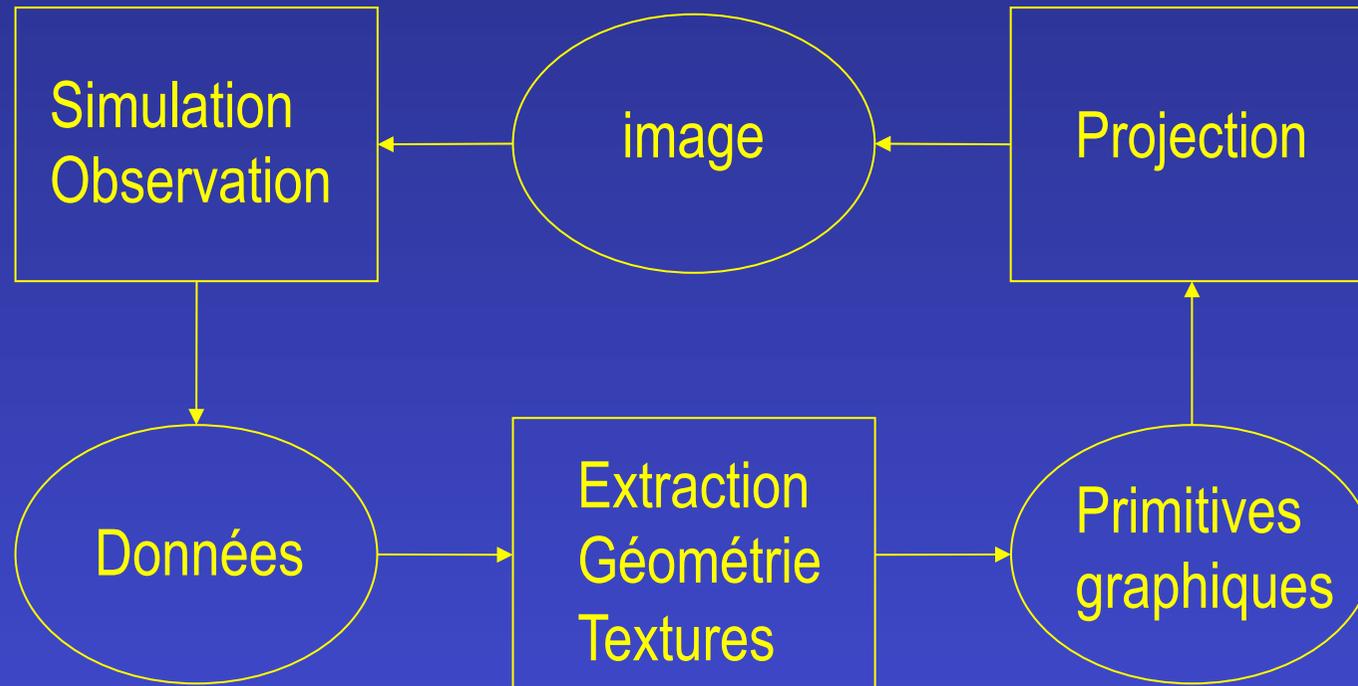
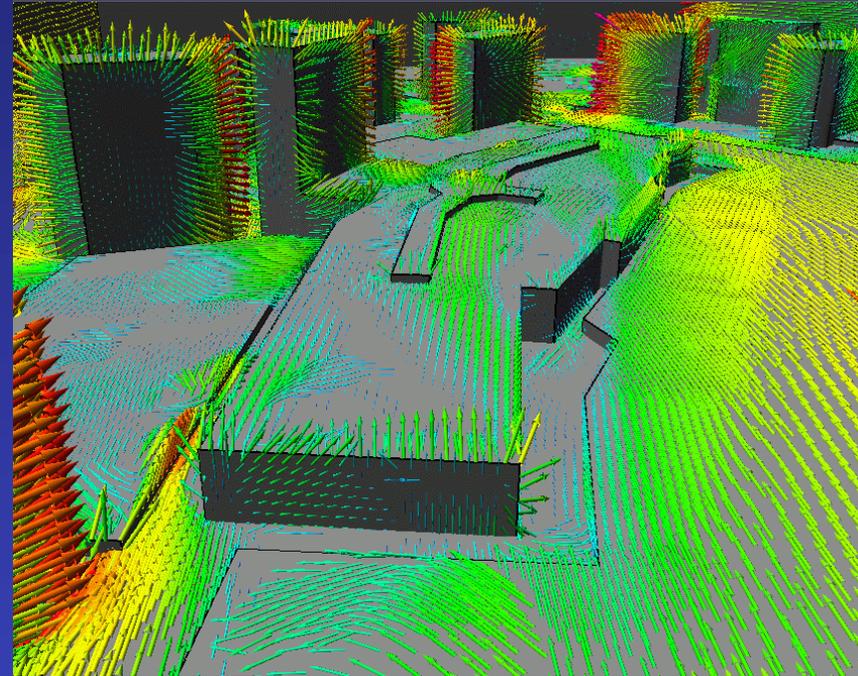
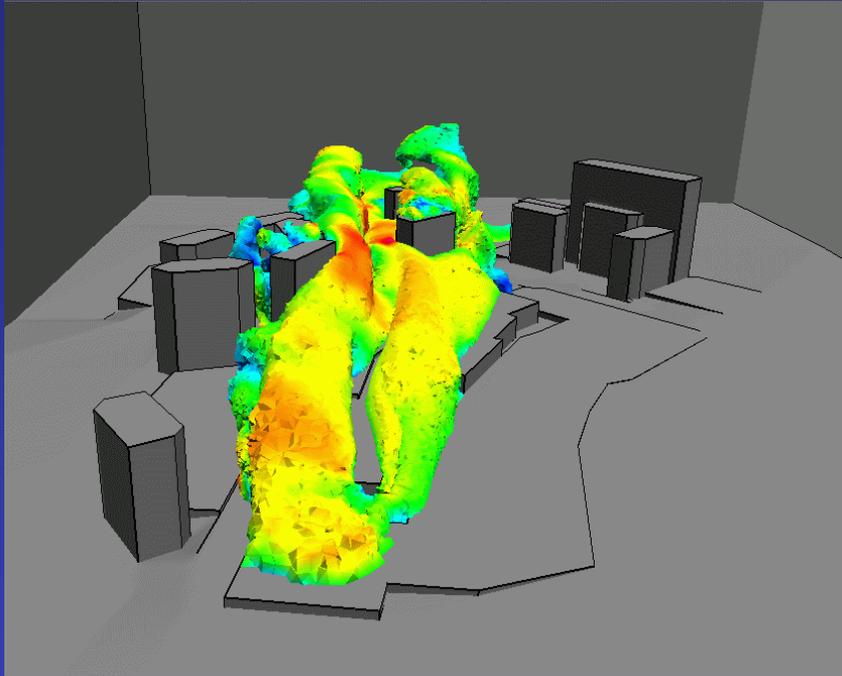

