

# Echelles de longueur et de temps dans un automate cellulaire pour modéliser les champs de dunes

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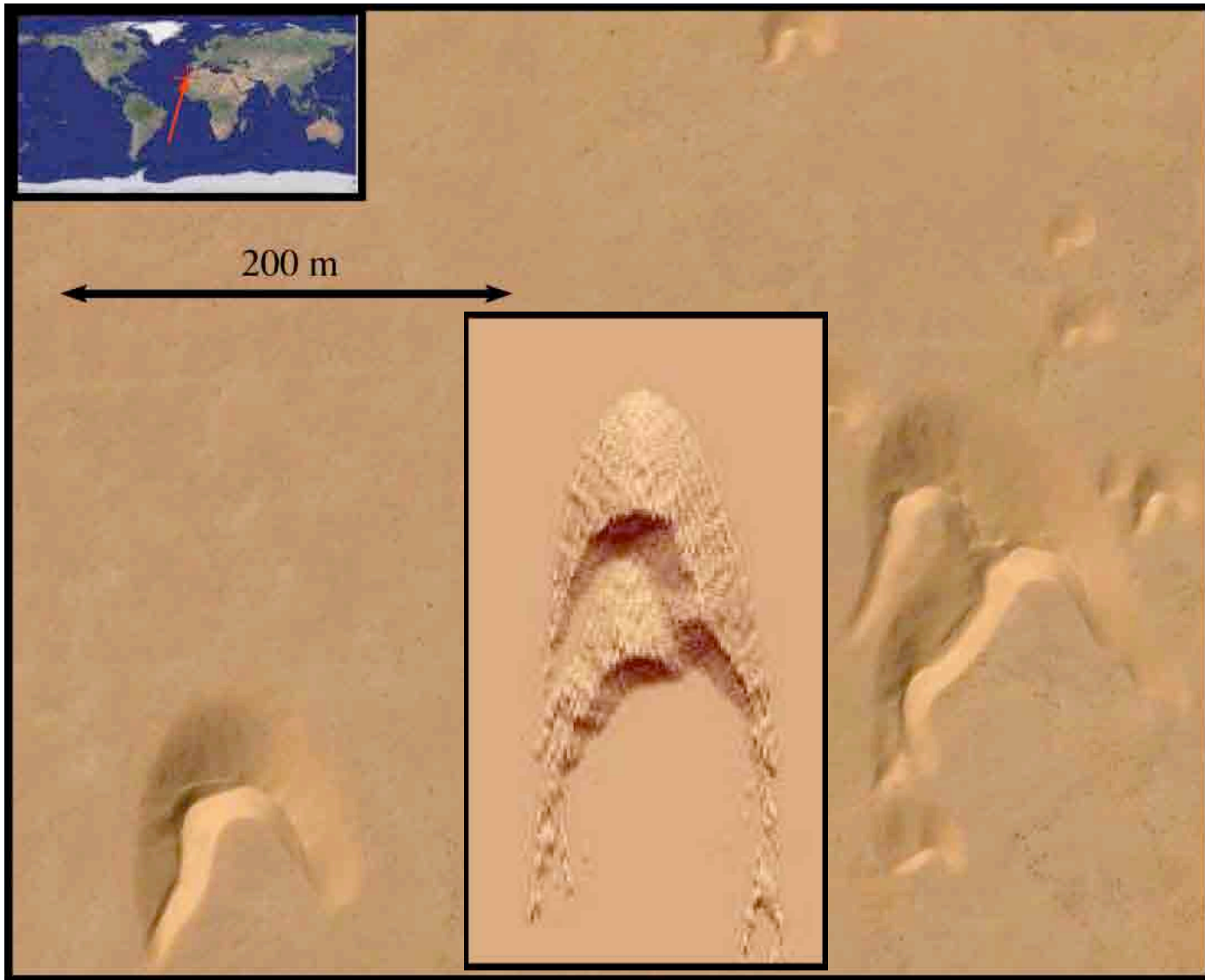
D. Zhang & O. Rozier



