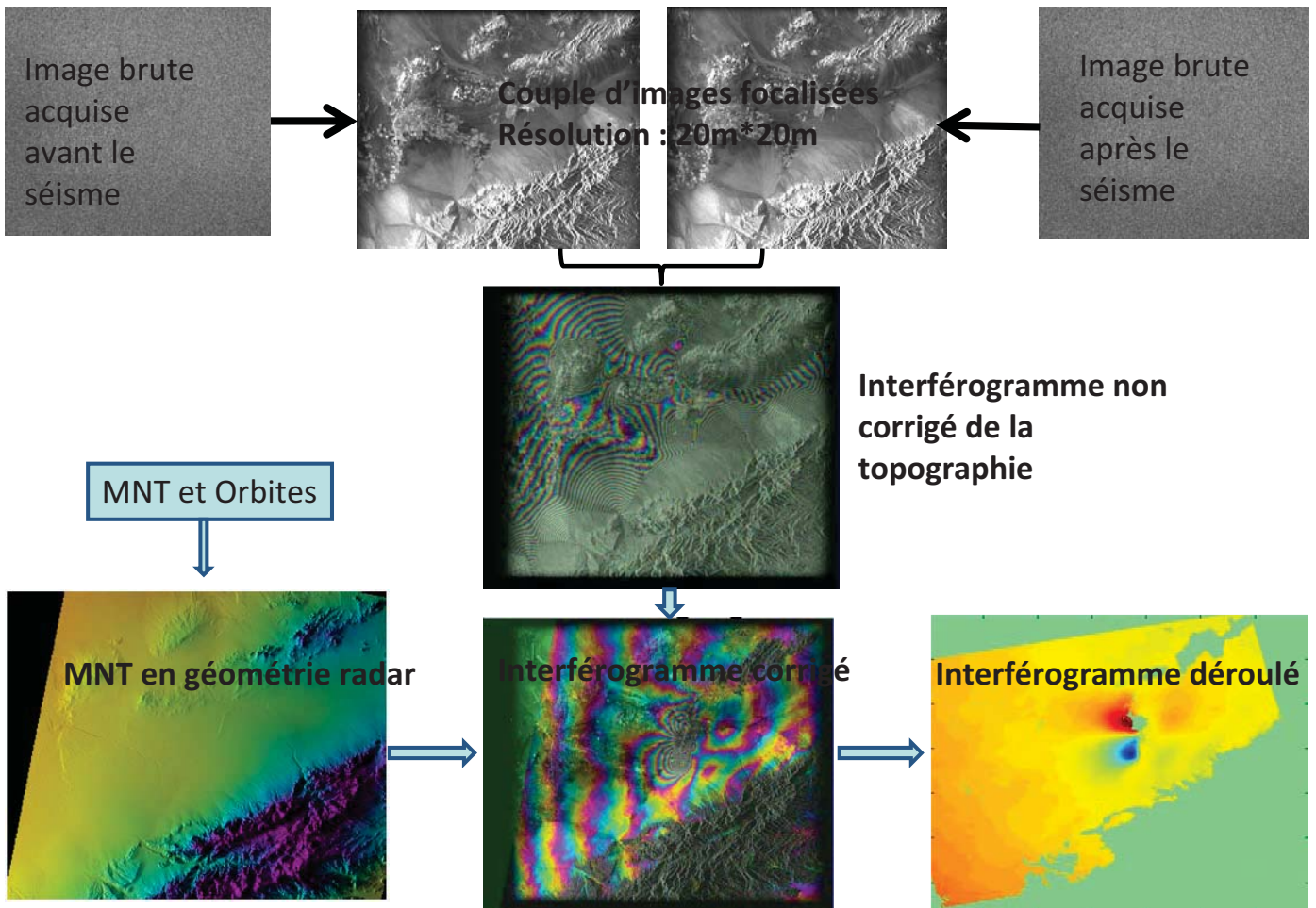
Exemple de résultat final du traitement interférométrique: un interférogramme déroulé et géocodé qui peut être interprété comme une carte de déplacement cosismique du sol suivant la direction de visée du radar.
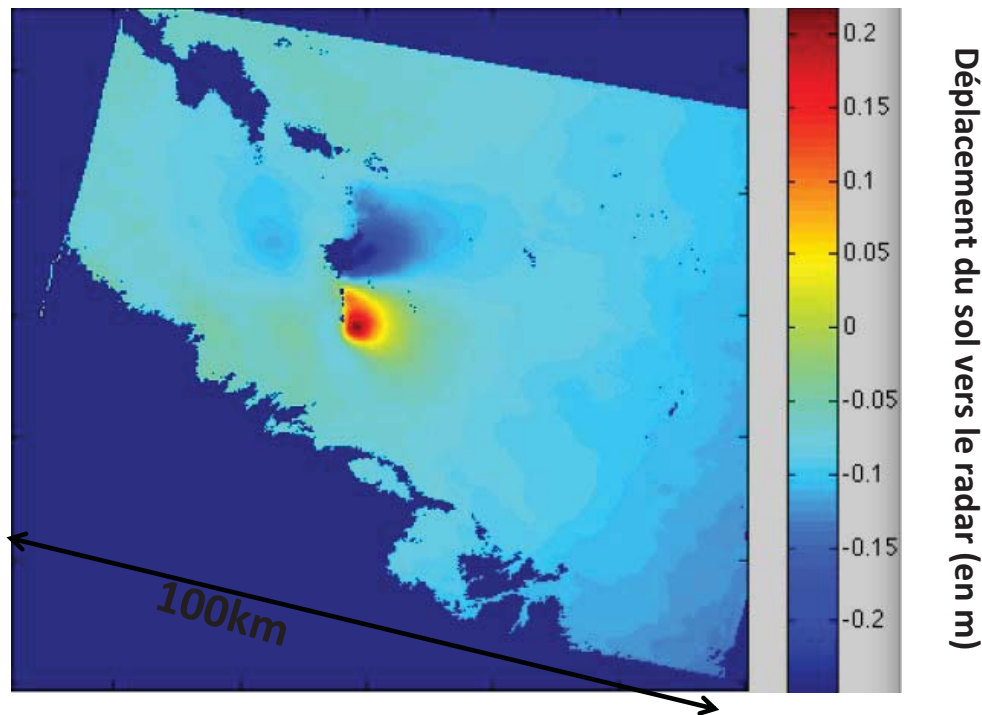
Cette carte est ensuite analysée sous Google Earth pour en tirer des informations sur la rupture et comparée avec des résultats issus de modèles directs basés sur des modèles élastiques simples (Okada 1985)