Visualisation

Georges-Pierre Bonneau

Boucle Simulation/Visualisation



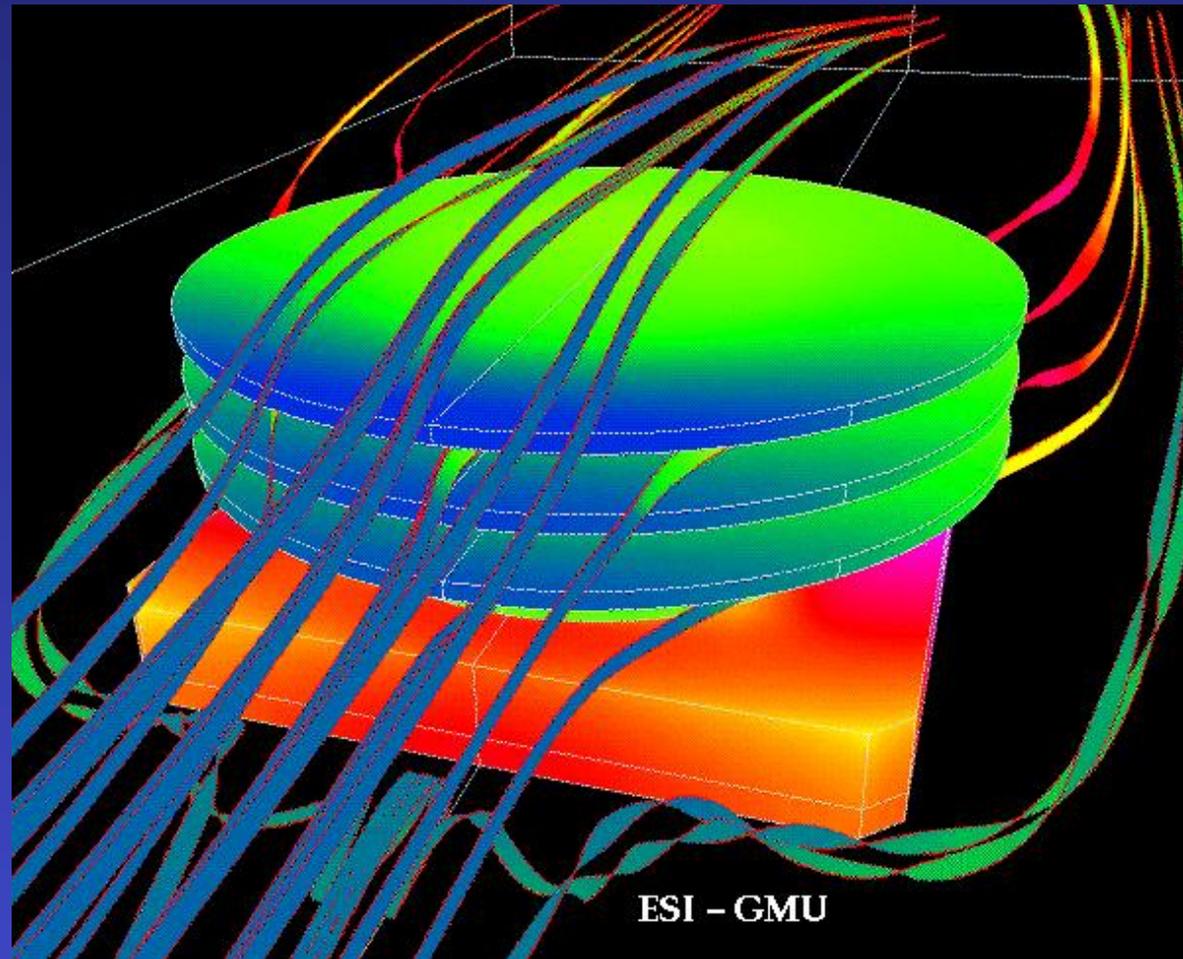
Exemples de Techniques de Visualisation



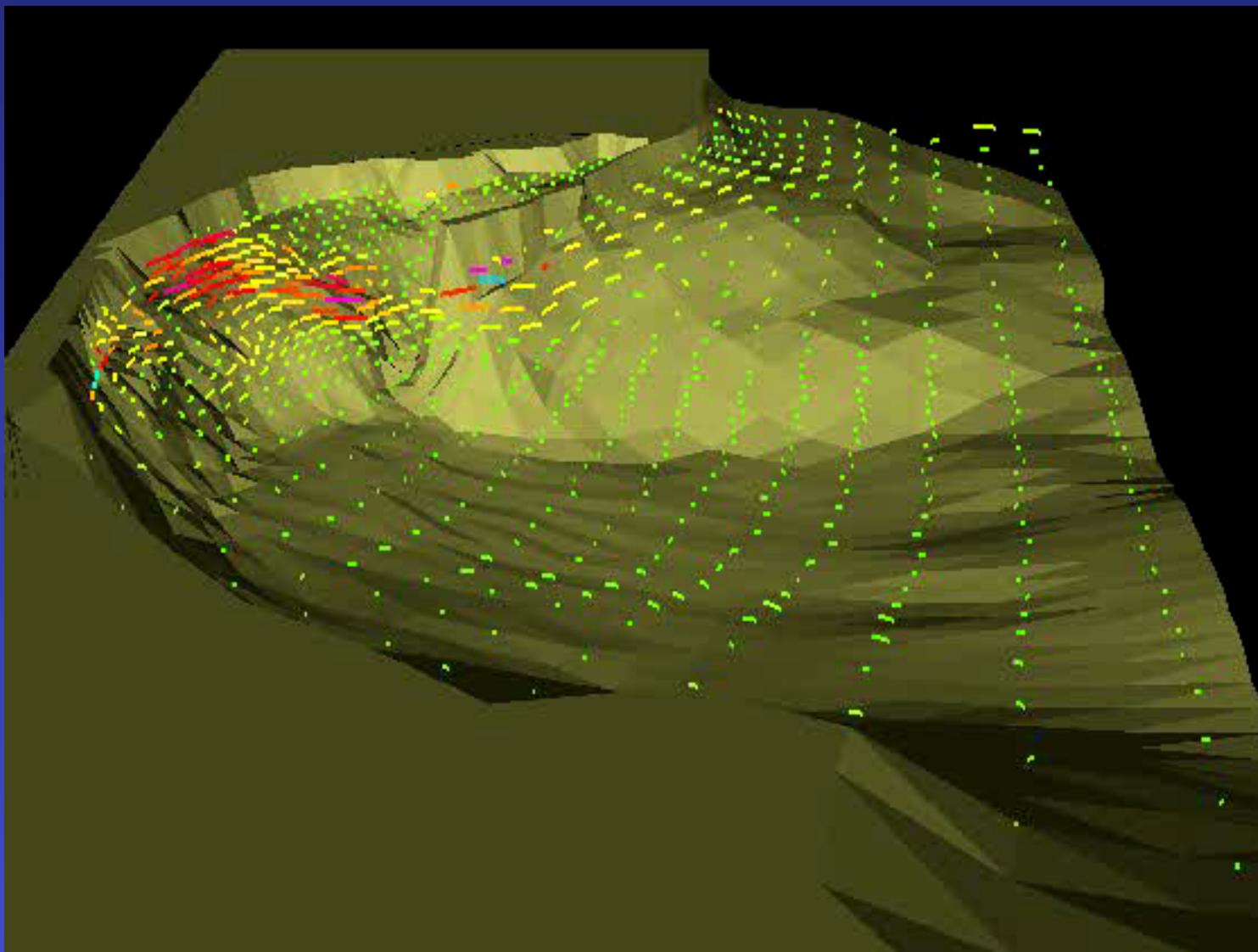
Données: concentration : 1 scalaire défini sur tout le volume
vitesse: 1 vecteur 3D défini sur tout le volume