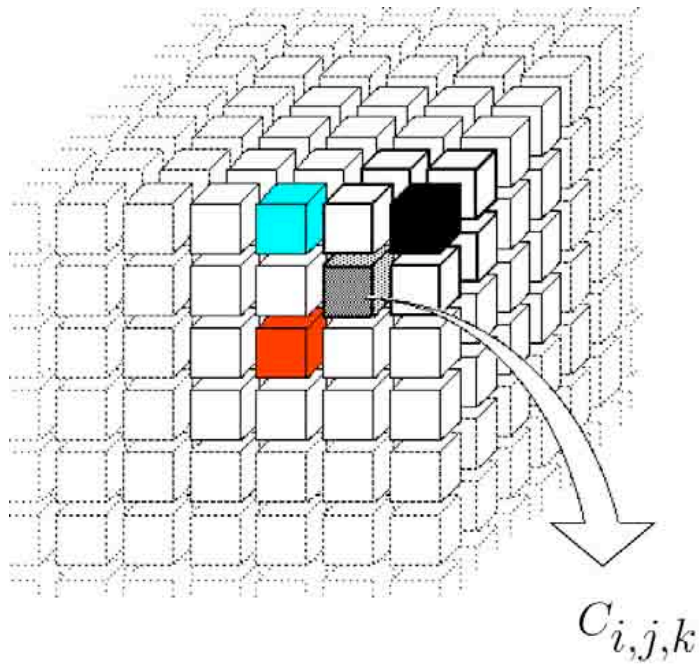
**PMMH**




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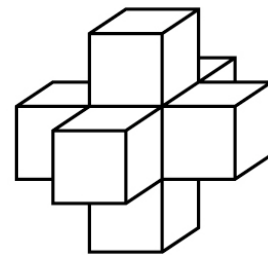
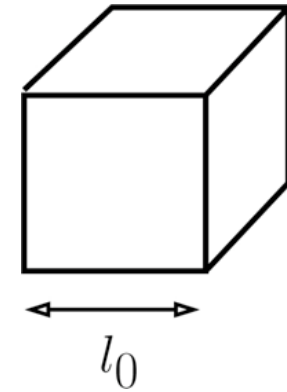
Est-ce que tentant c'que j'te disais?



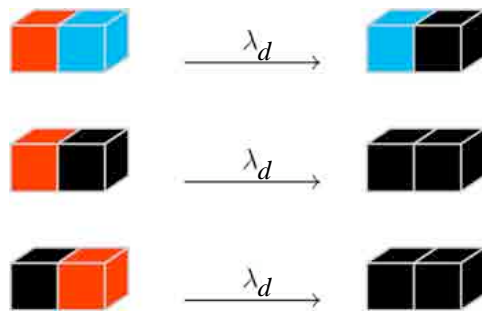
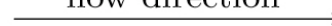
# Le CA dans tous ses états



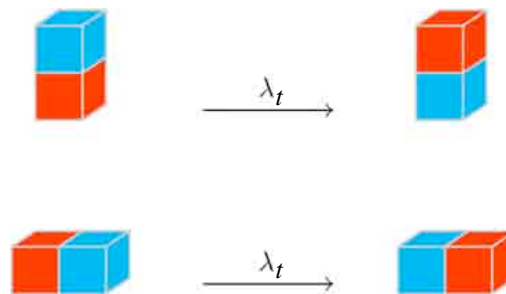
Granular material	 Grain
Mobilized granular material	 Mobilized grain
Fluid flow	 Fluid



