

Rendu réaliste d'une surface océanique non-bornée en temps réel

Jonathan Laroche
Huyen Trang Dinh

Plan

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- LOD
- Quadtree
- Bruit fractal et *height map*
- Difficultés
- Artéfacts visuels
- Résultats finaux
- Conclusion
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Introduction

GPU-Based Real-time Simulation and Rendering of Unbounded Ocean Surface

Xudong Yang Xuexian Pi Liang Zeng Sikun Li

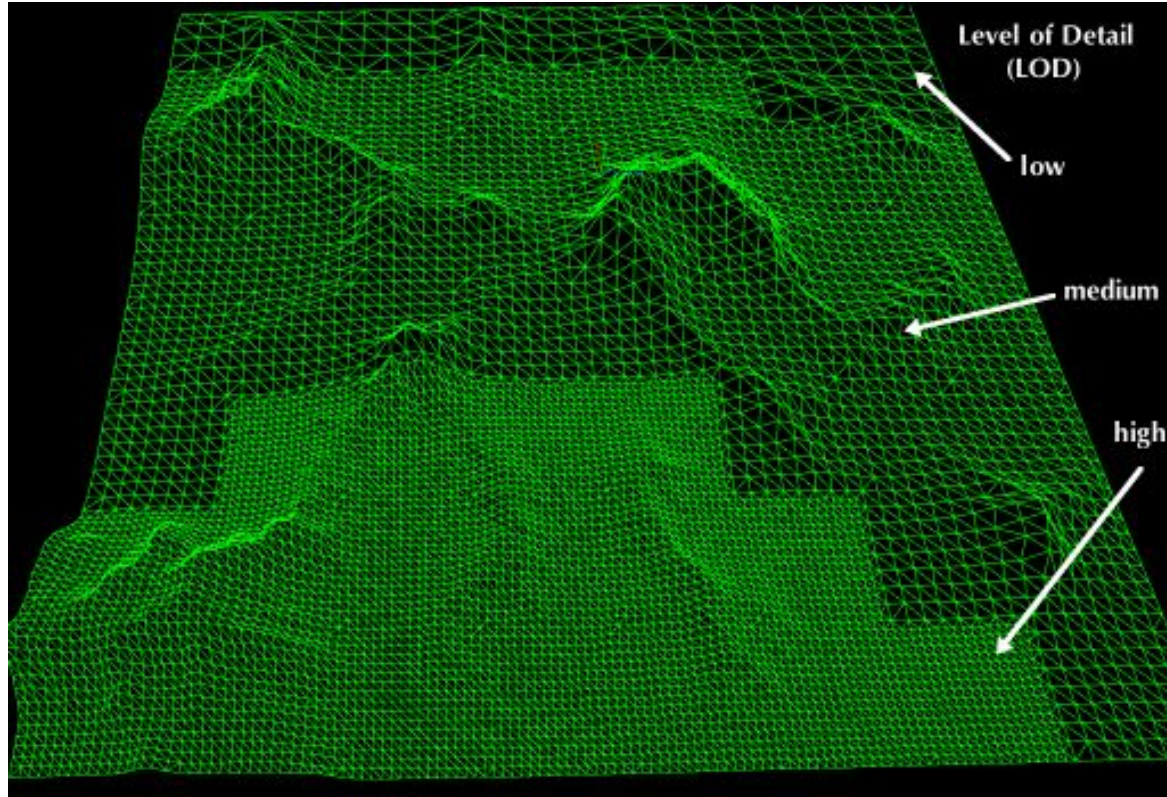
School of Computer, National University of Defense Technology, Changsha, 410073, P.R.China

yxd336@tom.com

Que voulons-nous dire par...

- Réaliste?
- Non-bornée?
- Temps réel?