Techniques: Isosurface colorées, Flèches colorées

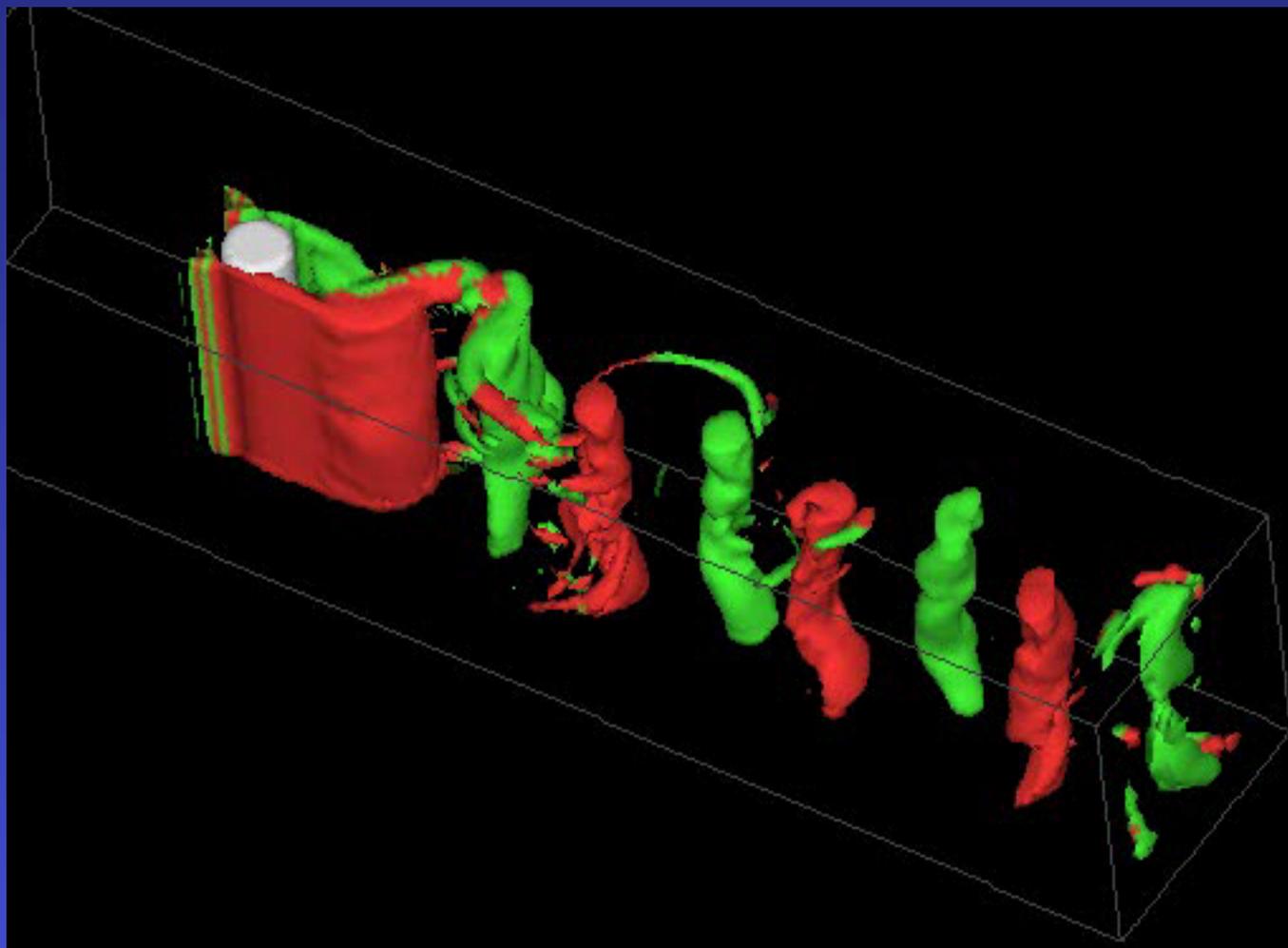
Exemples de Techniques de Visualisation



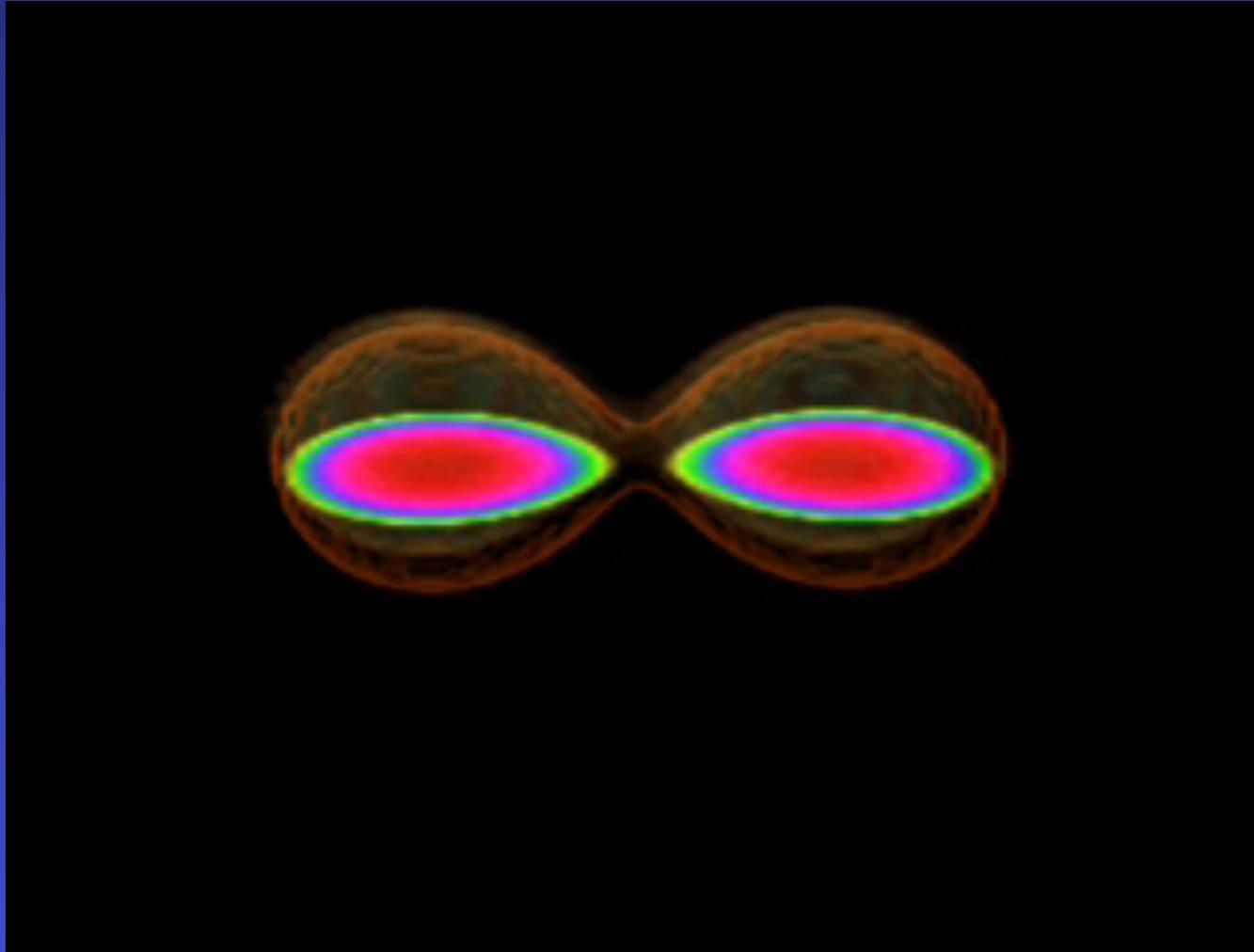
Exemples de Techniques de Visualisation



Exemples de Techniques de Visualisation

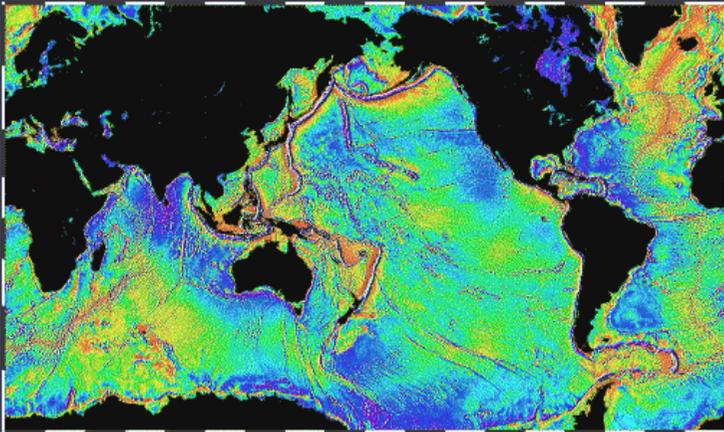