En guise de conclusion

- Effectuer le virage vers les techniques de calculs intensifs pour les étudiants.
- Former les étudiants aux méthodes de modélisation numérique et d'interprétation géophysique modernes.
- Rendre les étudiants attractifs aux yeux d'employeurs clés tels que les compagnies pétrolières et compagnies de services géophysiques internationales.
- Faciliter la mise en oeuvre de logiciels lourds initialement installés à PHITEM tels que gOcad, et anticiper l'utilisation de nouveaux logiciels pour le projet *Training in Geophysics*.

Evolution thermique
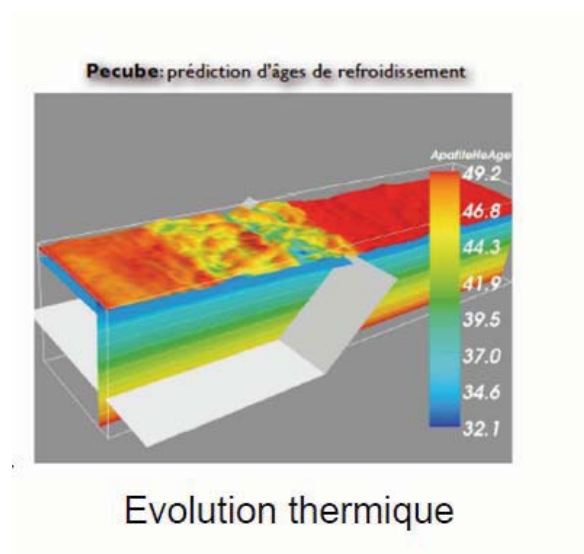
Annexes Equipements informatiques

ISTerre Salle 124 – TP Informatique (Novembre 2013)

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10 000 t/min – 3.4 To HD SAS @ 7 200 t/min – CentOS 6.4 64 bits
Gestionnaire de batch OAR – Environnement scientifique CIMENT – Grille de calcul CIGRI

Equipements informatiques

GARNIER & FILS
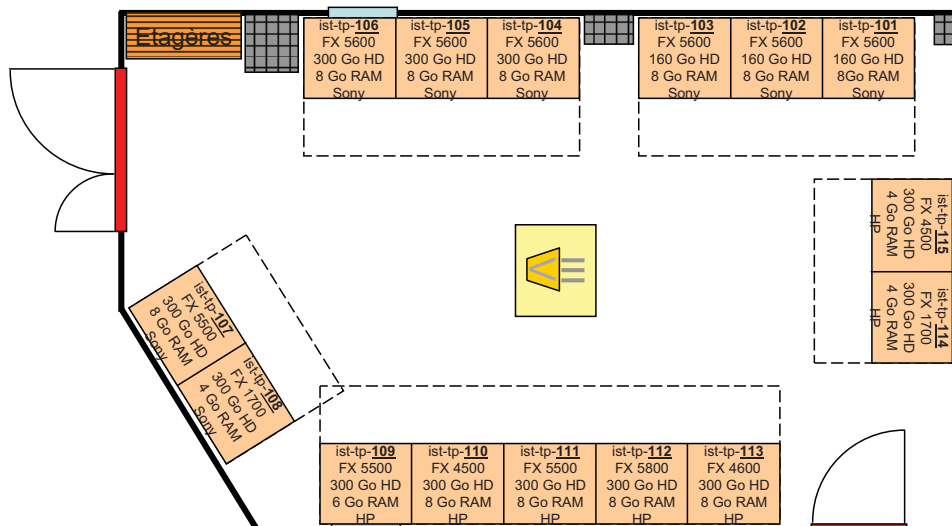
CLIENT	TOTAL	INVENTAIRE		ISTerre	
DATE	28-juin-12			Tests ISTerre	Remarques suite à une inspection préliminaire du matériel (17/10/2012)