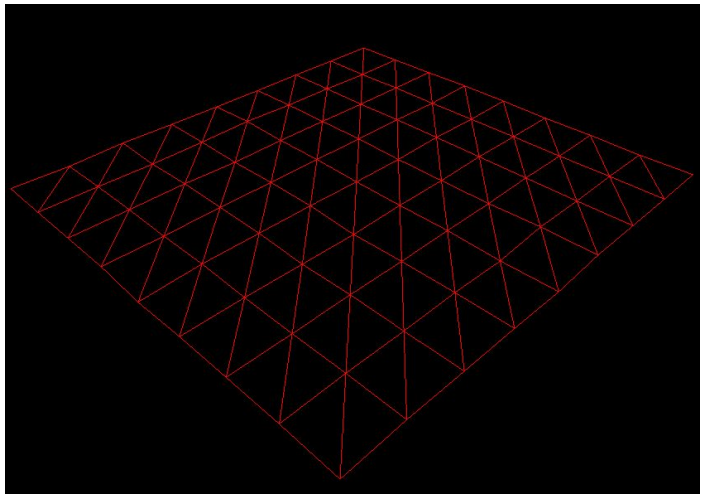
Concept du LOD



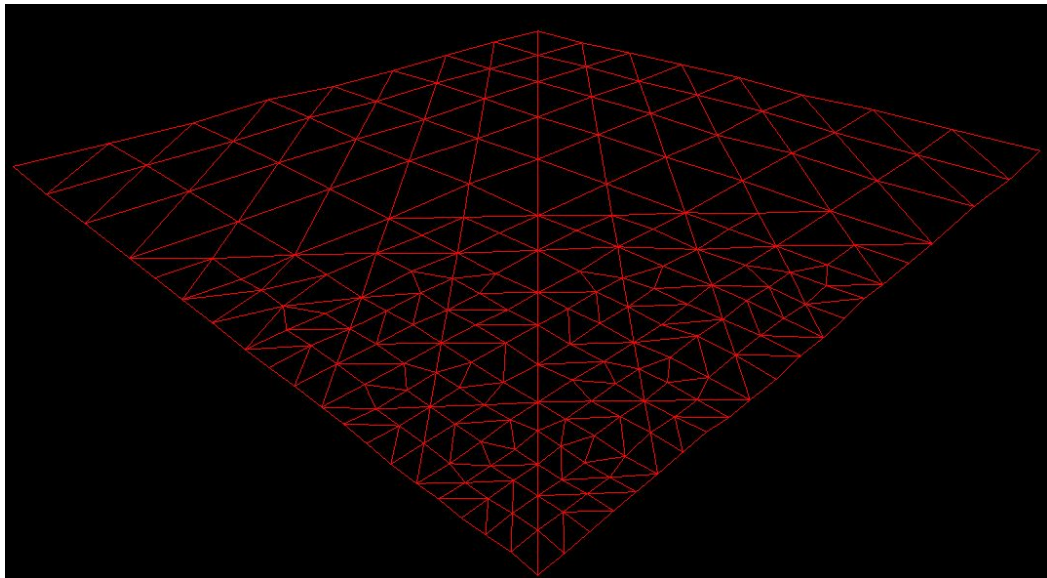
Implémentations naïve du LOD

- Patch uniformes avec tessellation selon la distance
 - Pas extensible (+gros -> +++sommets)
 - Limite de tessellation par le GPU

Loin:

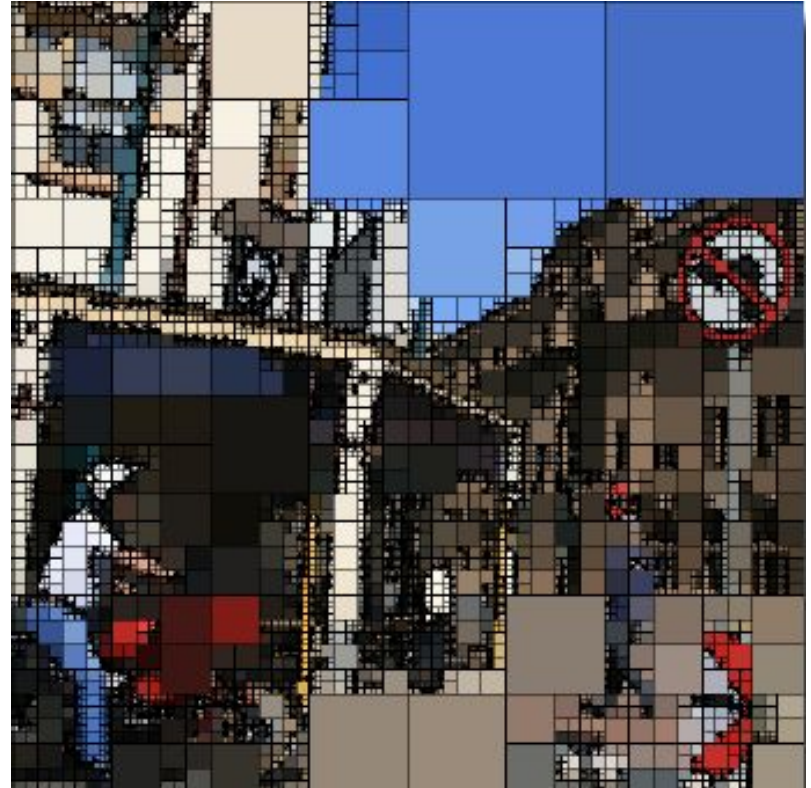


Près:



Quadtree

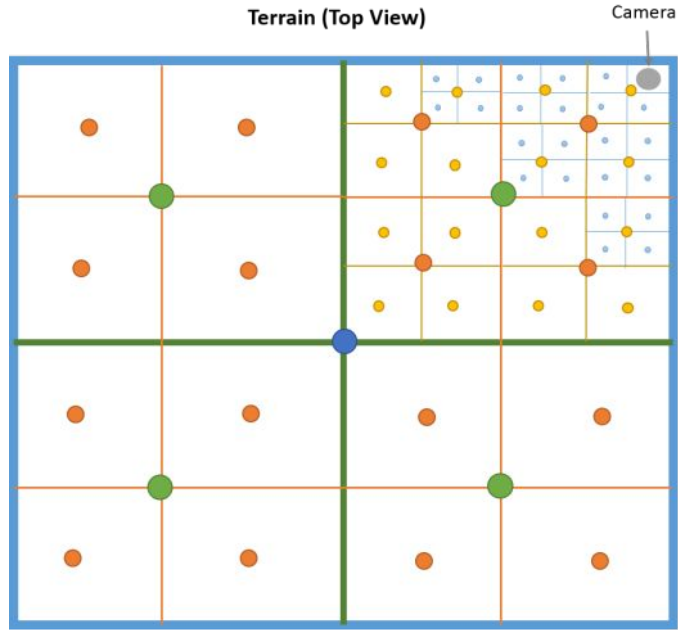
- Partitionnement d'un espace 2D
- Subdivision à l'obtention d'une condition donnée
- Dans cet exemple, tous les pixels d'un noeud ont la même valeur