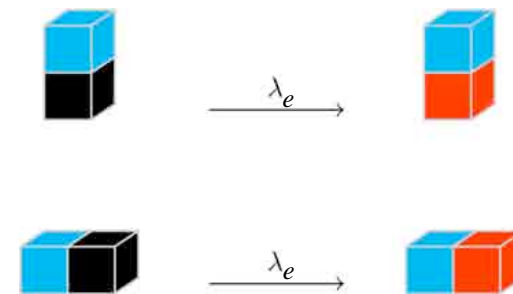
flow direction



Déposition



Transport

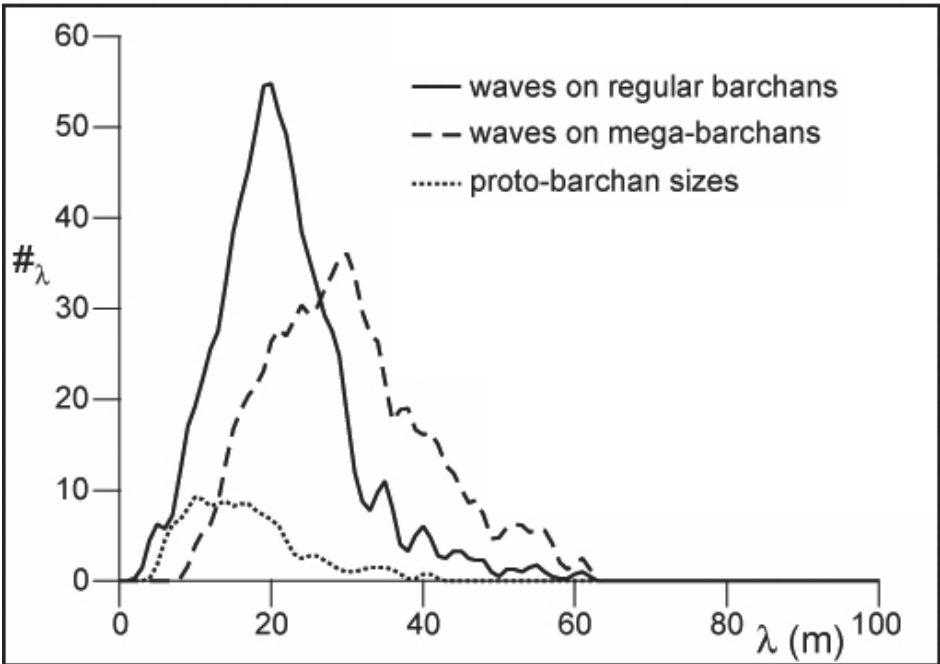
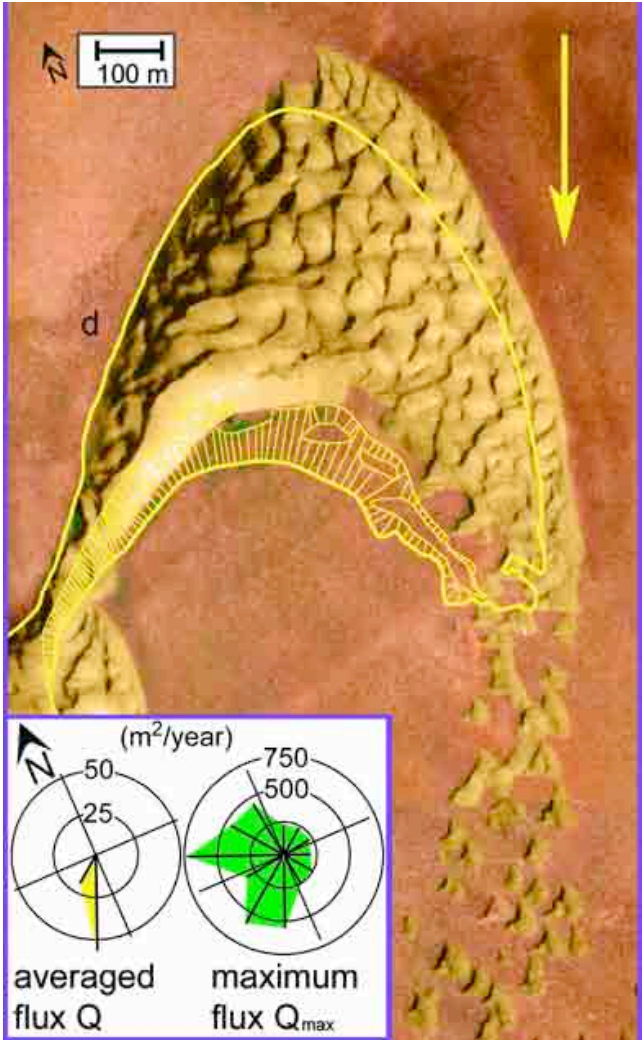
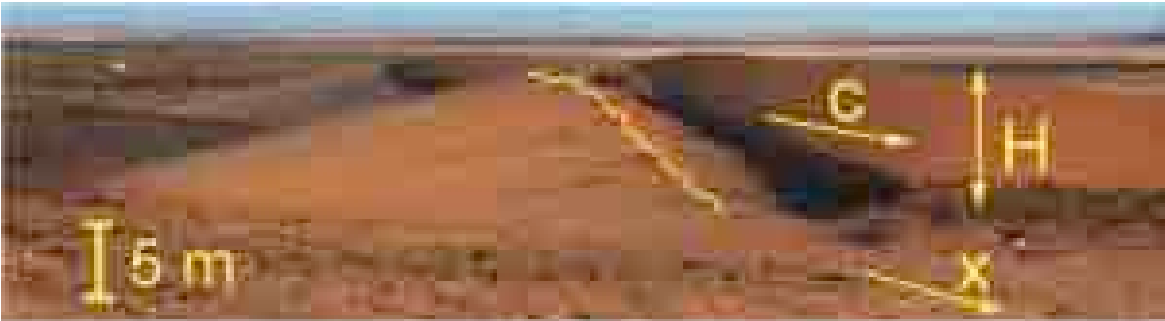