MARQUE	DESIGNATION	NUMERO DE SERIE	CONFIGURATION HARDWARE	Tests ISTerre	
UC HP	XW9400	CZC73536S3	AMD OPTERON 2.8 GHZ - 8GB 300 GB	OK	
UC HP	XW9400	CZC8332WQK	AMD OPTERON 2.8 GHZ - 8GB 300 GB	OK	Grande carte graphique nVIDIA / Test Ubuntu Live USB interrompu, probablement du fait de l'absence de pilote approprié.
UC HP	XW9400	CZC74879Q3	AMD OPTERON 2.8 GHZ - 8GB 300 GB	OK	
UC HP	XW9400	CZC7171F2S	AMD OPTERON 2.8 GHZ - 8GB 300 GB	—	Série de bips à la mise sous tension avec diode rouge clignotante à côté du bouton Marche / Arrêt. Ne démarre pas.
UC HP	XW9400	CZC7125CH7	AMD OPTERON 2.8 GHZ - 8GB 300 GB	—	Tacheture importante (speckle) sur les écrans provenant vraisemblablement d'un problème de carte graphique. Testé avec plusieurs écrans.
UC HP	XW9400	CZC7252W7R	AMD OPTERON 2.8 GHZ - 8GB 300 GB	OK	
UC HP	XW9400	CZC7383QMM	AMD OPTERON 2.8 GHZ - 8GB 300 GB	—	Date et heure perdues peut-être à cause d'une pile défectueuse sur la carte mère. Ne démarre plus après avoir réglé l'heure du PC.
UC HP	XW9400	CZC737599J	AMD OPTERON 2.8 GHZ - 8GB 300 GB	OK	
UC HP	XW9400	CZC7252W7T	AMD OPTERON 2.8 GHZ - 8GB 300 GB	~	Tacheture modérée sur les écrans provenant vraisemblablement d'un problème de carte graphique. Testé avec plusieurs écrans.
UC HP	XW9400	CZC83954R5	AMD OPTERON 2.8 GHZ - 8GB 300 GB	OK	Grande carte graphique nVIDIA / Test Ubuntu Live USB interrompu, probablement du fait de l'absence de pilote approprié.
UC HP	XW9400	CZC805749M	AMD OPTERON 2.8 GHZ - 8GB 300 GB	OK	Grande carte graphique nVIDIA / Test Ubuntu Live USB interrompu, probablement du fait de l'absence de pilote approprié.
UC HP	XW9400	CZC805749J	AMD OPTERON 2.8 GHZ - 8GB 300 GB	OK	Grande carte graphique nVIDIA / Test Ubuntu Live USB interrompu, probablement du fait de l'absence de pilote approprié.
UC HP	XW9400	CZC7383QMK	AMD OPTERON 2.8 GHZ - 8GB 300 GB	OK	Grande carte graphique nVIDIA / Test Ubuntu Live USB interrompu, probablement du fait de l'absence de pilote approprié.
UC HP	XW9400	CZC73252FW	AMD OPTERON 2.8 GHZ - 8GB 300 GB	OK	
UC HP	XW9400	CZC7252W7S	AMD OPTERON 2.8 GHZ - 8GB 300 GB	OK	Grande carte graphique nVIDIA / Test Ubuntu Live USB interrompu, probablement du fait de l'absence de pilote approprié.
UC HP	XW9400	CZC7301WC8	AMD OPTERON 2.8 GHZ - 8GB 300 GB	OK	Carte graphique nVIDIA Quadro FX 5800.
UC HP	XW9400	CZC71153BC	2X Opteron 2.8 GHZ 4GB DVDRW FX1700 300 GO	OK	
UC HP	XW9400	CZC8400DG5	2X Opteron 2.8 GHZ 4GB DVDRW FX1700 300 GO	~	Périphérique USB en grisé dans le BIOS. Nécessite un CD / DVD pour être amorcé. Problème général pour les périphériques USB ?
UC HP	XW9400	CZC8332F1L	2X Opteron 2.8 GHZ 4GB DVDRW FX4500 300 GO	OK	Disque dur interne contenant un système RedHat.
UC HP	XW9400	CZC71153B6	2X Opteron 2.8 GHZ 4GB DVDRW FX4500 300 GO	~	Câble DATA du disque SATA absent à l'intérieur du PC, disque interne SATA 300 Go HS, remplacement par un disque 160 Go maison.
Ecran SONY	SDM6S73	9934419	TFT 17 POUCES	OK	
Ecran SONY	SDM6S73	3366999	TFT 17 POUCES	OK	
Ecran SONY	SDM6S73	9934421	TFT 17 POUCES	OK	
Ecran SONY	SDM6S73	1551407	TFT 17 POUCES	—	Zones défectueuses sur l'affichage.
Ecran SONY	SDM6S73	9934467	TFT 17 POUCES	OK	
Ecran SONY	SDM6S73	1551451	TFT 17 POUCES	OK	
Ecran SONY	SDM6S73	1551277	TFT 17 POUCES	OK	
Ecran SONY	SDM6S73	9307896	TFT 17 POUCES	—	Vibrations de l'affichage, couleurs faussées.

Equipements informatiques

Ecran SONY	SDM6S73	3354261	TFT 17 POUCES	OK	
Ecran SONY	SDM6S73	1551384	TFT 17 POUCES	OK	
Ecran SONY	SDM6S73	3372320	TFT 17 POUCES	OK	
Ecran SONY	SDM6S73	3352973	TFT 17 POUCES	OK	
Ecran SONY	SDM6S73	9934766	TFT 17 POUCES	OK	
Ecran SONY	SDM6S73	1552371	TFT 17 POUCES	OK	
Ecran SONY	SDM6S73	9934413	TFT 17 POUCES	OK	
Ecran SONY	SDM6S73	9305992	TFT 17 POUCES	OK	
Ecran SONY	SDM6S73	9934483	TFT 17 POUCES	OK	
Ecran SONY	SDM6S73	9934432	TFT 17 POUCES	OK	
Ecran SONY	SDM6S73	9934760	TFT 17 POUCES	OK	
Ecran SONY	SDM6S73	1551401	TFT 17 POUCES	OK	
Ecran HP	1702	CNN5252WWZ	TFT 17 POUCES	OK	
Ecran HP	1702	CNN44507ST	TFT 17 POUCES	OK	
Ecran HP	1702	CNN51334D7	TFT 17 POUCES	OK	
Ecran HP	1702	CNC513316L	TFT 17 POUCES	OK	
Ecran HP	1702	CNC5131R1N	TFT 17 POUCES	OK	
Ecran HP	1702	CNT42485MJ	TFT 17 POUCES	OK	
Ecran HP	1702	CNN4370P6Y	TFT 17 POUCES	OK	
Ecran HP	1702	CNC5060FD7	TFT 17 POUCES	OK	
Ecran HP	1702	CNC4221PFB	TFT 17 POUCES	OK	
Ecran HP	1702	CNT432732L	TFT 17 POUCES	—	Connecteur VGA abimé. Couleurs faussées.
Ecran HP	1702	CNN5091SMR	TFT 17 POUCES	OK	
Ecran HP	1702	CNT5307H4R	TFT 17 POUCES	OK	
Ecran HP	1702	CNT434712L	TFT 17 POUCES	OK	
Ecran HP	1702	CNN44507QD	TFT 17 POUCES	—	L'affichage clignote brièvement toutes les 10 secondes environ.
Ecran HP	1702	CNT4327324	TFT 17 POUCES	OK	
Ecran HP	1702	CNT42573CY	TFT 17 POUCES	OK	
Ecran HP	1702	CNT4327B4V	TFT 17 POUCES	OK	
Ecran HP	1702	CNN44507Q9	TFT 17 POUCES	~	Ecran partiellement rayé et tâches à l'affichage.
Ecran HP	1702	CNN5110PK6	TFT 17 POUCES	OK	
Ecran HP	1702	CNT4347129	TFT 17 POUCES	—	Prise VGA tordue.