Quadtree

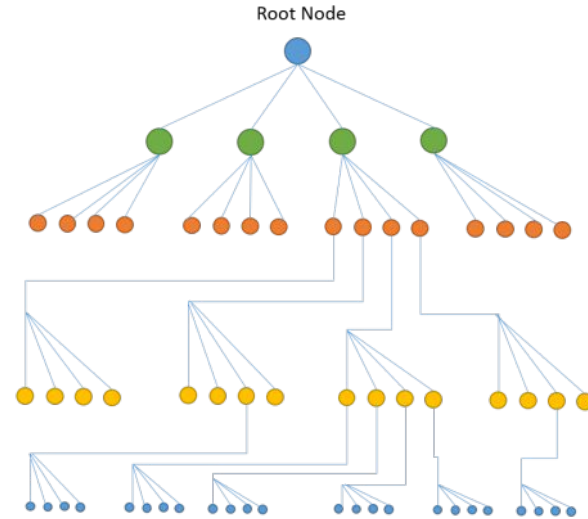
- 1) La racine la surface complète d'eau
- 2) Comparer la position de la caméra avec l'origine du noeud courant. Subdiviser en 4 récursivement si:
 - a) Caméra est suffisamment loin et ne requiert plus de subdivision
 - b) Niveau de subdivision maximal atteint
- 3) Pour les feuilles:
 - a) Génération d'un VAO à la construction
 - b) Effectuer le rendu lors de la traversée en préordre

Quadtree



<https://victorbush.com/2015/01/tessellated-terrain/>

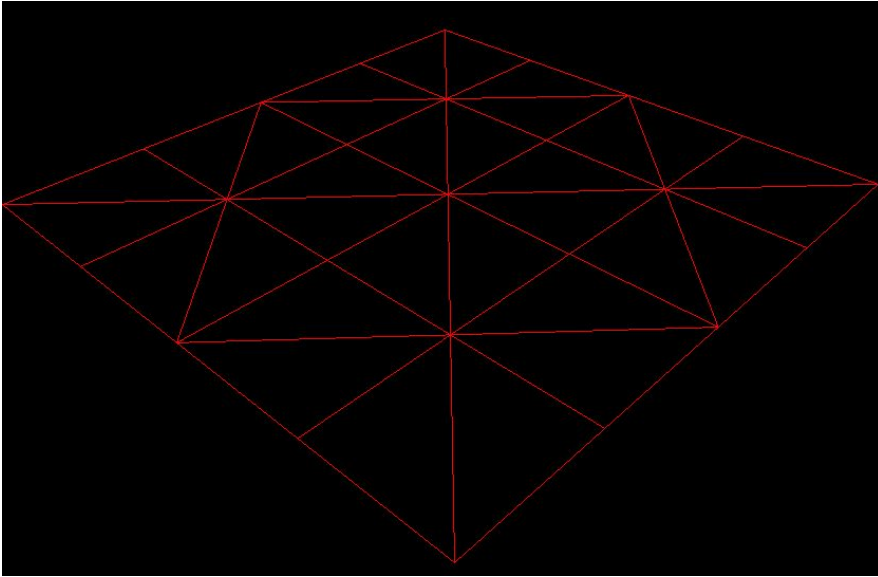
Terrain Quadtree



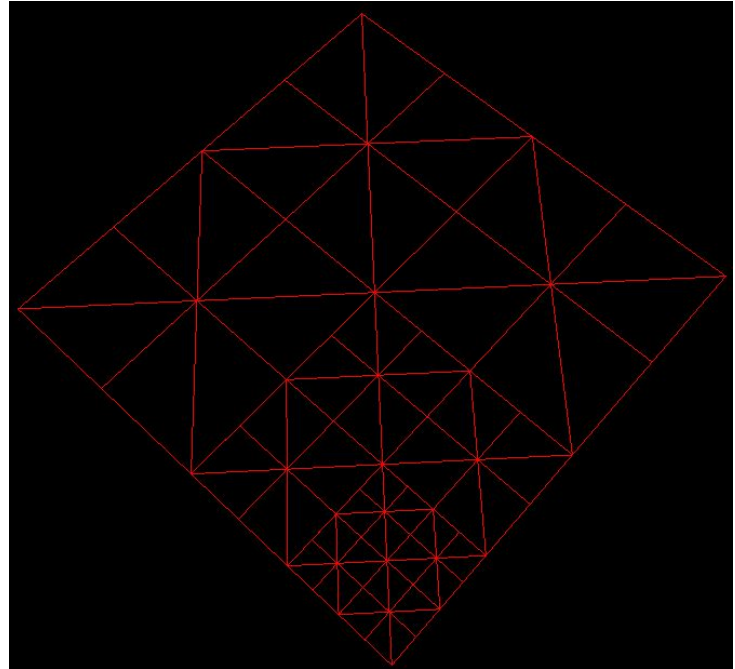
Implémentation du LOD

- Subdivision d'une seule *patch* en quad-tree

Loin:

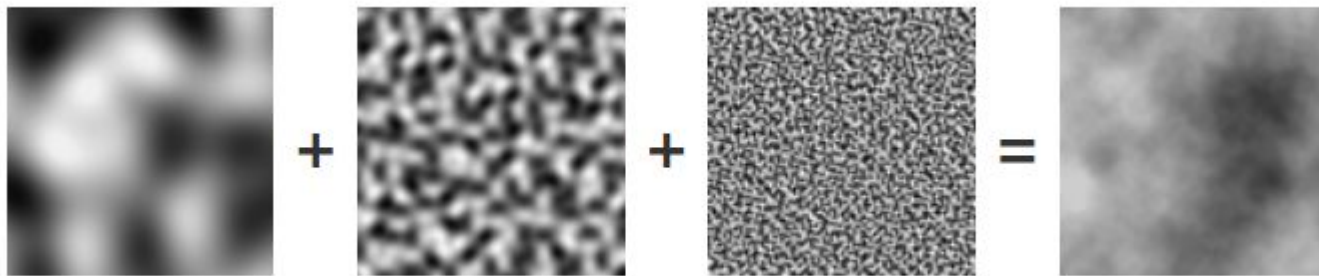


Près:



Bruit fractal

- Somme de bruits à plusieurs octaves
 - Fréquences doublés
 - Amplitudes réduites de moitié
- Complexification des hauteurs



<https://www.redblobgames.com/maps/terrain-from-noise/>

Height map (placage de hauteurs)

- Changer la hauteur des sommets selon le bruit calculé
- Trois paramètres (bruit 3d):
 - La position du sommet sur le plan (x et z)
 - Le temps

Implémentation possible: Rendu dans FBO

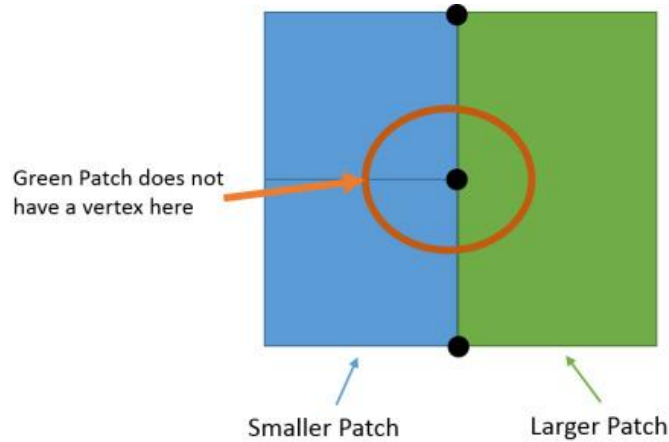
- 1ère passe: height map
- 2ème passe: normal map
 - Même FBO pour passe 1 et 2
 - Taille: Même que le maillage
- 3ème passe:
 - Rendu de la surface avec déplacement
 - Illumination
- 4ème passe (optionnel): Post-process, ajout d'effets
- 5ème passe (optionnel): Shadow maps

Difficultés

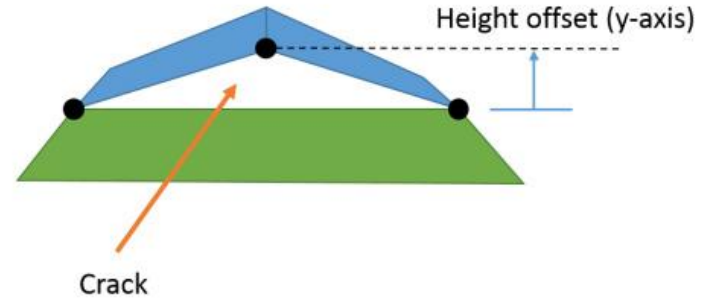
- Contexte (termes techniques, intérêts)
- Erreurs de traduction

Artéfacts visuels

- Craques aux jonctions en T



Top View

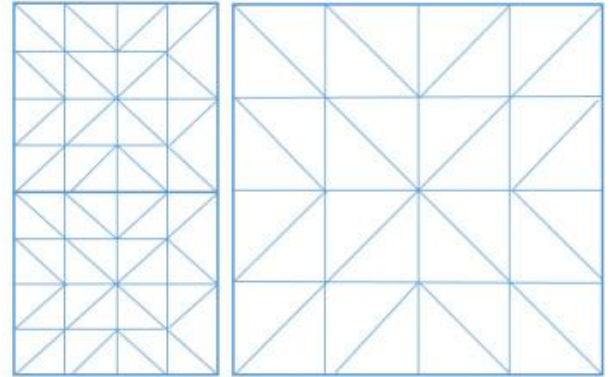
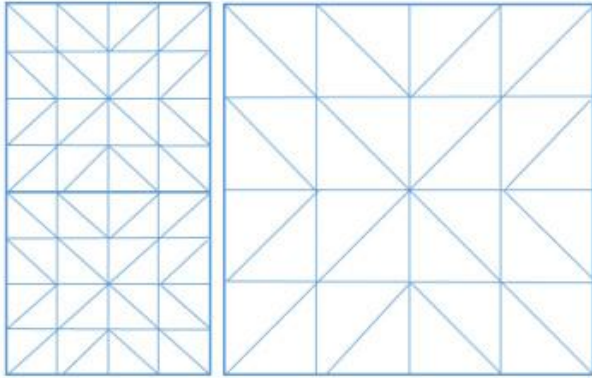