Exemples de Techniques de Visualisation

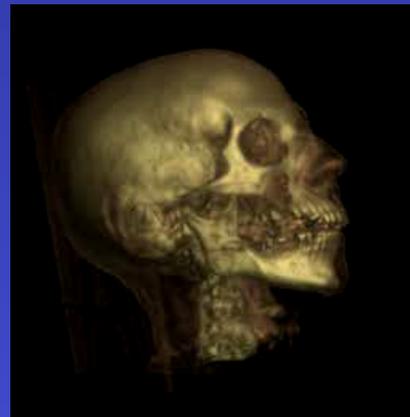


Grands ensembles de données en Visualisation scientifique

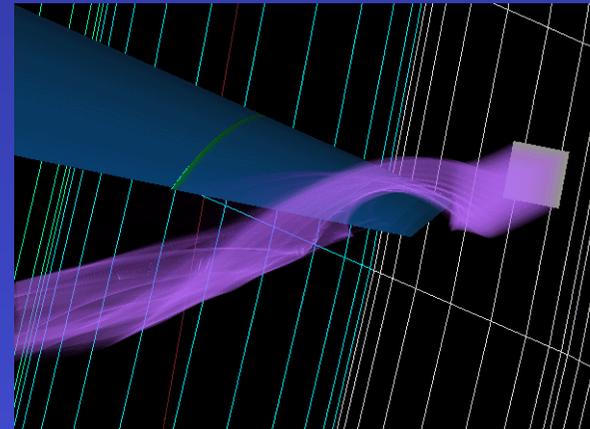
- Observation satellitaire
- Données médicales volumiques (scanner MRI/CT)
- Simulation numériques: statiques/dynamiques