Erosion

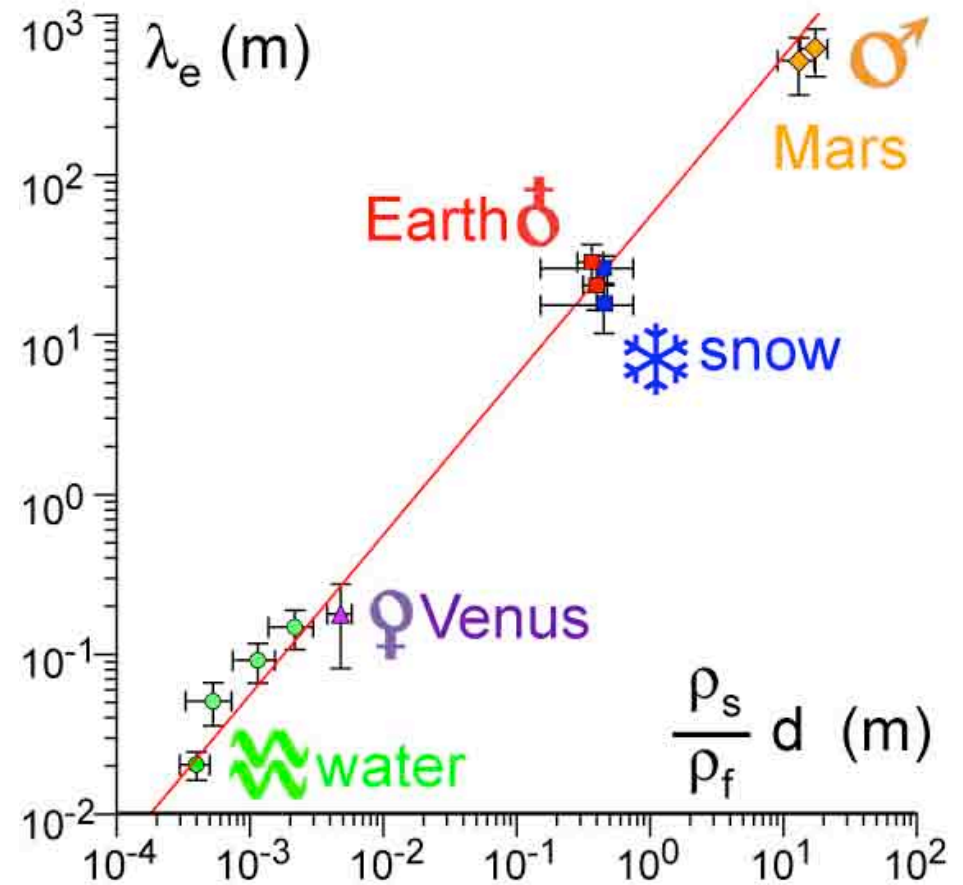
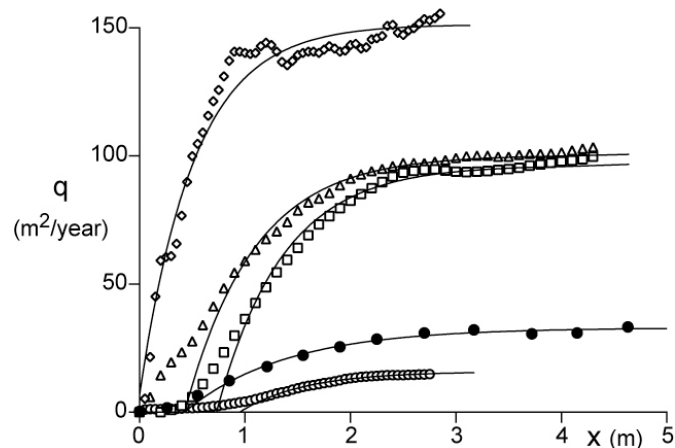
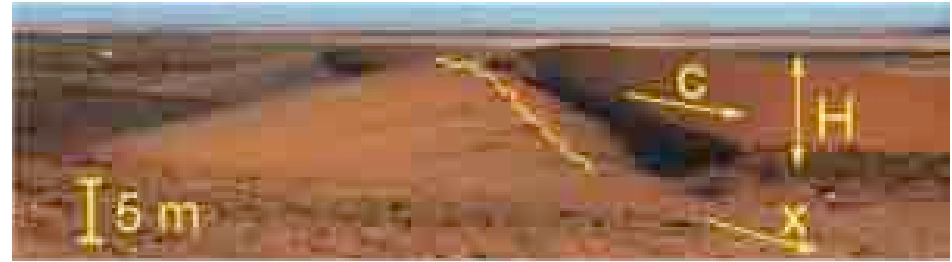
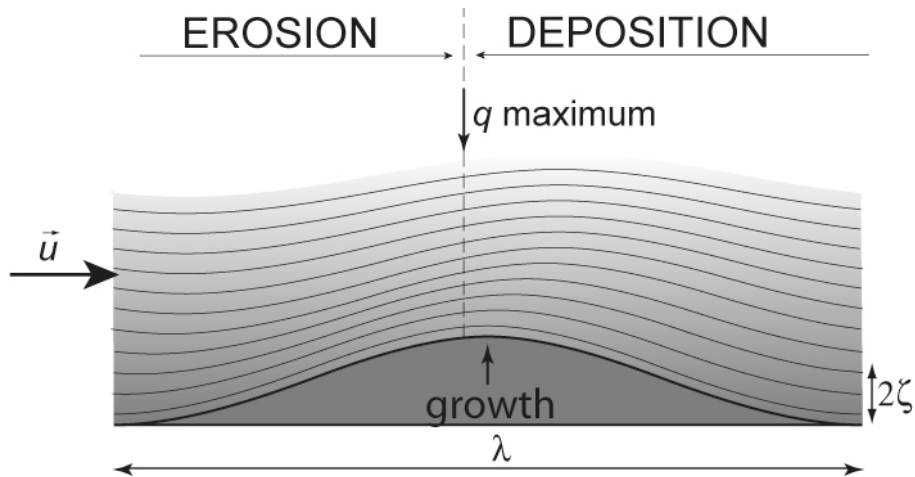
+ avalanches