Side View

Artéfacts visuels

- Craques aux jonctions en T

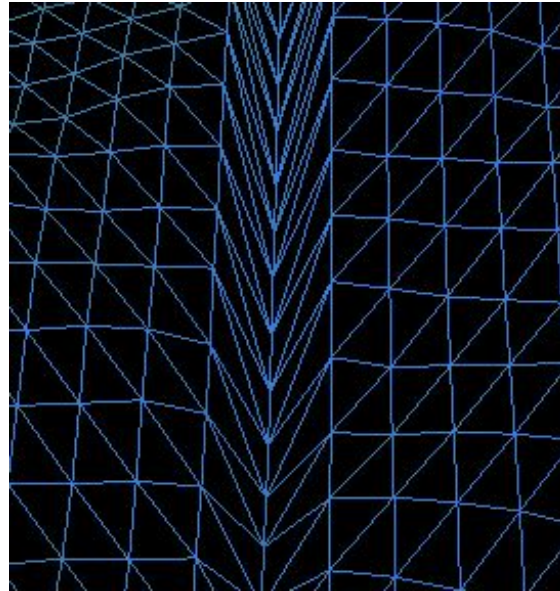
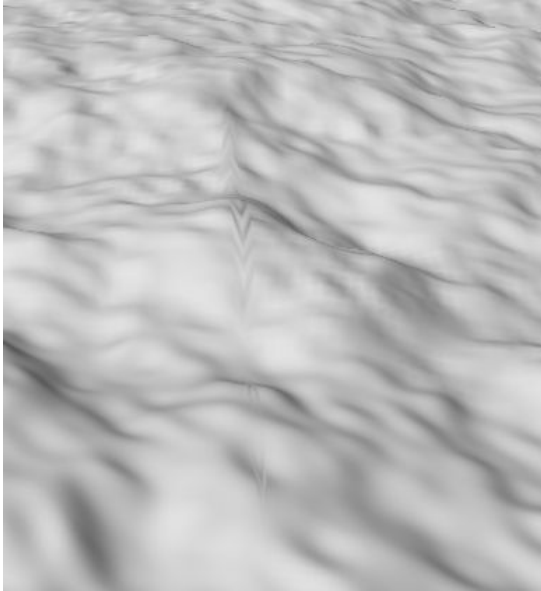
Scale Factor = 0.5 →