ERS-1/GeoSat

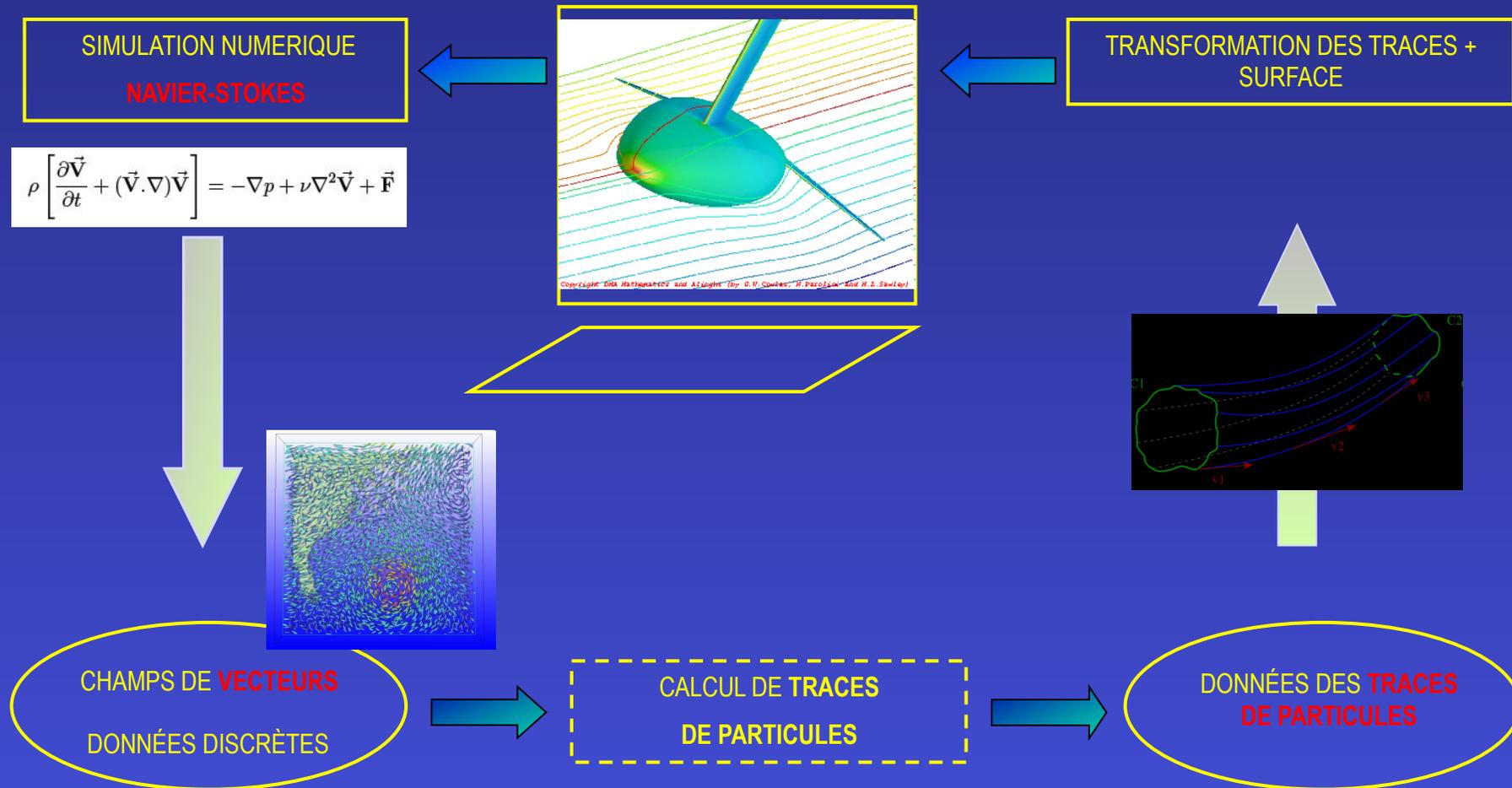


Stanford

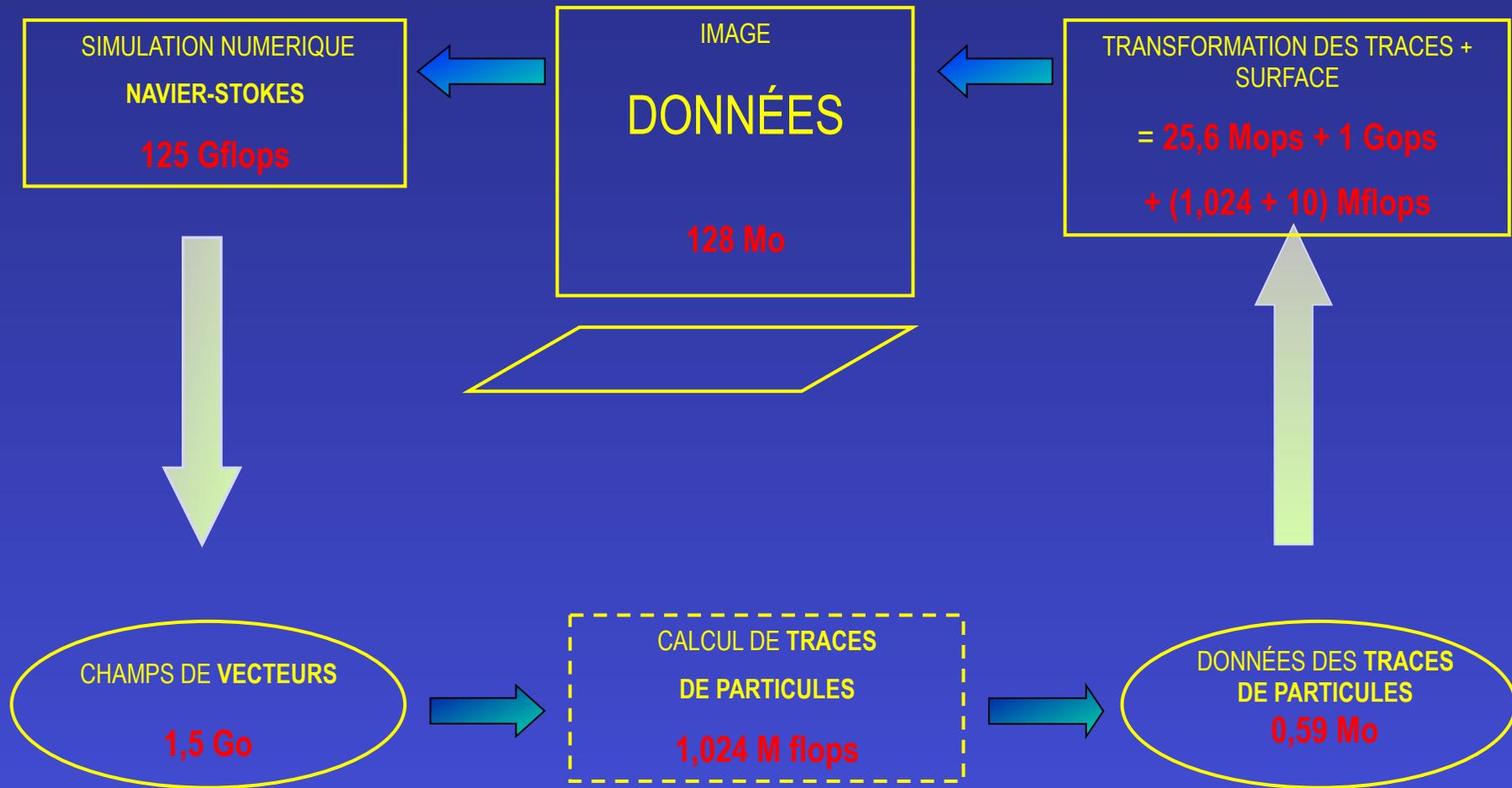


LLNL

Boucle Simulation-Visualisation en dynamique des fluides



Puissance de Calcul Haut Débit



- NASA's Turbo Pump > 100 Go
- Oak Ridge Supernova > 1 To
- Richtmyer-Meshkov Turbulent > 207 To