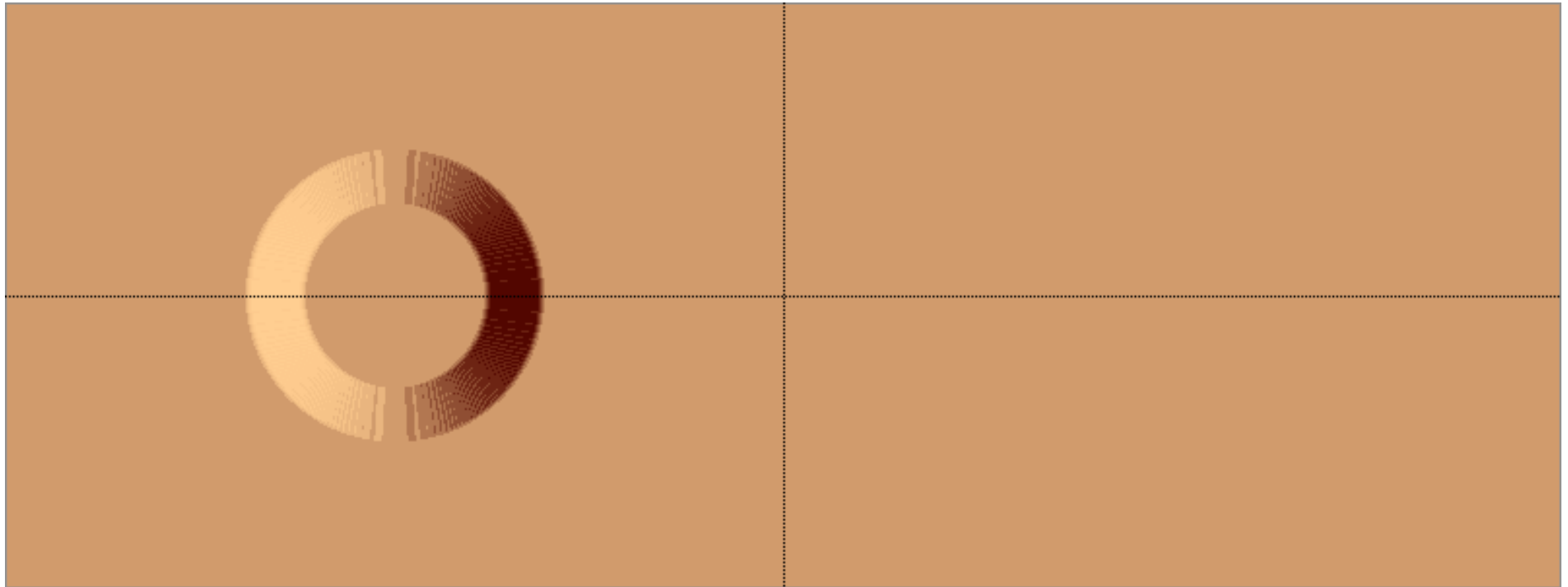
# Sur le terrain...