Général :	Câbles d'alimentation électrique des unités centrales HP et des écrans HP absents, soit 40 câbles manquants (ceux des écrans Sony sont inamovibles). Seront prélevés dans les stocks du laboratoire ISTerre.
	Claviers et souris absents (20 + 20). Seront prélevés dans les stocks du laboratoire ISTerre.
	Ecrans munis d'un connecteur VGA et ports graphiques DVI à l'arrière des PC : 40 adaptateurs VGA / DVI à acheter.
	Visserie des écrans plats sur les pieds inadaptée à cause des freins filet Loctite trop prononcés : achat de 200 vis M4 et de 100 rondelles.

Software	Editor	Location	Platforms	Parallel computing
Globe Claritas	**GNS Science**	Lower Hutt **New Zealand**	Primary support and development on **Linux Ubuntu 10.04 64-bit and RHEL5 64-bit** platforms. Support also available for Ubuntu 10.04 32-bit, RHEL4 and RHEL5 32-bit, Solaris (Sparc) 10 and Windows 7, Vista, XP and 2000 (x86, x86_64 in 32 bit mode) platforms. No longer supported for Linux Fedora systems.	▪ Scalable power: **support for Linux (Beowulf) PC cluster environments** ▪ Cluster-enabled 3D pre- and post-stack time & depth migrations ▪ **MPI-based parallel processing** ▪ Any CPU-intensive processing flow can be split across multiple instances and cores by flagging the section of the flow that needs to run in parallel and by indicating the number of required cores ▪ **Own modules can be run in parallel as well** - whether they are fully implemented inside the Claritas API, or just left as calls from RUNPYTHON or TRFUDGE modules.
ProMAX	**Halliburton**		**RedHat Enterprise Linux**	Resource balancing for large 3D projects Parallel processing is easily managed from the user interface Compute-intensive algorithms engineered to handle large data sets
SPW (Seismic Processing Workshop)	**PGC** (Parallel Geoscience Corporation)	Long Creek, Oregon **United States**	SPW product line includes Linux, **Windows** 2000/2003/XP products as well as Macintosh products.	**Client-server design** allows for optimal use of inexpensive laptop, workstation and large cluster systems. Scalable solutions for any size of project, from a single CPU system to hundreds of CPUs.
VISTA	**GEDCO** (Geophysical Exploration & Development Corporation -- Acquired by Schlumberger / WesternGeco)	Calgary, Alberta **Canada**	**Microsoft Windows operating systems**: 2000 / Server 2003 / XP 32- & 64-bit / Vista 32- & 64-bit / W7 32- & 64-bit. Was also available for the Linux environment: Redhat Enterprise 3.0, 4.0, 5.0 / Fedora 4, 6 / SUSE 10 / Ubuntu 6.0, 7.0. **Vista is no longer offered for Linux systems** due to a very low demand. Customers interested by a Linux implementation are now directed towards WesternGeco's Omega.	▪ Works with standard, off-the-shelf hardware ▪ **Optimized for dual-core and quad-core PCs (multithreading, parallelized calculations, 32-bit and 64-bit versions)** **Vista hardware requirements**: Hard drive: 80 Gb / RAM: 500 Mb / Processor speed: 1.6 GHz / Removable media: DVD drive
ECHOS	**Paradigm**	Multi-national software company	Running on **Linux 64-bit operating systems** **System specifications:** - All 64-bit, for x64 architecture processors - Red Hat Enterprise Linux 5.3 and above, 6.0 and above	Echos is fully scalable from a single laptop to high-performance computing clusters. The system is easily adaptable to multiple users performing multiple tasks **Production monitoring:** • System CPU and memory usage display for network parallel jobs • Network-wide job monitoring in a single window **Multi-core CPU or GPU processing** for reverse time migration

Software	Implementation	Upgrades	Content	I/O formats
Globe Claritas	**Job Control System** (JCS) offers a powerful spreadsheet overlay to the flow editor for multi-line processing and project management Interface to **Torque queuing system** allows for simple and sophisticated batch processing environments	20 years of development User-driven development philosophy: **3 main releases per year** and pro-active support **Latest release version 5.6 - November 2011**	Over **250** processing modules, editors, processing flows, utilities and graphical applications	▪ **SEG-Y, SEG-B, SEG-D, SEG-1, SEG-2 input**, and interactive SEG-Y analysis ▪ ASCII and extended SEGY formats integrate well with other tool sets ▪ **Hardcopy output** as mono/colour HP-RTL files, with conversion to TIFF, Versatec, Postscript, etc.
ProMAX			▪ Seismic data processing designed around an **interactive database** which allows rapid detection of geometry problems, statics problems and other surface-consistent trace attributes at any time during the processing sequence, without having to actually read trace data or access trace headers ▪ Database tools provide database visualization and analysis capabilities by visually linking geometry and surface-consistent trace attribute information to seismic data displays ▪ ProMAX MVA and ProMAX 3DPSDM provide velocity modeling, depth conversion and depth imaging workflows	
SPW (Seismic Processing Workshop)	**Executor** is a multi-threaded, multi-CPU program for executing the flows built in the **FlowChart module**.	Developments started in 1988. Current version is 2.3.7. Complete rewrite of SPW in progress to a new version 3	**SPW Engineering** is optimized for quickly processing near surface high-resolution. **SPW GPR** provides the tools for full processing of 2-D and 3-D ground penetrating radar data.	**SeisViewer** - A full featured, user definable seismic display and montage product. Plots using standard PC print/plot drivers avoiding expensive Unix solutions. High resolution TIFF, JPEG, PNG or BMP graphics, as well as direct output to printers.
VISTA	?	First developed in **1985** as the market's first PC-based seismic data processing software Latest version is 11.0 **Vista 12.0 to be released in May 2012** (OMNI 3D 12.0 was released in April 2012)	Discussions stopped after hearing that Linux versions are not longer being offered.	
ECHOS	**Highly interactive approach to job building**, parameter testing and interactive data analysis. The outcome of these operations are **fully parameterized job flows** that can be applied immediately to the entire dataset	25 years of customer usage (was Focus before being renamed to Echos)	Comprehensive **library of** close to **400 modules** for geometry definition and QC, amplitude scaling, wavelet extraction, deconvolution, multiple suppression, noise suppression, statics estimation, interpolation, velocity analysis, seismic imaging and seismic attribute extraction	