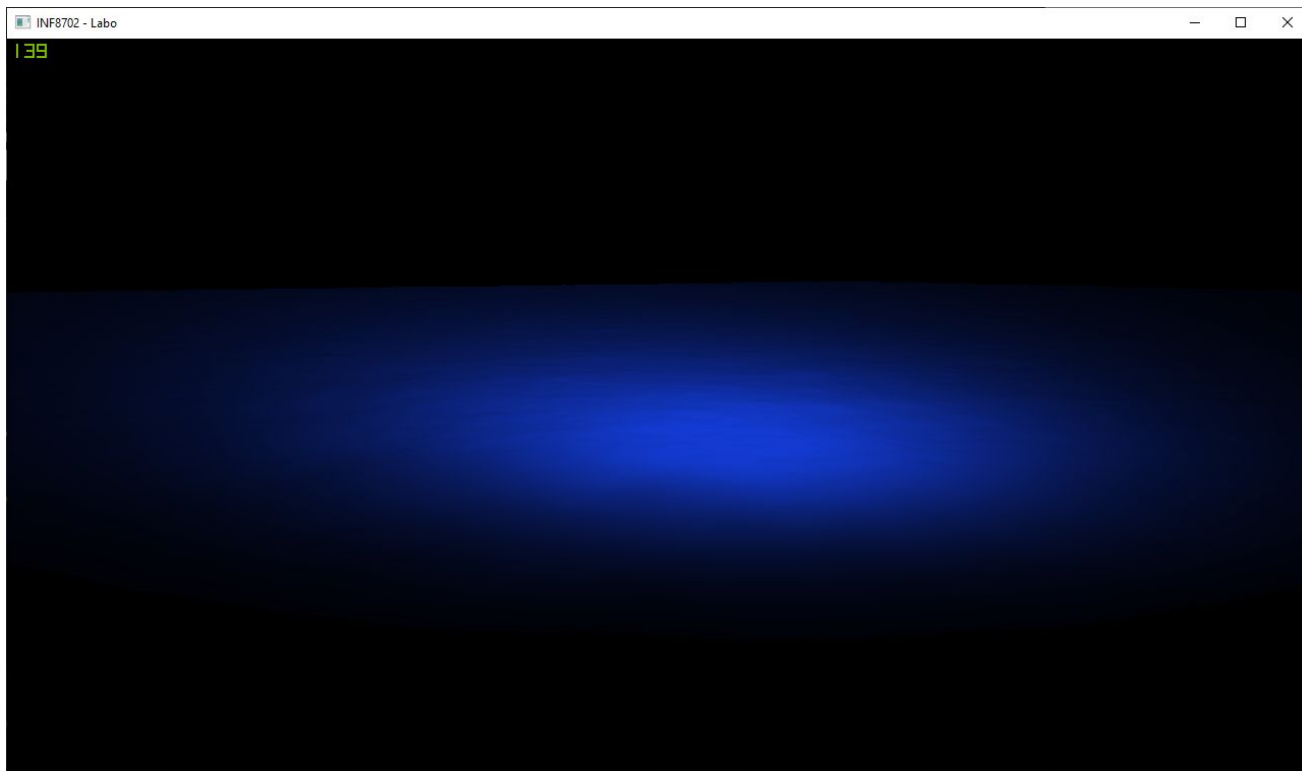
Scale Factor = 0.5 →

Artéfacts visuels

- Distortion du maillage



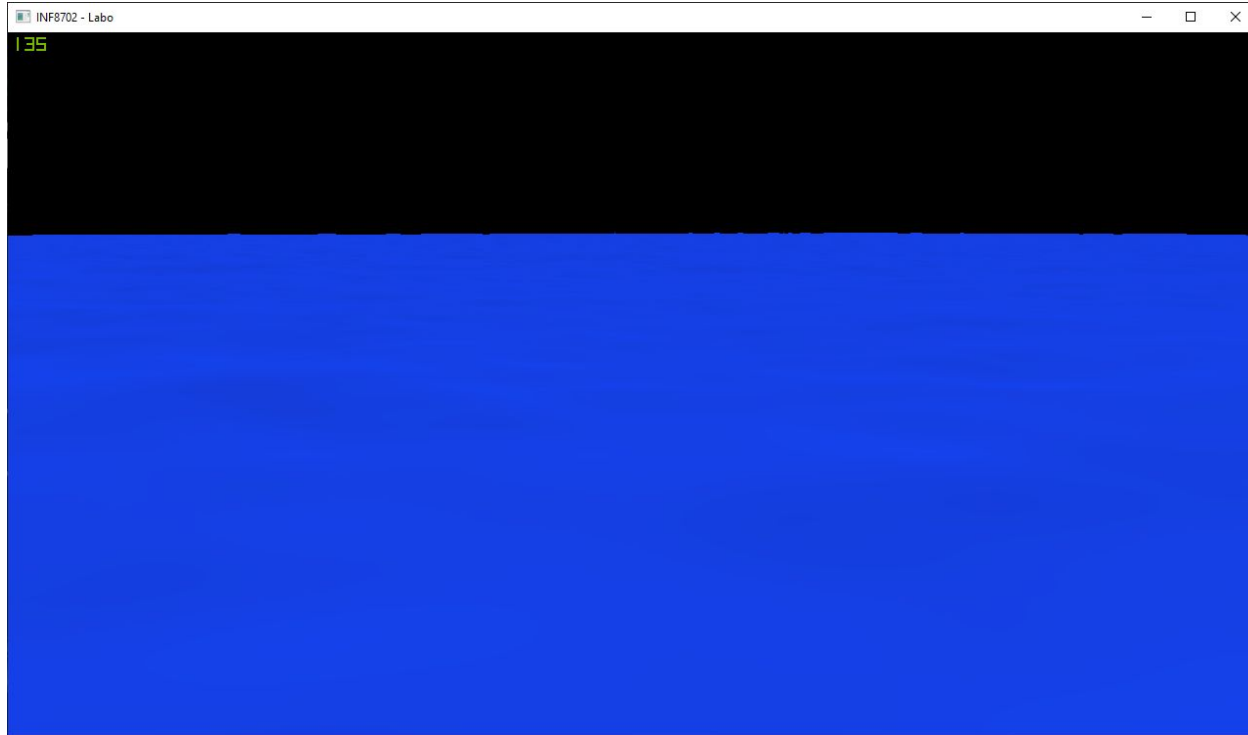
Spotlight