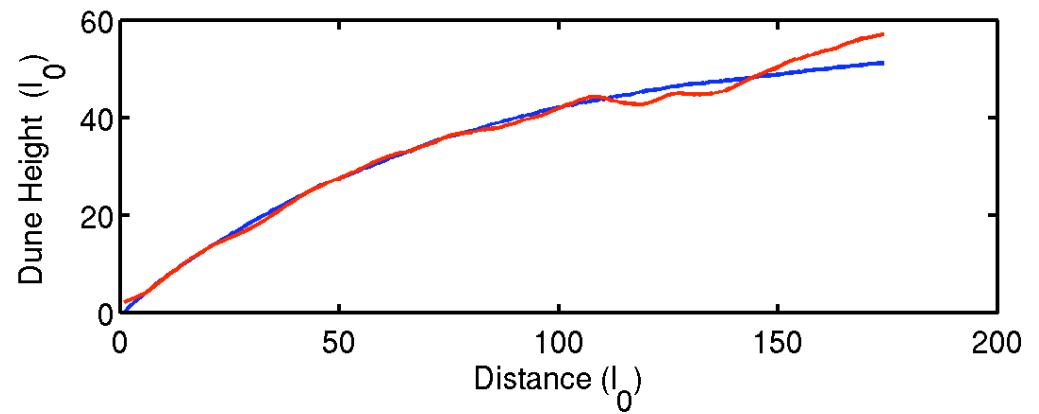
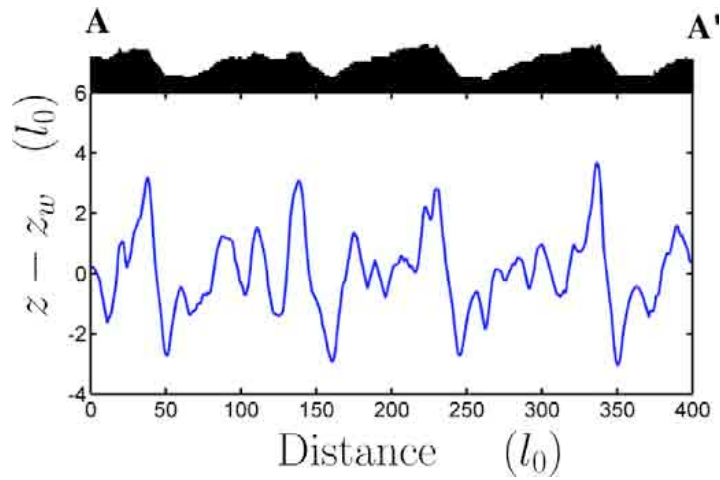
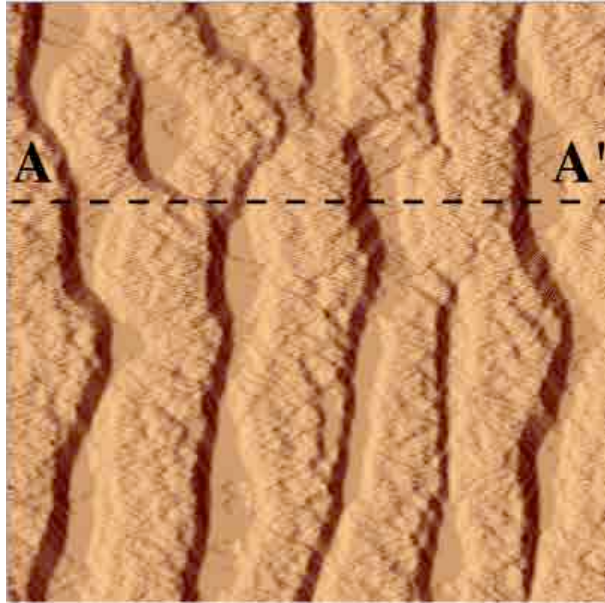
# Loi d'échelle des dunes élémentaires