Software	Applications	Customization	Pluses
Globe Claritas	**Full 2D/3D land and marine seismic processing** toolkit including **VSP processing**: from **GPR** to deep-crustal scale projects **Full interactive tool suite** for velocities, statics, geometry and **powerful QC analysis**	Designed as a development environment, for **easy porting of** the client's own **Python, C and Fortran codes** Globe Claritas is more like a Seismic Operating System than a conventional software package.	▪ Collaborative user community ▪ Ideal for practical **teaching of reflection seismic processing** using industrial workflows ▪ **Dynamic, extendable trace headers** with no limit to the number of header entries ▪ **Interactive processing** for: 2D/3D geometry specification and display, first break picking, refraction statics analysis and modelling, trace edit, horizon digitizing, velocity analysis, three-component polarisation analysis
ProMAX	**Complete suite of geophysical applications for 2D, 3D, VSP and depth imaging**, from shallow to deep reflection imaging. Also capable of (and actually used for) processing **GPR** data. Specialty geophysical applications include: - **ProMAX MVA** Migration Velocity Analysis - **ProMAX 3DPSDM** pre-stack depth imaging - **ProMAX VSP** - **ProMAX 4D**	**Integrates with third-party software**: development environment makes it easy to integrate proprietary geophysical analysis tools. For example, Paulsson Geophysical Services Inc. use internally developed VSP migration and imaging software running within the ProMAX infrastructure.	Interactive analysis for optimum parameter selection and problem solving ProMAX/SeisSpace seismic processing system Easy to use and to learn according to some users Backed by a large organization (Halliburton)
SPW (Seismic Processing Workshop)	Fully interactive 2-D and 3-D seismic data processing system **based on a flowchart user interface**. Conventional or multicomponent seismic processing. Can handle 2D, crooked line, 3D and marine surveys. Advanced QC capabilities.	Custom software solutions and interpretive processing tools are available on all platforms SPW V3 uses **open source Qt libraries and Qt plug-ins** for adding user code. Building dialogs is graphical, code and libraries are all C++.	**Flowchart module** à la Simulink (and Mustig)
VISTA	Software package for **QC and complete processing of 2D/3D seismic data acquired on land, offshore, or through VSP**. - Surface Related Multiple Attenuation (SRME) - Dynamic stacking in velocity analysis window - 2D/3D signal enhancement; 2D/3D white noise suppression - Adaptive subtraction - LAS log handling and plotting on VSP or surface seismic - Enhanced 3D uphole handling - VSP CDP mapping to P-P or P-S images	?	Discussions stopped after hearing that Linux versions are not longer being offered.
ECHOS	• **Surface Related Multiple Attenuation** (SRMA) designed for 2D and 3D seismic surveys. • **Intelligent Noise Suppression** for AVA techniques. • **Time-Frequency Analysis** with Gabor-Morley filters. • Echos can serve as host for the **GeoDepth (Kirchhoff) pre-stack time migration** add-on module. • **Reverse Time Migration** (RTM) developed in conjunction with Acceleware Corporation for 2D and 3D forward modeling and imaging in isotropic or anisotropic media, surface seismic of VSP seismic imaging, streamer, OBC and onshore data. • **Multi-Component Processing**: OBC data, converted waves	Data **compatibility with other Epos-based products**, for expanded workflows and project coverage. Open solution with programming libraries and tool kits for **client customization.**	Industry standard for seismic processing and data analysis Developed and issued by a large software editor

