Fluid Dynamics

Physics 472B
Spring 2018

Static vs Dynamic

Hydro-Statics

$$P_{static\ fluid} = \rho g h$$

$$\rho = \frac{m}{V} = fluid\ density = 100\ \frac{kg}{m^3} = 9.343E-5\ \frac{lbsec^2}{in^4}$$

$$g \quad acceleration\ of\ gravity \quad 386.4\ \frac{in}{sec^2}$$

$$h = depth\ of\ fluid = 84\ in$$

$$P_{bottom} = 9.343E-5 * 386.4 * 84 = 3.032\ psi$$

Laminar to turbulent flows

http://f*&kyeahfluiddynamics.tumblr.com/search/turbulence/page/1

The entire class in one picture

Instabilities

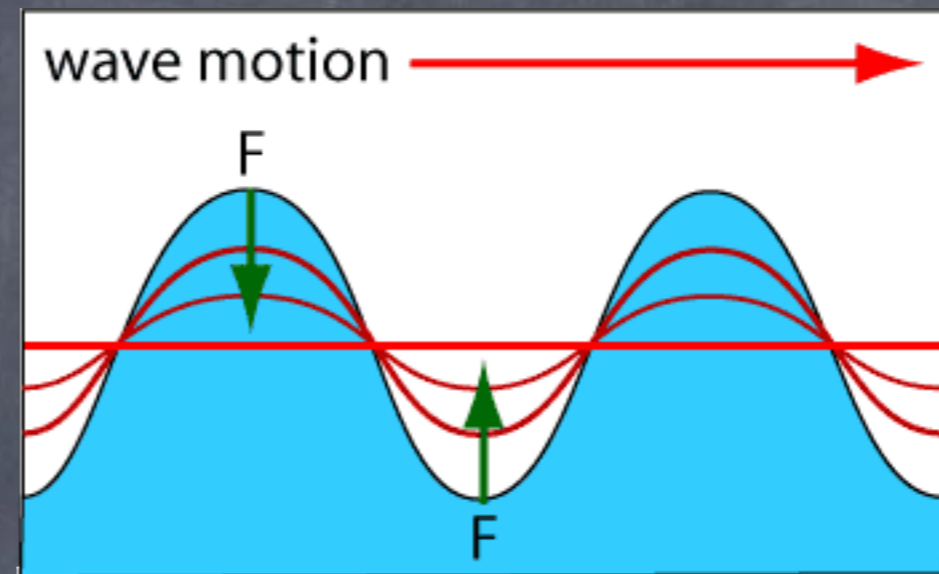- Van Karman vortex streets
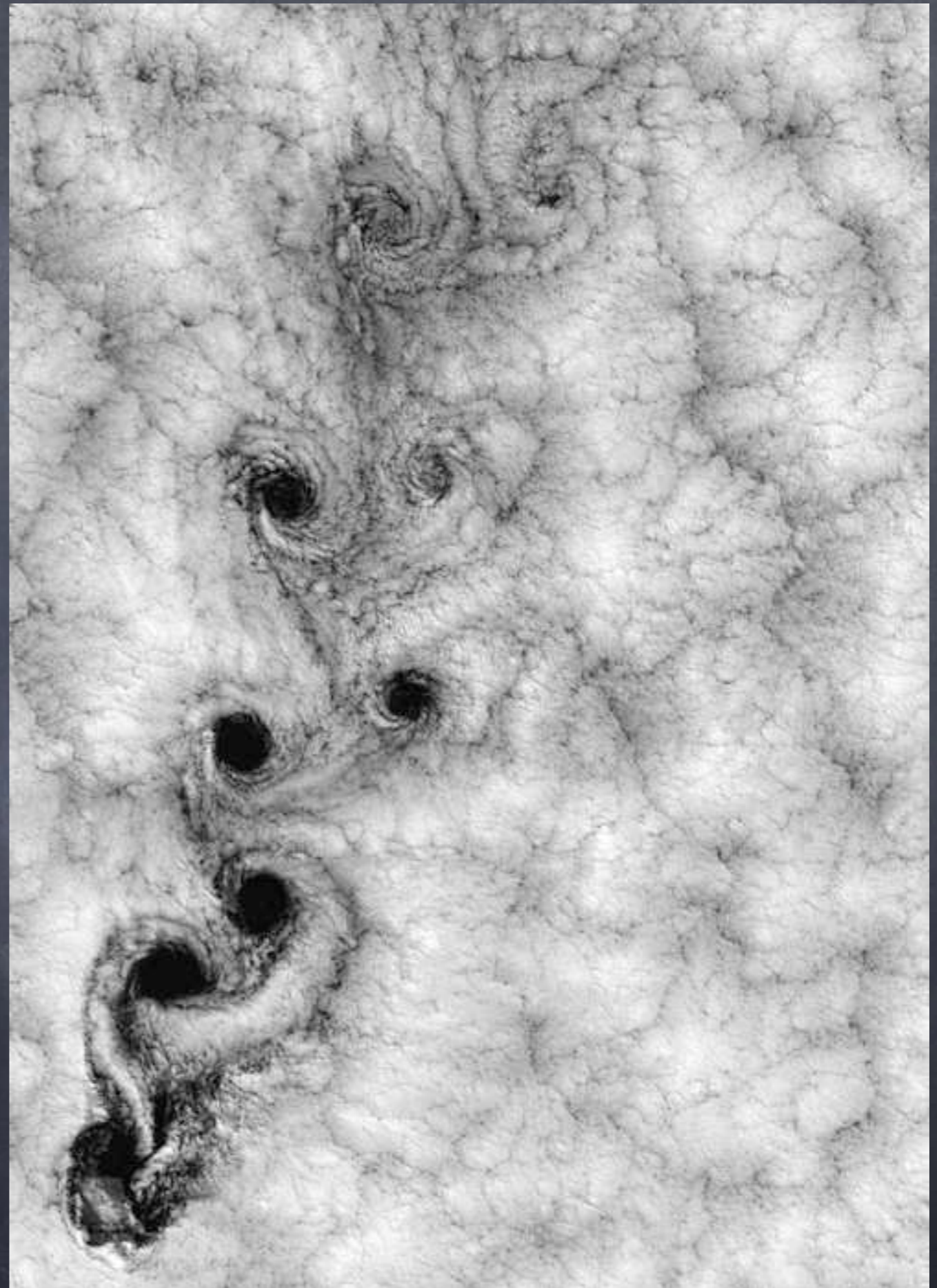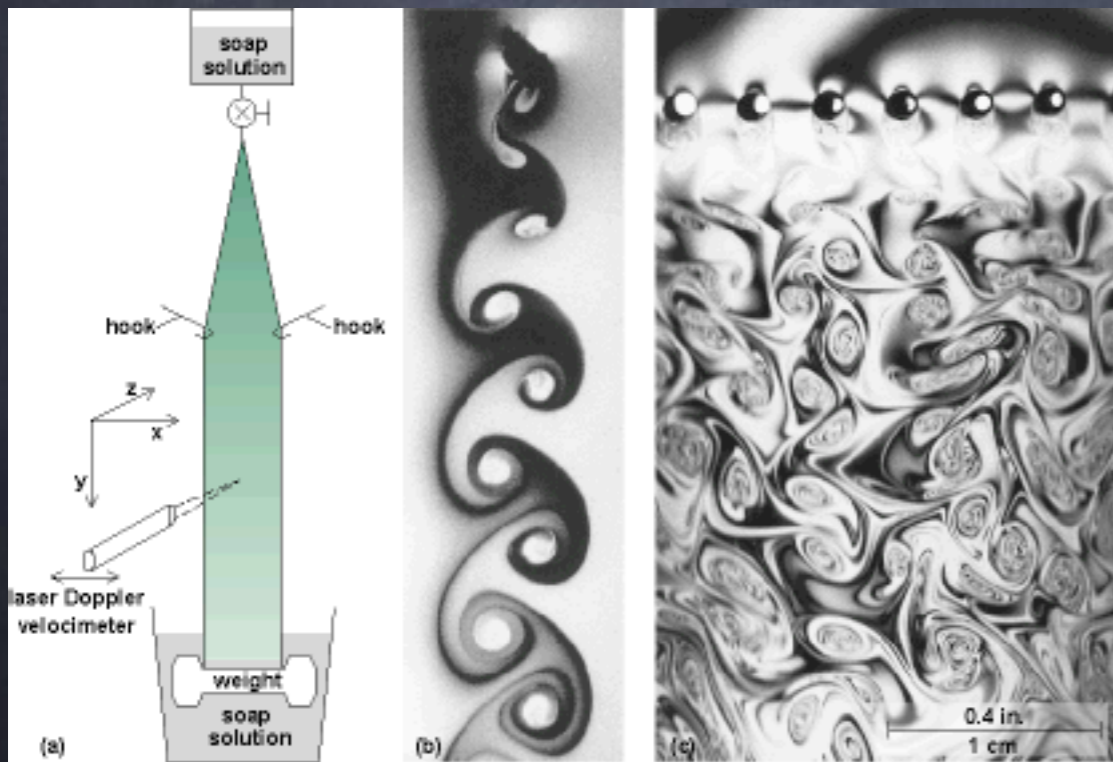
Waves