# Vagues de dunes (1)



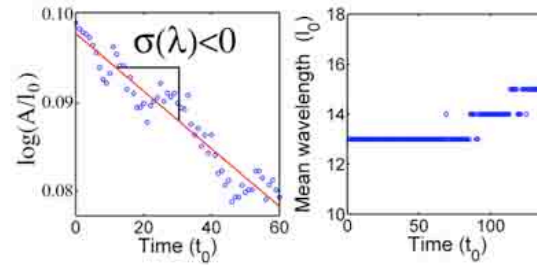
# Vagues de dunes (2)



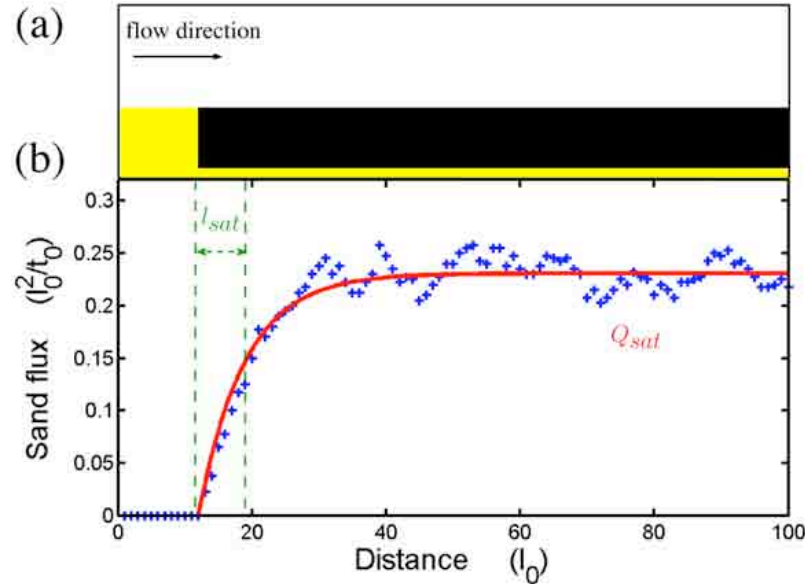
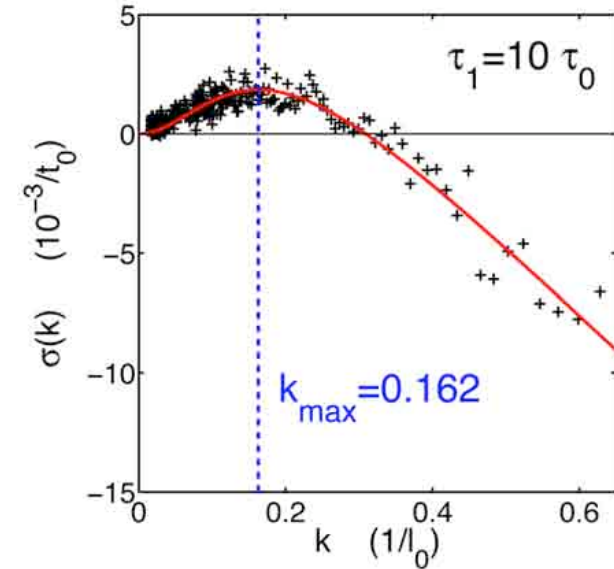
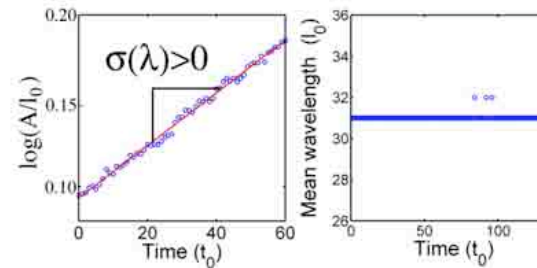
# ADSL → échelle spatiale