Software	Minuses	Licenses	Cost	University clients
Globe Claritas	<Trial version to be tested> Check possibilities in handling big data files, in depth imaging, in processing VSP data Ergonomy	▪ Site licensed across all of the client's systems from laptops to teaching labs to supercomputers ▪ Research workstation licenses for individual researchers also available ▪ Can be licensed onto students laptops by extension of agreement	Academic site license valid for 20 users: 20 000 USD Annual support 4 000 USD	Imperial College London The University of Tulsa
ProMAX	Not for very heavy processing? Black box for students? Aging software?			▪ ProMAX users hotlist maintained by Cornell University (only those who have chosen to have their names listed). ▪ **Most users are only using ProMAX2D**. Includes many deep seismic profiling projects around the world: COCORP, INDEPTH, URSEIS. ProMAX2D also used by the Danish Lithosphere Centre, the University of Hawaï, the Geophysical Institute of Israël, and Politecnico di Milano. ▪ **ProMAX3D** used by small companies and a limited number of universities, notably University of Pau (old version no longer maintained on IBM RS/6000) and University of Aarhus.
SPW (Seismic Processing Workshop)	▪ New installations are **V3** which is **not yet officially released**: VSP and GPR processing not implemented before 2013 ▪ SPW license does not include any pre-stack depth imaging, only basic post-stack depth migration ▪ Small company: possible delays for delivering upgrades	50% discount for non-commercial (teaching and research) purposes.	**SPW 3D license** is $21000 USD for academic use and has no limitations. **Annual support and updates** after the first year are $3500 USD for the SPW 3D license. 10 additional academic licenses for use by students, teachers and researchers for $50 USD per license per year	Universities mostly using **SPW Engineering**, a smaller package capable of handling up to 150 channels per record and a maximum of 100,000 traces per dataset. 5-year agreement concluded with IRIS in 1999 for obtaining lower prices of SPW for IRIS members. V3 Recently purchased by IFP School.
VISTA	<Needs to be tested>		1050 USD per license (public price?)	▪ Eligible universities receive either an in-kind sponsorship or a discount for GEDCO's latest versions of VISTA and OMNI 3D software. GEDCO supplies universities with soft-key licenses, optimal for usage in a classroom setting. ▪ Licenses are valid for one year (must renew annually). **Installed in 44 univ**. ▪ 8 universities participating in Canada; 11 in the United States; 5 in South America; 15 in Europe; 3 in Asia; 1 in Africa; 1 in Australia. Among these: University of Calgary - CREWES, Cornell University, University of Texas at Austin, University of Kansas, University College Dublin, Christian Albrechts Universität zu Kiel, GEOMAR, Curtin University of Technology.
ECHOS	More difficult to use than ProMAX, but nevertheless user-friendly Switch to Seismic Unix for publication quality plots ?		Paradigm University Program 2012: Echos is one among 23 self-contained applications which can be acquired for USD 2000 per year, per product, and for 5 licenses.	IPGP, Scripps, Woods Hole, Lamont, UTIG (according to S. Singh) See Paradigm University Program 2012.

Software	Responsiveness	Contact
Globe Claritas	Excellent	Marijke Willemse M.Willemse@gns.cri.nz http://www.globeclaritas.com Got a trial version valid one month starting from June 13th 2012.
ProMAX	No response yet	www .halliburton. com Request for a quote sent on 7 May 2012. Waiting for an answer. Follow-up message on June 21st 2012.
SPW (Seismic Processing Workshop)	Good	Dan Herold dherold@parallelgeo.com SPW V2 can be used freely with the specially encrypted "La Chantourne" seismic dataset (courtesy of PGC).
VISTA	Bad	www .gedco.com / info @ gedco.com Jody Jones <JJones61 @ slb.com> Account Manager WesternGeco GeoSolutions Direct: +1 (403) 303-8691 Cell: +1 (403) 617-0095 Request for a quote sent on 7 May 2012. Follow-up message on June 21st 2012. Answer received June 25.
ECHOS	Good	Many offices around the world. Three offices in France (Paris, Nancy, Pau). Katherine Harington <Katherine.harington @ pdgm.com> Global University Sales Coordinator Paradigm Geophysical (UK) Limited Dukes Court, Bldg. C, 3rd Floor, Duke Street Woking, Surrey, GU21 5BH, U.K. Direct +44 (0) 1483 758158 Fax: +44 (0) 1483 758001 Skype: Katherine.harington11, www. pdgm.com

INSTITUTE OF GEOLOGICAL AND NUCLEAR SCIENCES LIMITED

ACADEMIC SOFTWARE LICENCE AGREEMENT

DATED: **9 October 2012**

BETWEEN: The **INSTITUTE OF GEOLOGICAL AND NUCLEAR SCIENCES LIMITED** a duly Incorporated company having its principle place of business at 1 Fairway Drive, Lower Hutt, New Zealand ("GNS")

AND: **Université Joseph Fourier (UJF)** having its principle place of business at BP 53, 38041 Grenoble Cedex 9, France (GNS and UJF each a "party" and together the "parties")

RECITALS

0.1   GNS has developed GLOBE *Claritas*™ seismic processing software for authorised use by third parties under licence from GNS.

0.2   UJF desires to acquire one or more licences from GNS to use GLOBE *Claritas*™ "as is" to process seismic data.

0.3   Each individual licence under this Agreement will be defined in a separate schedule. Each schedule is to be executed separately, and when so executed is incorporated by reference to this Agreement and shall become part of this Agreement. Terms and conditions in said schedule(s) shall supersede any conflicting terms and conditions in this Agreement for only the specific licence defined in said schedule(s). Each schedule, together with the terms and conditions of this Agreement shall constitute and be construed a separate agreement.

0.4   The PURPOSE of the purchase of the software licence is to enable UJF to undertake teaching and processing of seismic reflection and refraction data.

0.5   Definitions:
The term **"Licence Type"** shall mean the scope of the licence granted. A licence type of **"Academic Licence"** shall mean the right to use the Licensed Software for teaching and research purposes at the specified site.

IT IS HEREBY AGREED AND DECLARED as follows:

1.   GNS hereby grants and UJF accepts upon the terms and conditions set out below a non-transferable and non-exclusive license to use GLOBE *Claritas*™ from the date of this Agreement until this Agreement is terminated as set out below, for use at UJF premises in **Grenoble.**

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2. From the date of first delivery of GLOBE *Claritas*™ to UJF this License Agreement, together with any attachments hereto or specifically referenced in this Agreement, constitutes the entire agreement between the parties and supersedes all negotiations or communications or understandings, oral or written, between the parties with respect to the licensing and use of GLOBE *Claritas*™. Any amendment to this Agreement shall not be binding on either party unless such amendment is in writing and executed by both parties.

3. "GLOBE *Claritas*™" as used herein means all computer programs, software manuals and any modifications, corrections, updates, improvements, or enhancements thereto and related documentation or information, to the extent any of the foregoing are delivered or provided by GNS to UJF from time to time during the term of, and licensed by GNS to UJF, under this Agreement. GNS shall deliver GLOBE *Claritas*™ at such time and place and in such manner as GNS may determine at its sole discretion.