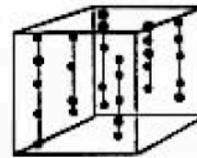
Kilo-octet (Ko)	10^3 octets	Page dactilographiée
Mega-octet (Mo)	10^6 octets	Petit roman
Giga-octet (Go)	10^9 octets	Camionnette remplies de romans
Tera-octet (To)	10^{12} octets	2To : bibliothèque académique
Peta-octet (Po)	10^{15} octets	200Po : tout ce qui a été déjà imprimé
Exa-octet (Eo)	10^{18} octets	5Eo : tous les paroles depuis le début de l'humanité

TAB. 7.1 – du Ko à l'Eo - curtesy of Kasik

Recherche de gisements pétrolières



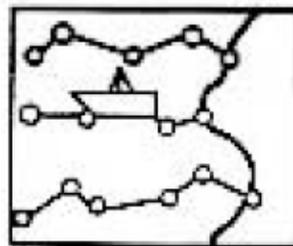
• WELL LOG DATA (Courtesy D.Lane & D.Krinsel)



	Location		Mineral
5.50	1.00	0.00	11.0
5.50	1.00	10.00	10.0
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.

Données: $(x_i, y_i, z_{i_j}; M_{i_j})$ $i = 1, \dots, N$, $i_j = 1, \dots, N_i$.

Mesures océanographiques



Location		Temperature
23.56	37.80	27.3
49.29	54.78	69.2
67.24	43.42	10.2
.	.	.
.	.	.
.	.	.
.	.	.

$$(x_{ij}, y_{ij}; T_{ij}) \quad i, j = 1, \dots, N, M.$$

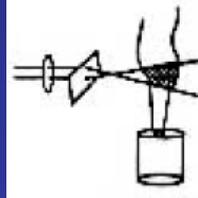
Scanneurs médicaux



X_i	Y_j	Z_k	Density
0.000	0.000	0.000	243
0.000	0.000	0.015	175
.	.	.	.
.	.	.	.
0.000	0.000	1.000	186
0.000	0.016	0.000	187
.	.	.	.
.	.	.	.
.	.	.	.

Données: $F_{ijk} = F(x_i, y_j, z_k)$ $i, j, k = 1, \dots, N$.

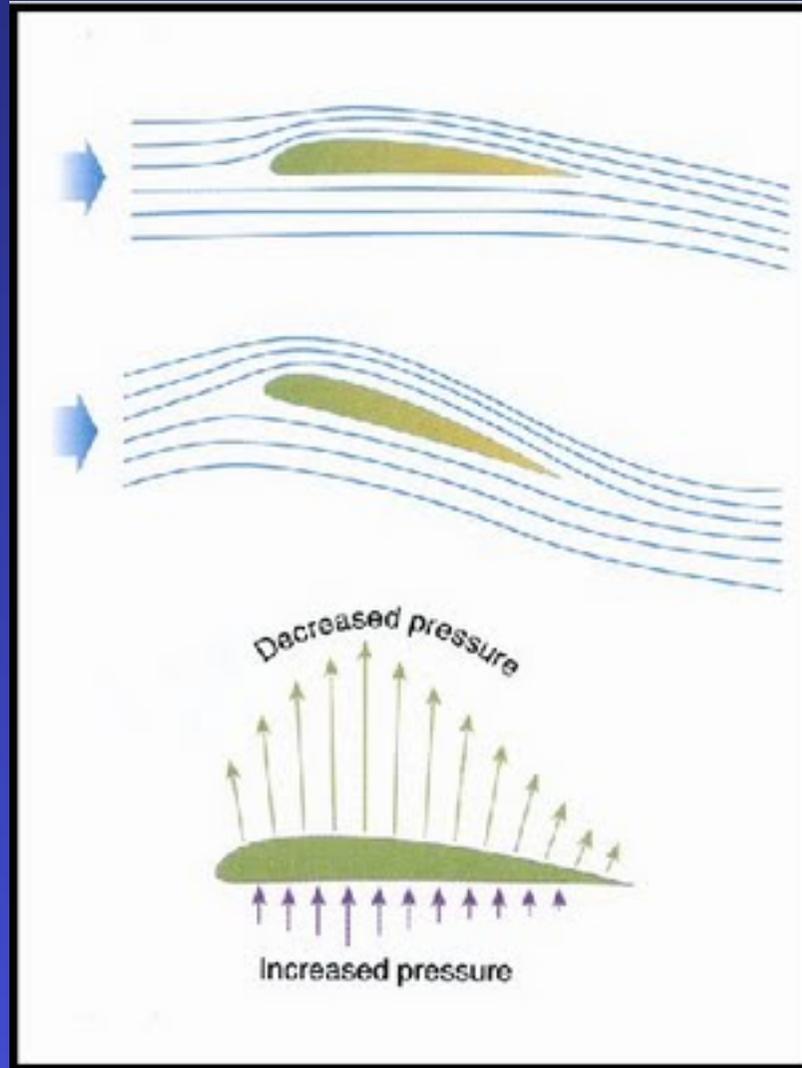
Mesures optiques de combustion



	Location			Concentration
0.00	0.00	0.02	001	
0.00	0.00	0.04	007	
0.00	0.00	0.06	003	
.	.	.	.	
.	.	.	.	
.	.	.	.	
.	.	.	.	

$$(r_i \cos(\Phi_j), r_i \sin(\Phi_j), z_k; C_{ijk})$$

Mesure de pression aérodynamique



	Location			Pressure
	-132.1	38.5	6.1	0.164
	-128.3	38.5	6.6	0.119
	-116.8	38.5	7.5	0.067

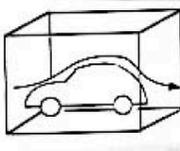
$$(x_{ij}, y_{ij}, z_{ij}; P_{ij}), \quad i = 1, \dots, N_u, \\ j = 1, \dots, N_v,$$

$$(x_{ij}, y_{ij}, z_{ij}) = W(u_i, v_j),$$

$W(u, v)$ surface paramétrique de l'aile.