Waves and flows

- Couette flow

Radius Ratio=0.80

Re=52   Re=93   Re=104   Re=301   Re=601
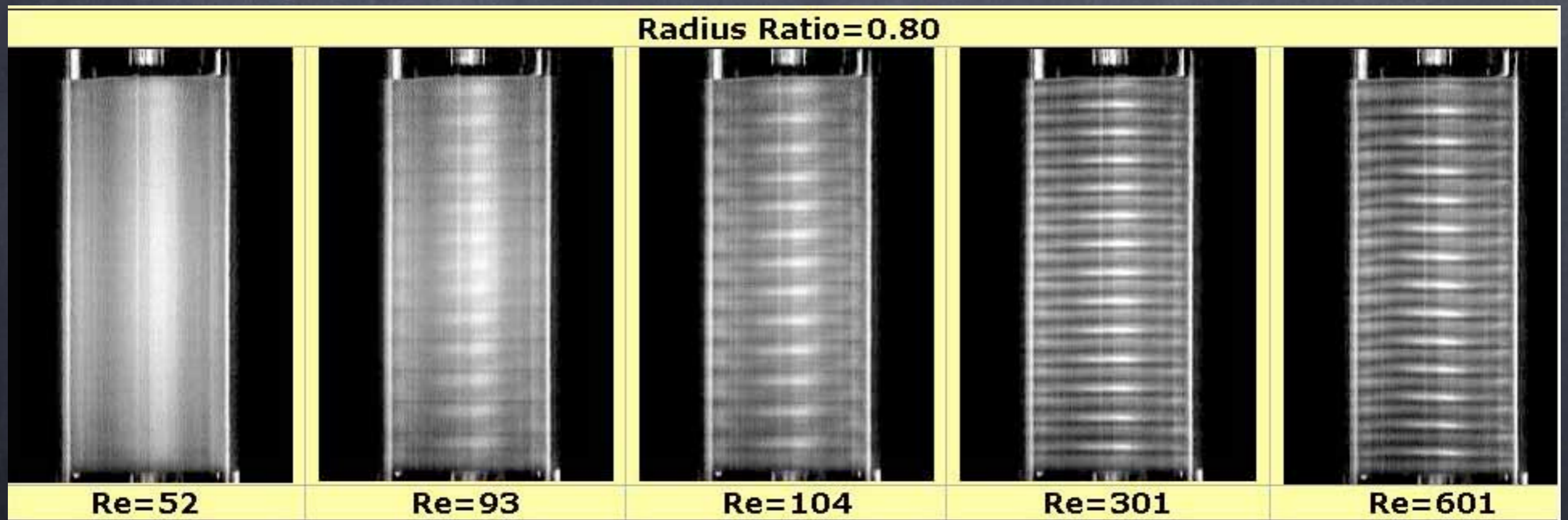
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Turbulence
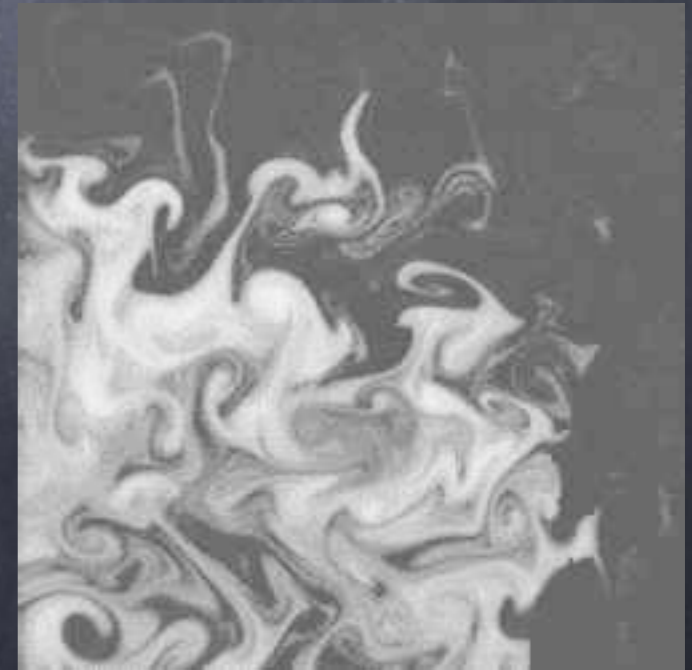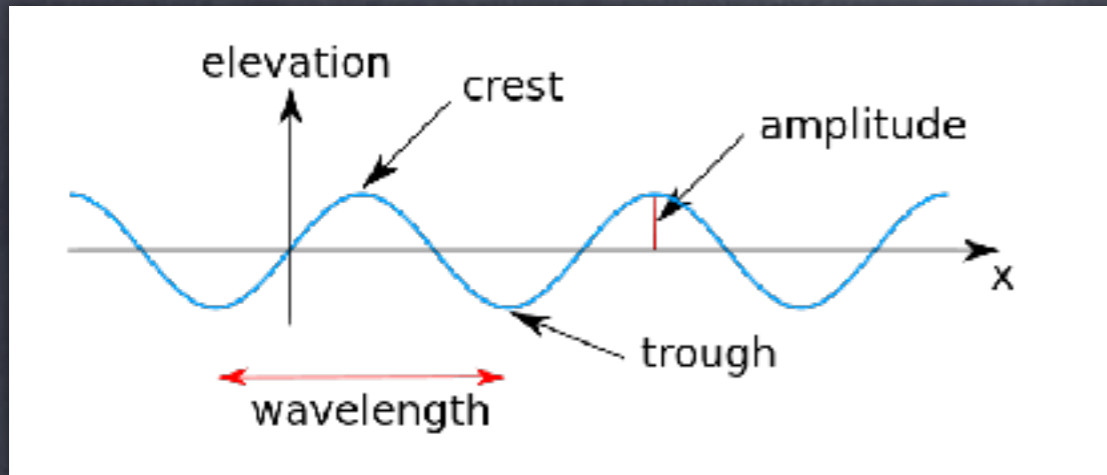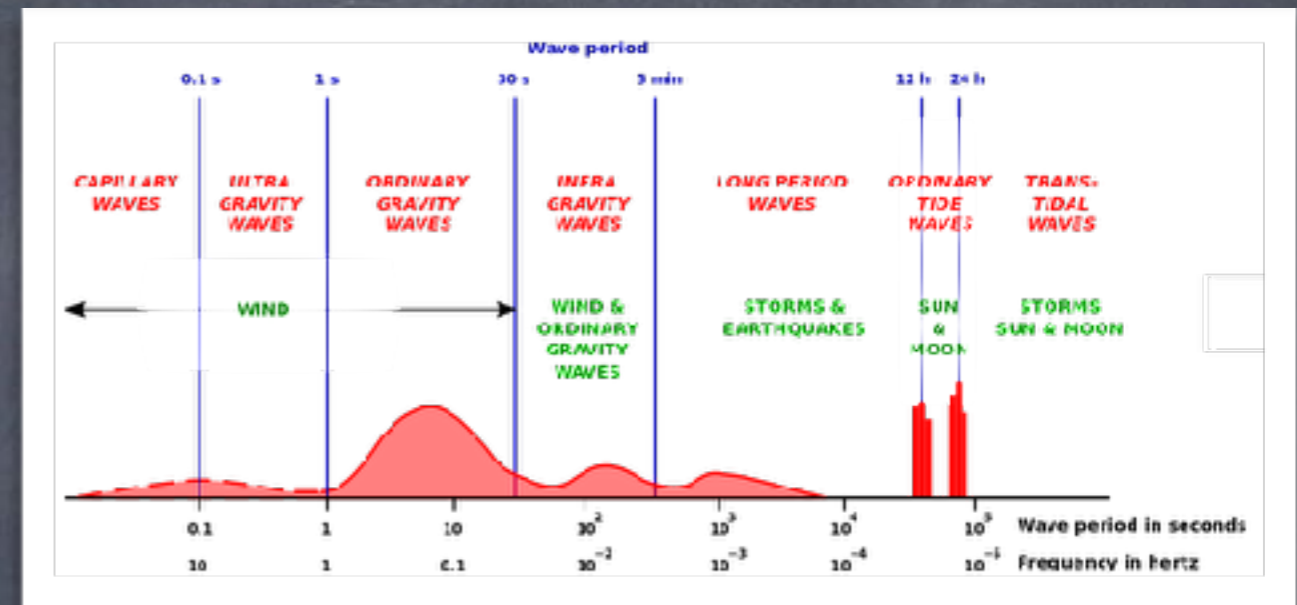
http://knol.google.com/k/the-secret-of-turbulence#