    Unless otherwise agreed GNS shall supply:
    (i)   UJF with binary computer code of GLOBE *Claritas*™ on a CDROM together with instructions for its installation and operation on one or more of the supported computer systems.
    (ii)   One digital copy of the GLOBE *Claritas*™ software manual.

4. GLOBE *Claritas*™ shall be used by UJF only for the purpose described above and in the schedule(s) and for such uses and applications for which GLOBE *Claritas*™ is suitable and GLOBE *Claritas*™ shall not be used by UJF for any other purpose whatsoever.

5. GLOBE *Claritas*™ is proprietary to GNS and constitutes the confidential Information of GNS. UJF agrees that it shall receive and maintain in confidence all Information of GNS; GLOBE *Claritas*™ shall not be disclosed, published, or otherwise made available to any persons whomsoever, by UJF without GNS' express prior written consent. UJF shall disclose GLOBE *Claritas*™ only to their appropriately trained employees who have a need to know and use the same and who are engaged in seismic processing, development of seismic processing methods and techniques and testing of such processing methods.

6. UJF shall have the right to provide reports, results, information and data generated by GLOBE *Claritas*™ to third parties in accordance with the schedules and other terms and conditions contained herein, provided that all such reports, results, information and data contain full acknowledgement of GLOBE *Claritas*™ software and GNS and the existence of this licence. UJF hereby indemnifies GNS for all costs, losses, damages and other expenses suffered by GNS as a result of UJF providing such reports, results, information and data to third parties.

7. UJF shall not cover, remove, or obliterate any proprietary notices placed or required to be placed on GLOBE *Claritas*™. UJF shall not, in whole or in part reverse engineer, modify, duplicate, merge or make any other copies of GLOBE *Claritas*™ without GNS' express prior written consent.

8. UJF agrees to reproduce and include the following notice on any copies it makes of GLOBE Claritas™ or on any copies of GLOBE Claritas™ it receives from GNS which do not carry the same:
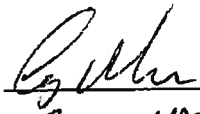
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    ALL RIGHTS RESERVED. This contains information which is proprietary to the Institute of Geological and Nuclear Sciences Limited, New Zealand. It is not to be duplicated in any fashion or disclosed to anyone outside the organisation.

9. GLOBE Claritas™ may not be sublicensed, sold or transferred in whole or in part.

10. UJF may not sell, assign or transfer its rights or interests under this Agreement.

11. The liability of GNS under this Agreement whether in contract or in tort for any loss, damage or injury arising directly or indirectly from any defect or non-compliance of GLOBE Claritas™ is limited, at GNS's option to replacing or repairing within a reasonable time such defective or non-complying Software. GNS shall not be liable for any general, special, indirect, incidental or consequential damages including but not limited to loss of business, loss of profits, loss of information or loss of use from any cause whatsoever even if advised of such damages or the possibility of such damages.

12. GNS SHALL HAVE NO LIABILITY WITH RESPECT TO ITS OBLIGATIONS UNDER THIS AGREEMENT FOR CONSEQUENTIAL, EXEMPLARY, OR INCIDENTAL DAMAGES EVEN IF IT HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

13. (i) Whilst GNS is not aware of any infringement of any third party rights GNS makes no warranty whatsoever in connection with GLOBE Claritas™ or its use by UJF. GNS makes no warranty that UJF' use of any information given to it pursuant to this Agreement or the authorised use of GLOBE Claritas™ will not infringe any patent, copyright, or registered design, or any other third party rights. The parties record their intention to consult as to the appropriate action to be taken and at whose expense if UJF' use of any information given to it pursuant to this Agreement is alleged to infringe third party rights.

    (ii) NOTWITHSTANDING the foregoing, UJF shall not admit, without the consent of GNS, any allegations made by the third party against either GNS or UJF that GLOBE Claritas™ licensed or used by UJF under this Agreement infringes any patents, copyrights or property right of a third party, or has caused or resulted in injury to persons or tangible property and shall co-operate with GNS in every way reasonable to defend any consequential action or dispute. This obligation shall not require UJF to incur any expense except as may be agreed at the time with GNS.

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14.   GNS shall have the right to terminate this License Agreement immediately if:

        (i)   UJF is in breach of this Agreement;

        (ii)   UJF fails to make payments under this Agreement when due and continues to fail to make payment within 7 days after GNS has made a demand in writing that such payments be made;

        (iii)   UJF commits an act of bankruptcy, is insolvent, enters into a scheme of receivership, compounds with creditors, is actually wound up, enters into a scheme of amalgamation or take over, its funding arrangements are suspended or sequestrated.

15   This Agreement may be terminated at any time by written agreement of the parties.

16.   Upon termination of this License Agreement UJF shall immediately delete all copies and backup copies of GLOBE *Claritas*™.

17.   Notwithstanding any other provision, termination of this Agreement shall be without prejudice to any rights of either party in respect of any antecedent breach or failure or to the continued operation of Paragraphs 6, 7, 13, and 14 of this Agreement.

18.   GNS shall, at GNS' option, have the right to collect from UJF its reasonable expenses incurred in enforcing this Agreement including legal fees.

19.   A failure by GNS to exercise a right provided under this Agreement shall not be deemed to be a waiver of that right and the waiver or failure of GNS to exercise in any respect any right provided under this Agreement shall not be deemed a waiver of any further right under this Agreement.

20.   Should any part or provision of this Agreement be held unenforceable or in conflict with the applicable laws or regulations of any jurisdiction, the invalid or unenforceable part or provision shall be replaced with a provision which accomplishes, to such an extent as is possible, the original business purpose of such part or provision in a valid and enforceable manner, and the remainder of this Agreement shall remain binding on the parties.

21.   Any notice given under this Agreement may be served by prepaid registered letter through the post to the last known business address of the party to whom it is given and it shall operate and be deemed to have been served after four business days from the date of being posted and proof that the letter was properly addressed and posted shall be sufficient evidence of service.