$$\lambda_{\max} \approx 40l_0$$

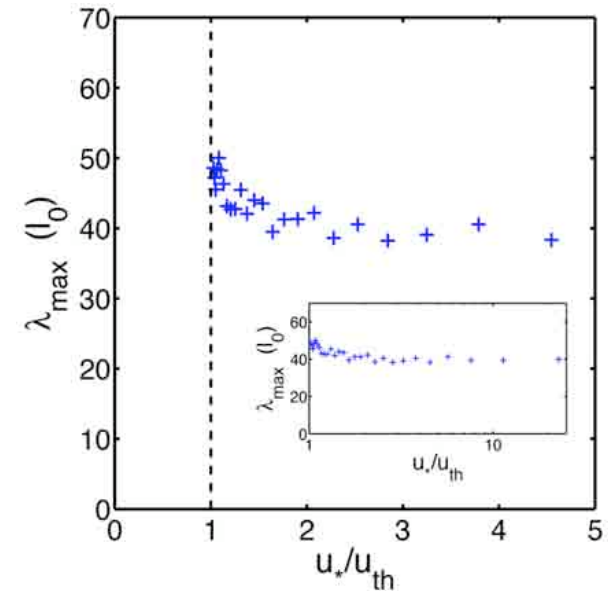
(a) Stable wavelength



(b) Unstable wavelength



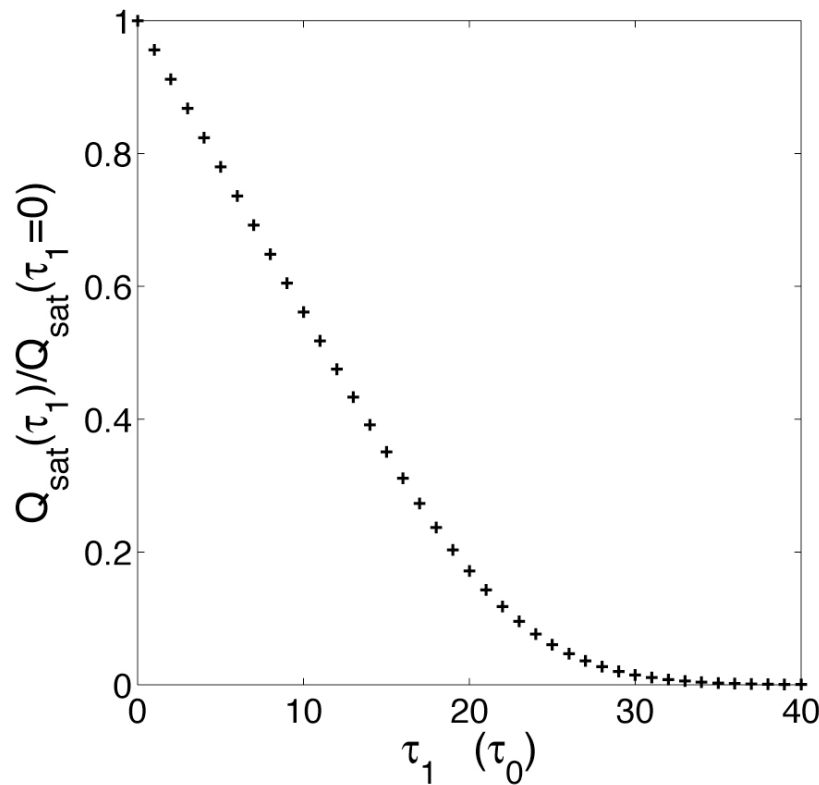
$$l_{\text{sat}} \approx 6l_0$$





# Transport → échelle temporelle

$$q_{\text{sat}} = \begin{cases} 0 & \text{if } u_* \leq u_{\text{th}} \\ \chi u_*^{2\gamma} (u_*^2 - u_{\text{th}}^2) & \text{if } u_* \geq u_{\text{th}} \end{cases}$$



$$\frac{q_{\text{sat}}}{q_{\text{sat}}^0} = 1 - \left( \frac{u_{\text{th}}}{u_*} \right)^2$$

$$t_0 = \frac{q_{\text{sat}}(\tau_1)}{\langle q_{\text{sat}} \rangle} l_0^2$$



# Le CA dans tous ses états (2)