http://arstechnica.com/science/news/2008/11/is-turbulence-a-chaotic-repeller-or-attracter.ars

http://matter.cc.brandeis.edu/research/_turbulence.gif
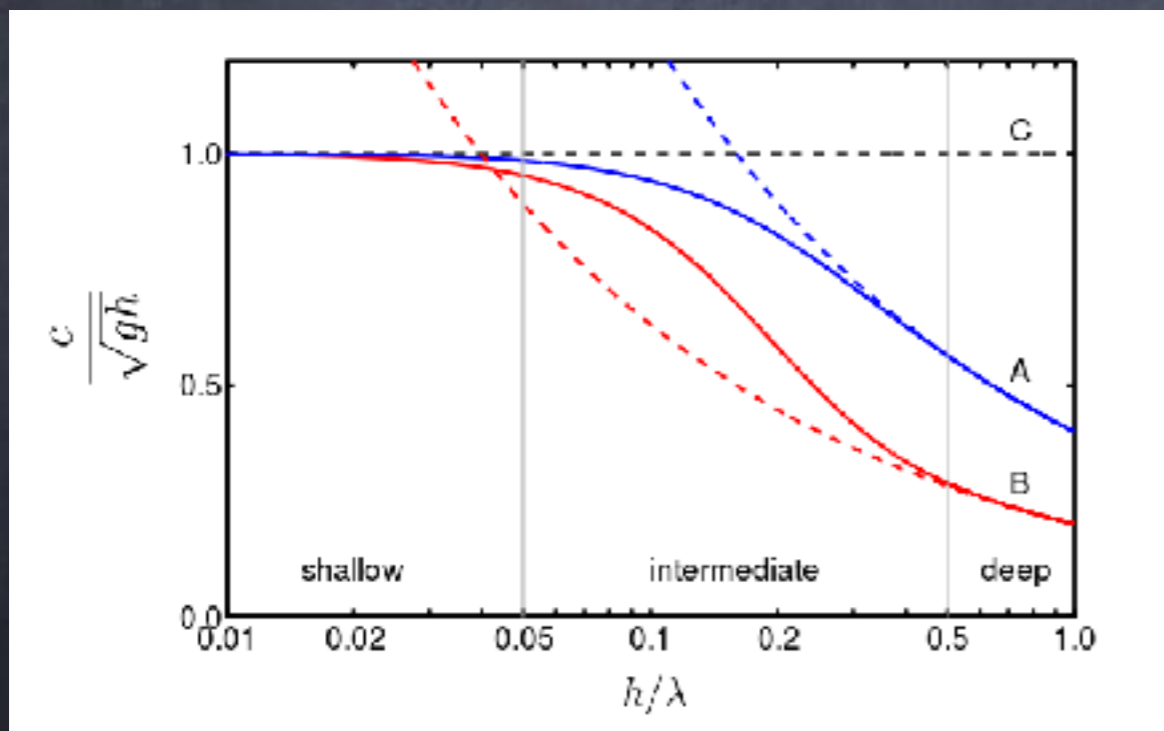
Surface Waves