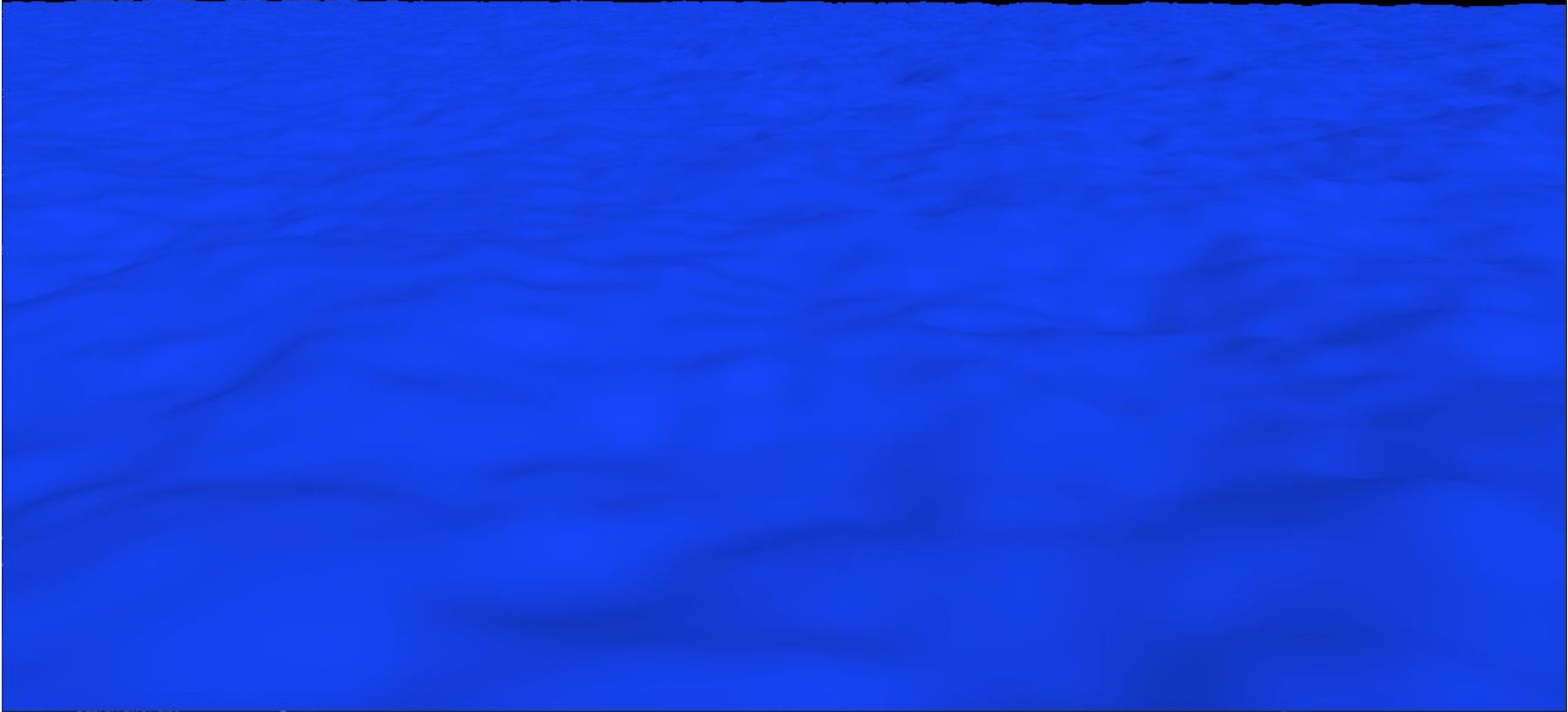
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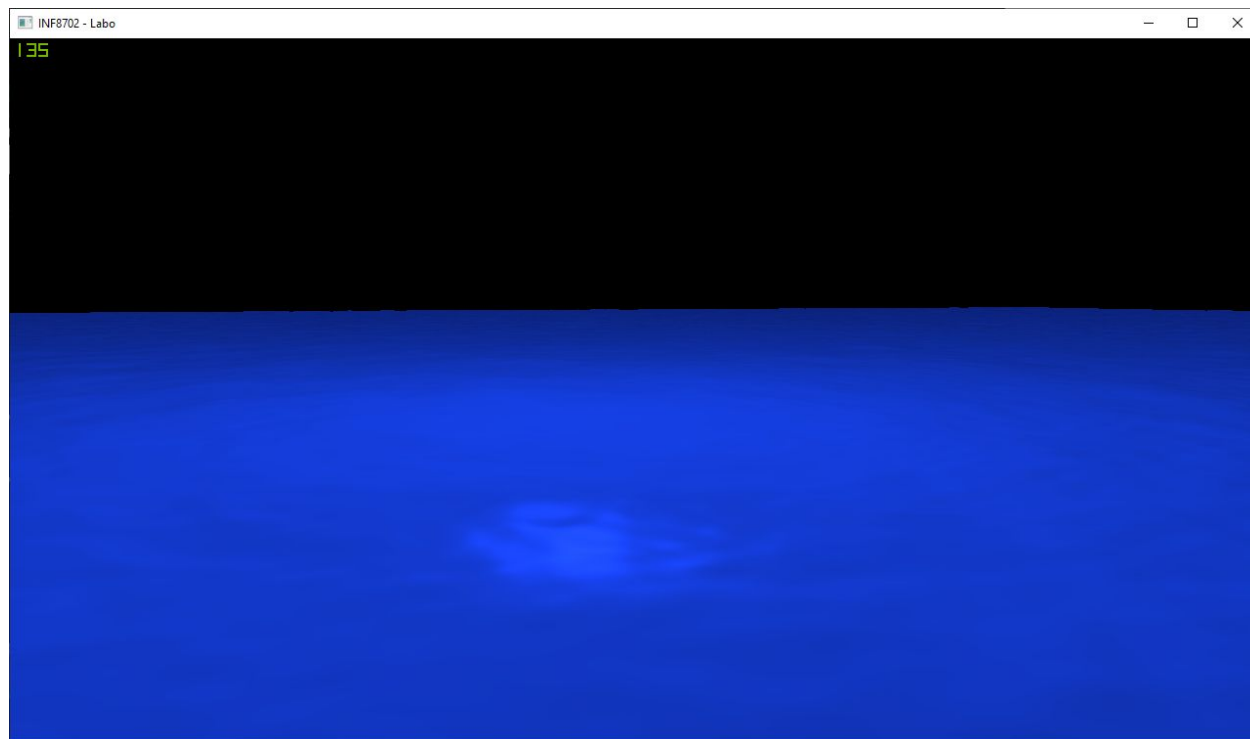
Directionnelle