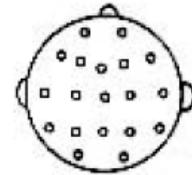
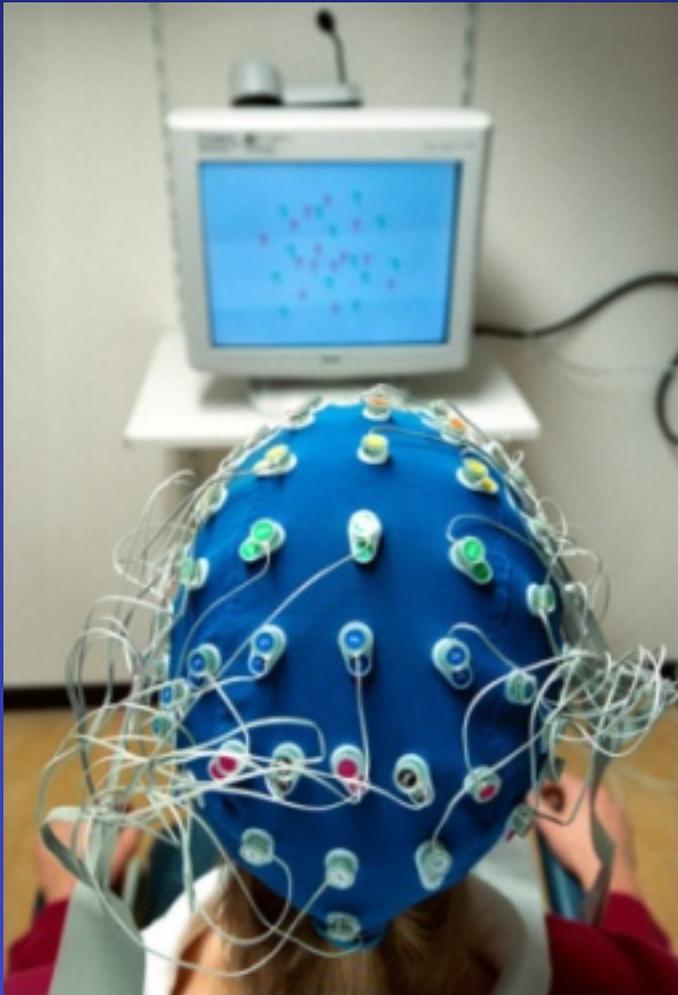
Aérodynamique



	Location			Velocity		
		7.77	9.45	3.85	(1.33 2.34 0.45)	
	4.14	-2.78	2.68	(1.86 3.56 1.25)		
		
		
		
		
		

$$(x_{ijk}, y_{ijk}, z_{ijk}; (u_{ijk}, v_{ijk}, w_{ijk})) \quad \begin{aligned} i &= 1, \dots, N_x, \\ j &= 1, \dots, N_y, \\ k &= 1, \dots, N_z. \end{aligned}$$

EEG



	Location			Voltage
6.54	4.56	5.64	0.033	
9.14	-3.14	1.38	0.086	
9.45	2.12	1.19	0.310	
.	.	.	.	
.	.	.	.	
.	.	.	.	
.	.	.	.	

Données: $(x_i, y_i, z_i; V_{ij})$, $i = 1, \dots, N$,
 $j = 1, \dots, 6$.
 $(x_i, y_i, z_i) \in \text{cr\^a}ne$.