Dispersion of gravity waves on a fluid surface. Phase and group velocity divided by $\sqrt{gh}$ as a function of h/λ. A: phase velocity, B: group velocity, C: phase and group velocity $\sqrt{gh}$ valid in shallow water. Drawn lines: based on dispersion relation valid in arbitrary depth. Dashed lines: based on dispersion relation valid in deep water.
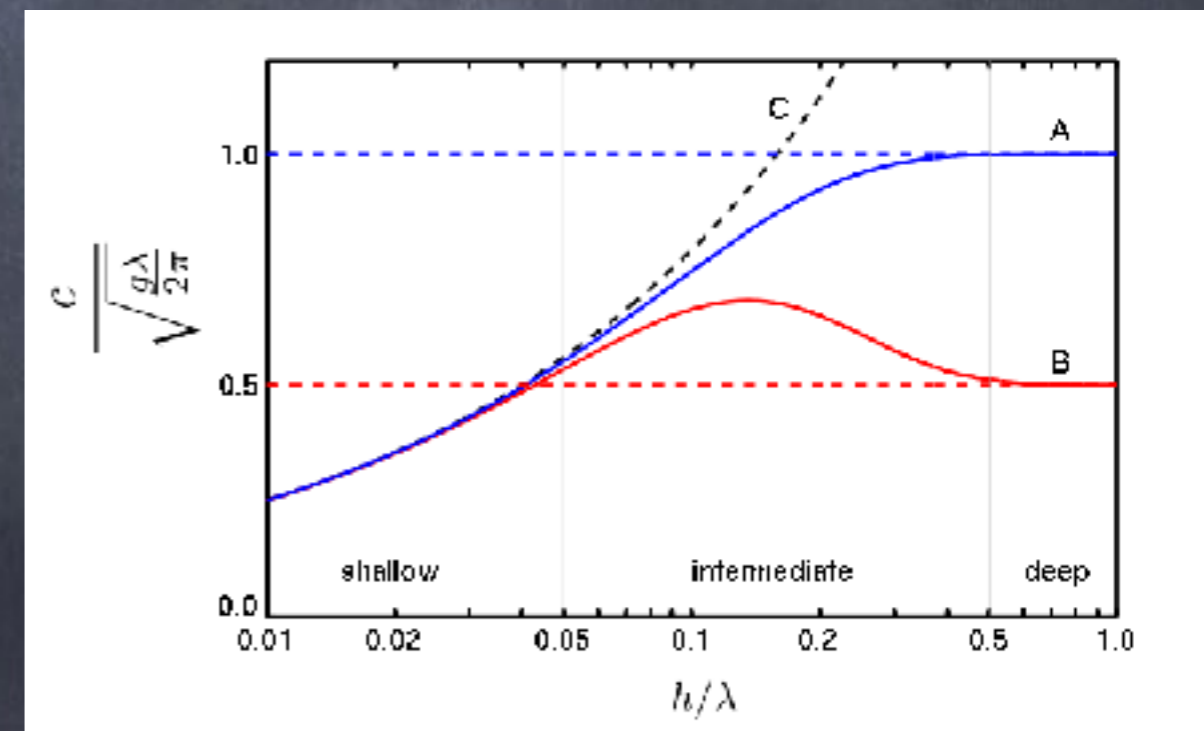
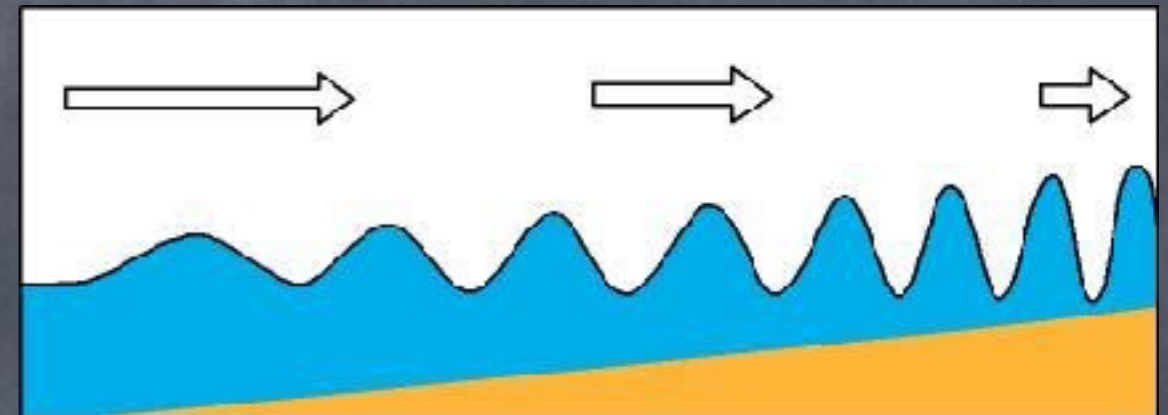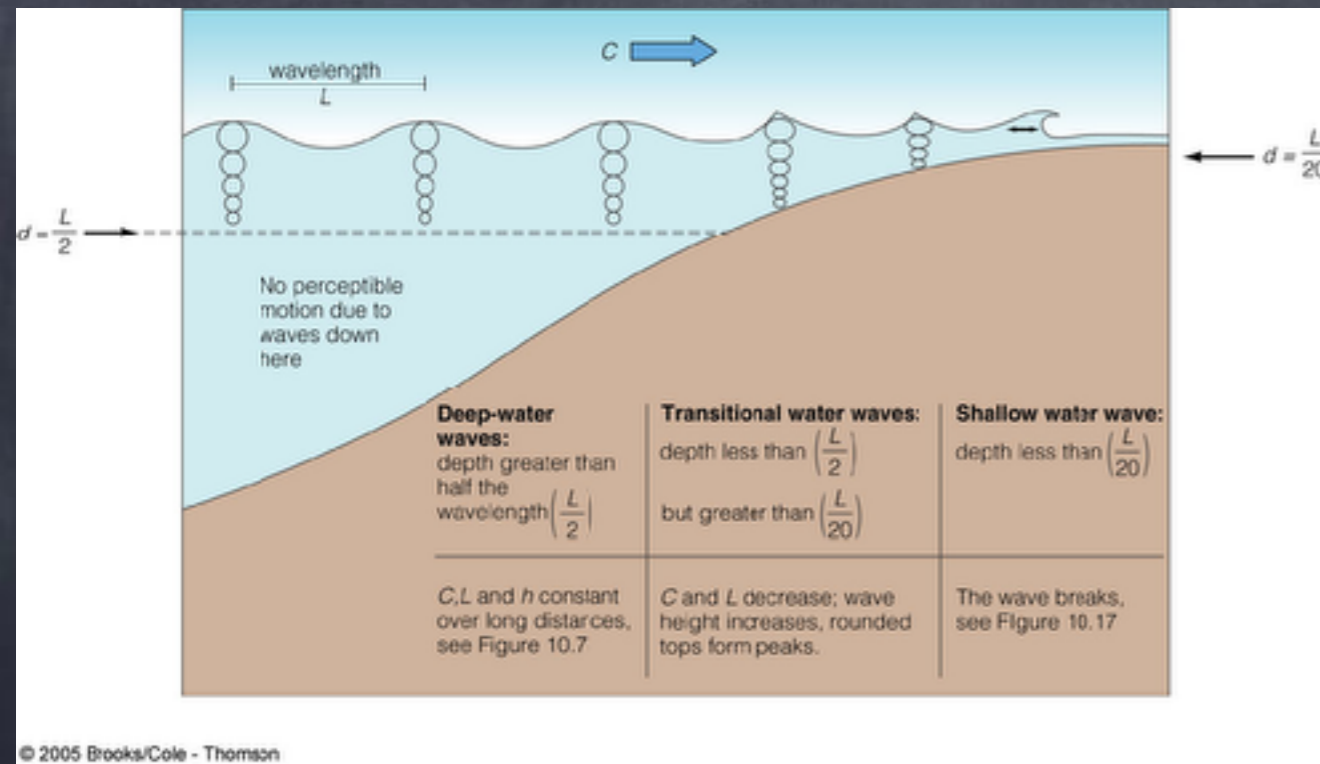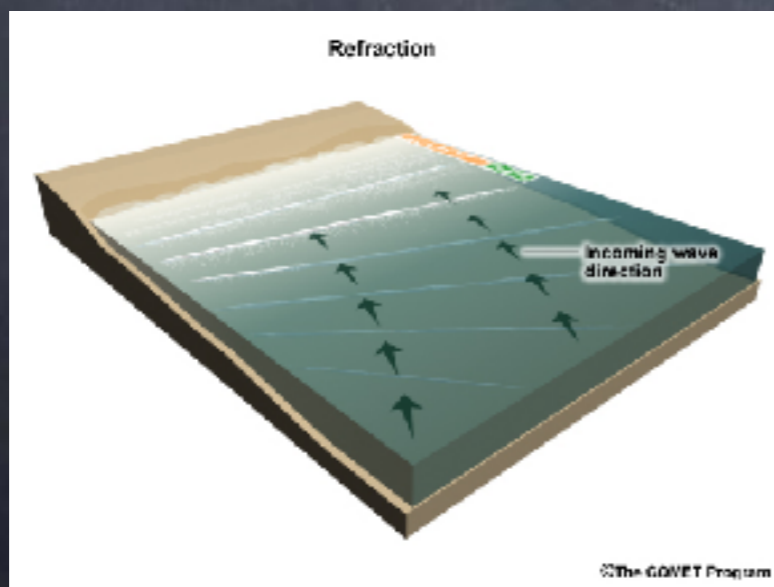Dispersion of gravity waves on a fluid surface. Phase and group velocity divided by deep-water phase velocity $\sqrt{g\lambda / (2\pi)}$ as a function