22.   UJF shall pay GNS for the License rights granted under this Agreement in accordance with the Price and Payment Schedule as described in the schedule(s). Unless otherwise agreed in writing, payment shall be on the 20th of the month following GNS' invoice.

23. This Agreement shall be governed by and interpreted in accordance with the laws of New Zealand.

IN WITNESS WHEREOF this Agreement has been signed on the date first written above.

SIGNED for and on behalf of) Signature: _____
INSTITUTE OF GEOLOGICAL) Name: _Guy MARLEW_
AND NUCLEAR SCIENCES LIMITED) Designation: _COO GLOBE CLIMDS._
) Date: _15/10/11._

SIGNED for and on behalf of) Signature: _____
Université Joseph Fourier) Name: _____
) Designation: Philippe CARDIN
) Date: Directeur de l'IS Terre
) _08/11/2012_

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SCHEDULE 1 - ACADEMIC LICENCE

1.0 Descriptions

1.1 Description of the licence

UJF will use GLOBE Claritas™ only for the purposes of teaching and research by its staff. UJF will not use GLOBE Claritas™ to provide services or otherwise generate revenue for UJF, nor will UJF represent the availability to third parties the existence of this licence or projects using GLOBE Claritas™ as an alternative to the purchase or lease of GLOBE Claritas™ from GNS. This licence is part of the Academic Software Licence Agreement signed by UJF and GNS.

1.2 Description of GLOBE Claritas™

GLOBE Claritas™ is a software package for processing seismic reflection and refraction data. It includes a suite of processor modules, which may be combined using a specialised editor and task-builder, to form an executable seismic job. It also includes standalone interactive applications for purposes such as noise muting, stacking velocity analysis and refraction statics analysis. The operation of GLOBE Claritas™, and descriptions of the processor modules are described in the software manuals.

2.0 Sites at which the License applies

This License is for the use of GLOBE Claritas™ by UJF at the premises of UJF in Grenoble.

3.0 Maintenance and Support

Maintenance of the Software will be undertaken by GNS at their Lower Hutt office. If UJF detects that some part of the Software is producing incorrect output, they shall notify GNS of the malfunction via electronic mail, facsimile, or letter, and include as much supporting evidence as is available to assist in determining the nature of the problem. GNS shall endeavour to repair the problem as soon as possible, with a priority dependent upon the severity of the problem. The solution to the problem may, at GNS's option, be distributed either as a binary object or executable module, or as part of a complete release of GLOBE Claritas™.

New versions of GLOBE Claritas™ may be made available to UJF from time to time.

UJF may suggest to GNS, improvements that could be made to GLOBE Claritas™. If these suggested changes are considered strongly desirable to all GLOBE Claritas™ users, GNS may, at its discretion, effect the suggested changes and make them available to UJF. However, if a suggested change is deemed to have limited use to GLOBE Claritas™ users, the software development expenses (or some proportion of them) required to effect the change may be charged to UJF. Such expenses would be agreed in writing beforehand by both parties.

If requested in writing by UJF, GNS will have an appropriately experienced member of its staff travel to Grenoble to help with the installation of the GLOBE Claritas™ Software and to give some preliminary tuition in its use. Such a service will be charged at GNS's then current chargeout rates.

Questions that UJF may have, regarding the usage of GLOBE Claritas™ software, may be directed to GNS by electronic mail, facsimile or letter by a designated contact person.

4.0 Price and payment schedule

All amounts are expressed in United States Dollars and are exclusive of any withholding or other taxes that may apply.

The purchase price of a GLOBE Claritas™ Academic Site License for Université Joseph Fourier is:

Item	Price
Academic Teaching and Research License (Including two year's maintenance at a reduced rate.)	US$24,000
Annual Maintenance fee for Commercial Workstation Pro License (Applicable annually after two years of date of purchase)	US$ 4,000 p.a.

The Globe Claritas Academic site license allows use for non-profit research and education purposes. In this case an Academic Software License allows for 20 students, and includes servicing for 2 years. This fee will be invoiced upon receipt of a Purchase Order from Université Joseph Fourier, and payments will be made in two instalments, one on delivery the second on deployment.

The consequent four years support and maintenance fees will be locked at US$4,000 per annum. The maintenance will be paid annually, one instalment for each year of maintenance. The University of Joseph Fourier is not obligated to continue with maintenance and support, and they can decline the option at any time. The yearly maintenance fee may be reviewed by GNS at any time after the sixth anniversary of this Agreement. GNS may at its discretion increase the maintenance fee at any time following such a review.

All features of GLOBE Claritas are included.

This quote is valid until 31 December 2012 and excludes any applicable taxes or levies. The GLOBE Claritas™ software is supplied upon receipt of this signed licence agreement.

5.0 Special Conditions

5.1 Acknowledgement - UJF will acknowledge in all publications that GLOBE Claritas™ is used under licence of GNS
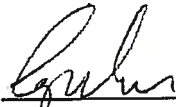
5.2 Notices and communication – Any notice and all communications, such as but not limited to usage of GLOBE *Claritas*™, trouble shooting, enhancements and modifications to be served by UJF to GNS shall be addressed to (or other place or contact person designated):

Manager, GLOBE Claritas
Institute of Geological and Nuclear Sciences
P.O. Box 30 – 368
Lower Hutt, New Zealand

Tel   +64 4 5701444
Fax   +64 4 5704600
Email claritas.support@gns.crl.nz

GNS will only accept such notices or communications from a designated UJF staff member and GNS will reply to that staff member. The designated staff member is:

SIGNED for and on behalf of   )   Signature:
INSTITUTE OF GEOLOGICAL   )   Name: _Guy MARLEN_
AND NUCLEAR SCIENCES LIMITED   )   Designation: _COO GLOBE Claritas_
)   Date: _15/10/12._

SIGNED for and on behalf of   )   Signature:
Université Joseph Fourier   )   Name:
)   Designation: **Philippe CARDIN**
)   Date: Directeur de l'ISTerre

08/11/2012

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