Pluviométrie

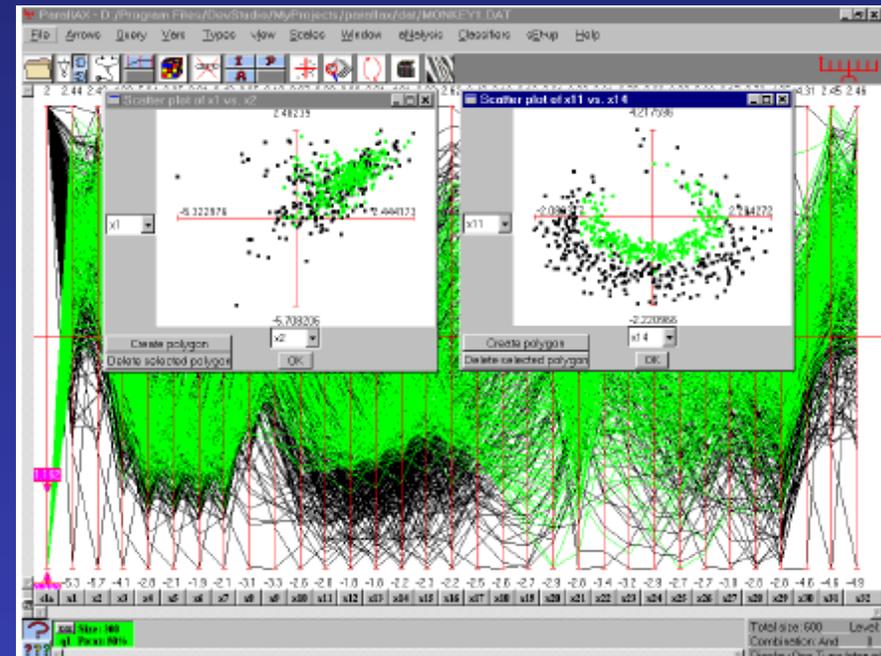
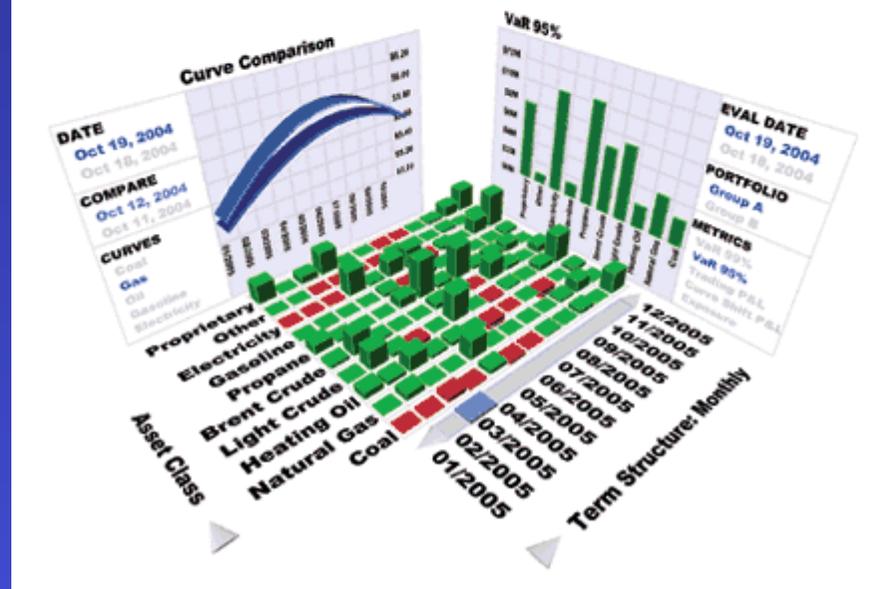
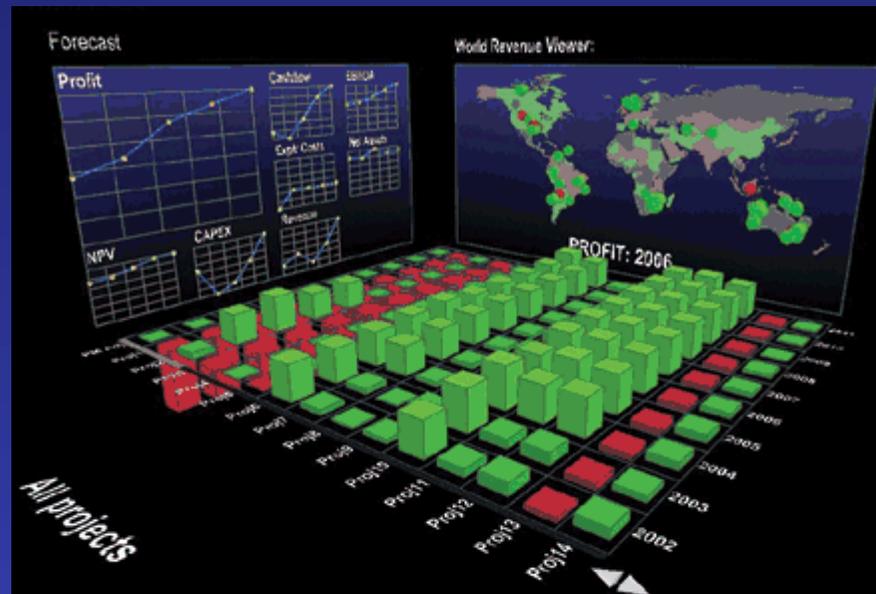


Longitude	Latitude	Rainfall
43 19' 34"	23 36' 13"	14.6
21 35' 59"	45 09' 36"	23.6
43 19' 34"	23 36' 13"	14.6
.	.	.
.	.	.
.	.	.
.	.	.

$(x_i, y_i, z_i; R_i), \quad i = 1, \dots, N.$
avec la restriction $x_i^2 + y_i^2 + z_i^2 = 1.$

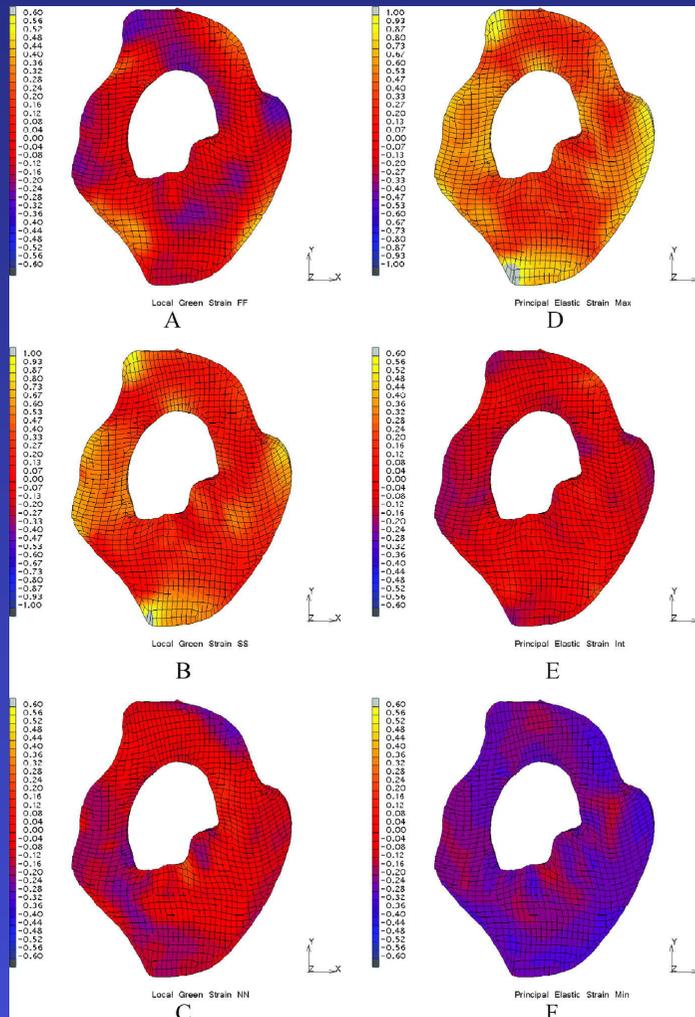
$$(x_i, y_i, z_i) = (\sin\Phi_i \cos\Psi_i, \sin\Phi_i \sin\Psi_i, \cos\Phi_i)$$

Marchés financiers



Données dimension N

Simulation Elements Finis




	Location			Temperature
	21.9	69.2	23.1	88.7
	95.3	11.9	99.7	78.9
	-	-	-	-
	-	-	-	-
	-	-	-	-
	-	-	-	-
	-	-	-	-
	-	-	-	-
	-	-	-	-
	-	-	-	-

Données: $(x_i, y_i, z_i; T_i)$, $i = 1, \dots, N$,
 Faces: $F_k = P_1, \dots, P_N$,
 Cellules: $C_j = F_1, \dots, F_M$.

- Origine
 - Simulation ou Observation
 - Domaine
 - 1D, 2D, 3D, nD
 - Type
 - Scalaire, vectoriel, tensoriel
 - Régularité des sites de données
 - Cartésien, Curviligne, Non-structuré, Dispersé
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