of relative depth h / λ. Blue lines (A): phase velocity; Red lines (B): group velocity; Black dashed line (C): phase and group velocity $\sqrt{gh}$ valid in shallow water. Drawn lines: dispersion relation valid in arbitrary depth. Dashed lines (blue and red): deep water limits.
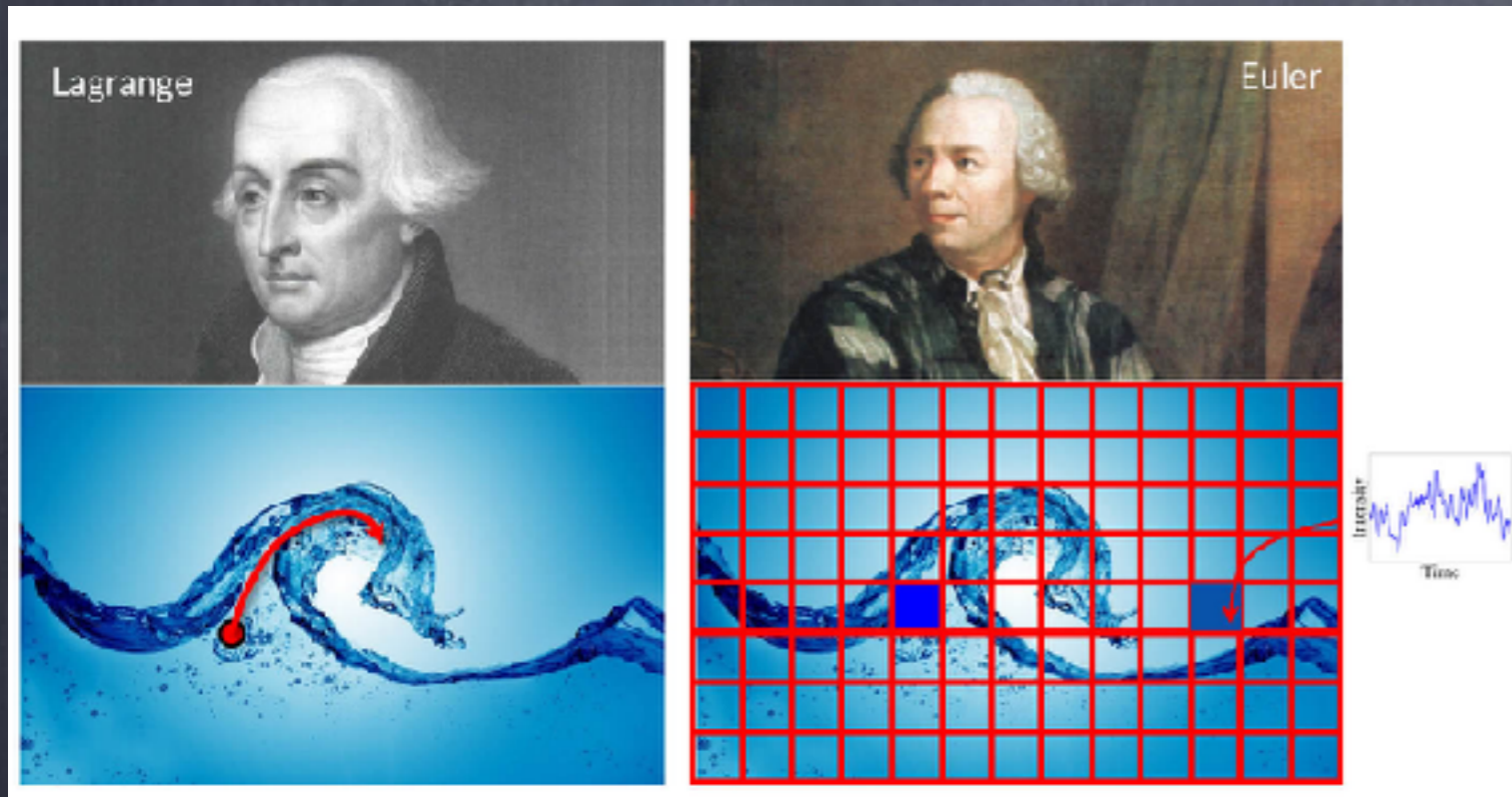
Beaching