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Positionelle

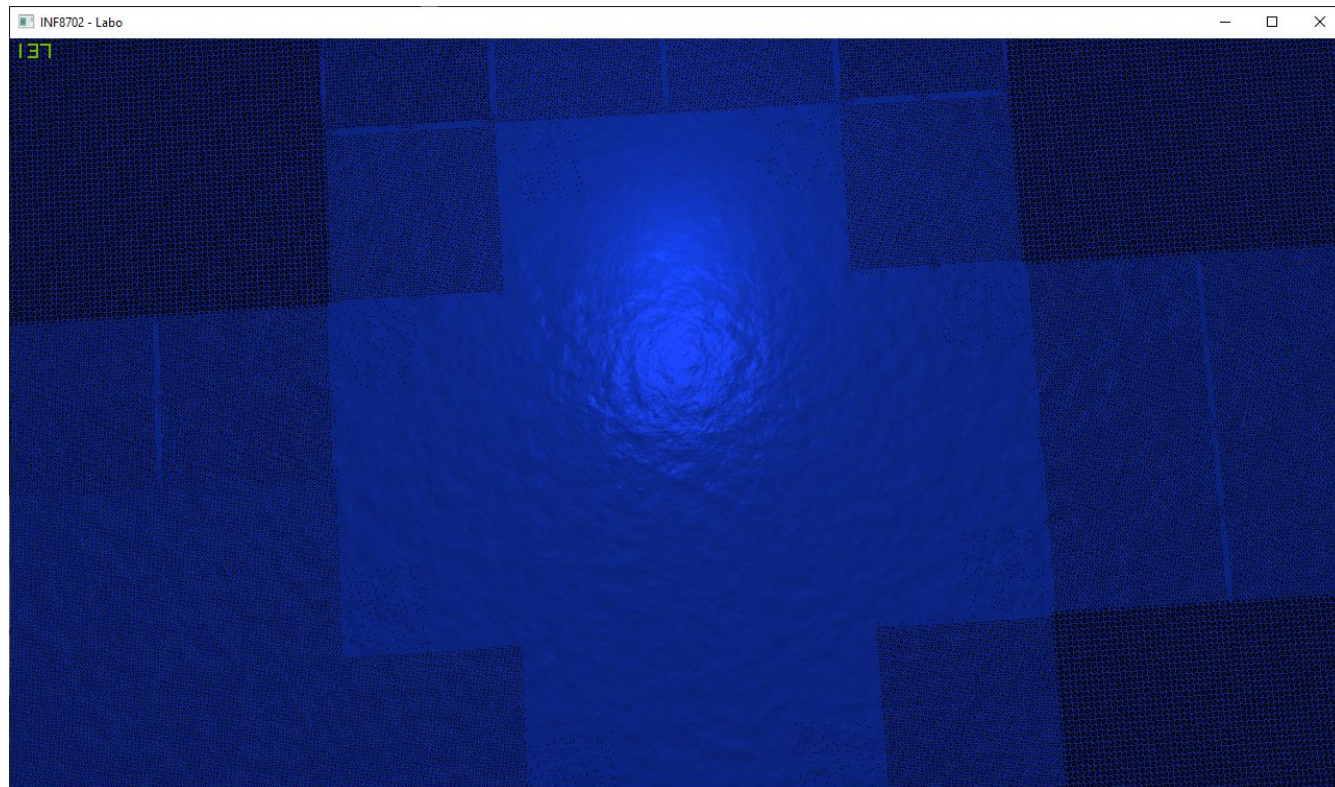


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Press Alt+Z to use GeForce
Experience in-game
overlay

Affichage en grille





Press Alt+Z to use GeForce
Experience in-game
overlay

133

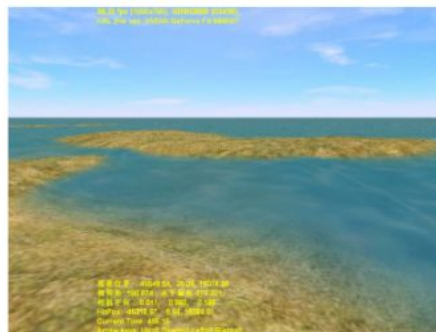


Press Alt+Z to use GeForce
Experience in-game
overlay

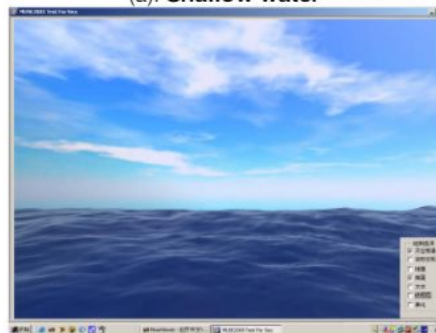
Conclusion

- Skybox
- Couche de terre/biomes
- Utilisation de textures
- Frustum culling
(Geometry shader)

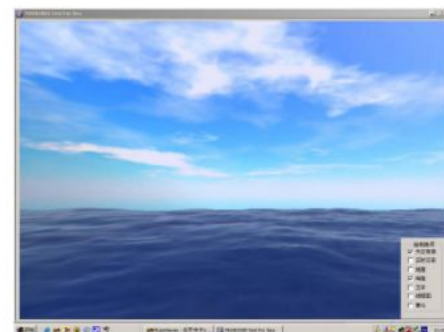
Figure 2: From left to right, 2005.



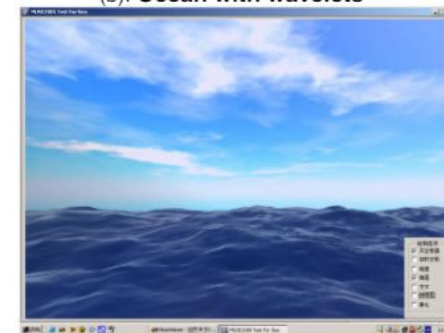
(a). Shallow water



(c). Ocean with middle waves



(b). Ocean with wavelets



(d). Ocean with billowy waves

<http://www-evasion.inrialpes.fr/Membres/Fabrice.Neyret/images/fluids-nuages/waves/Jonathan/articlesCG/GPUBasedRealTimeSimulationAndRendering2005.pdf>

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