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https://i.stack.imgur.com/LUKMQ.jpg

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marine/SWW/media/graphics/refraction_strightbeach.jpg

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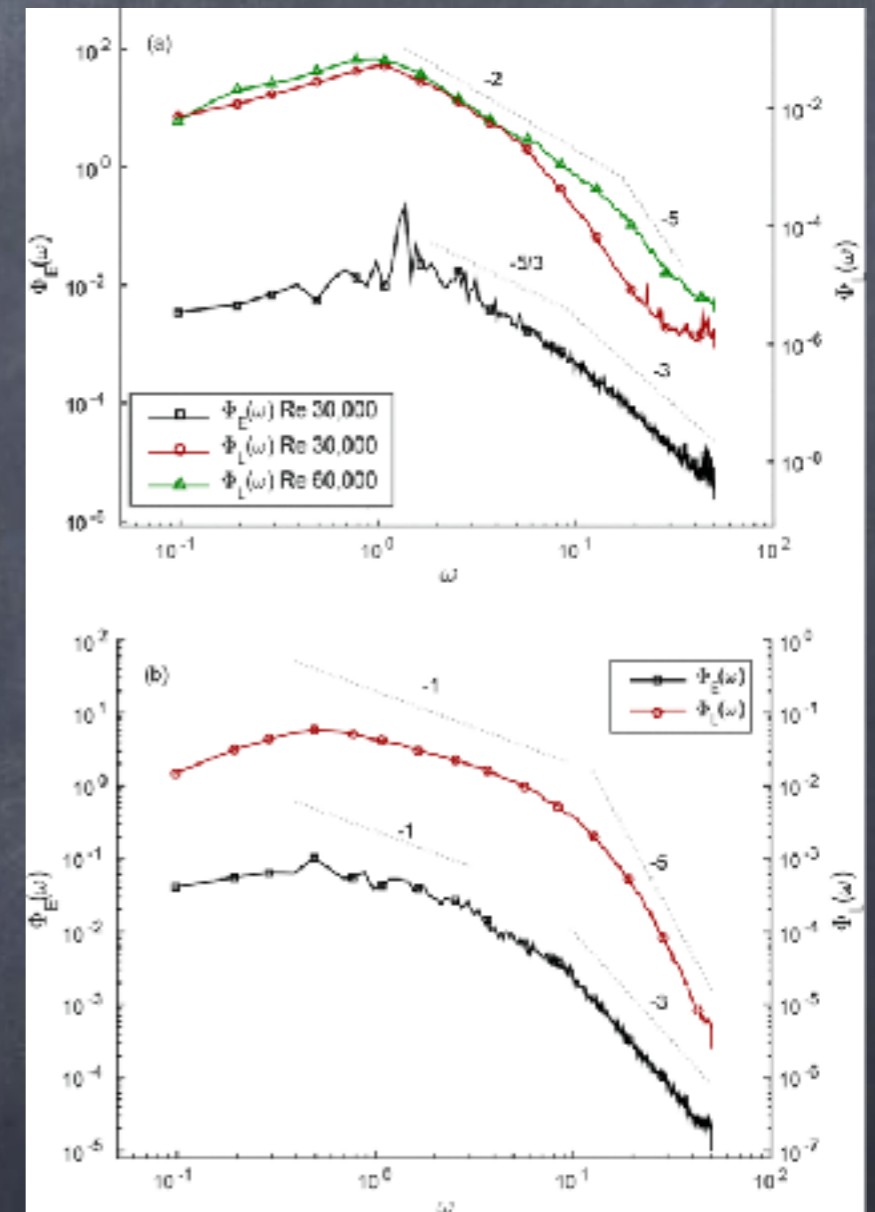
Lagragian vs Eulerian