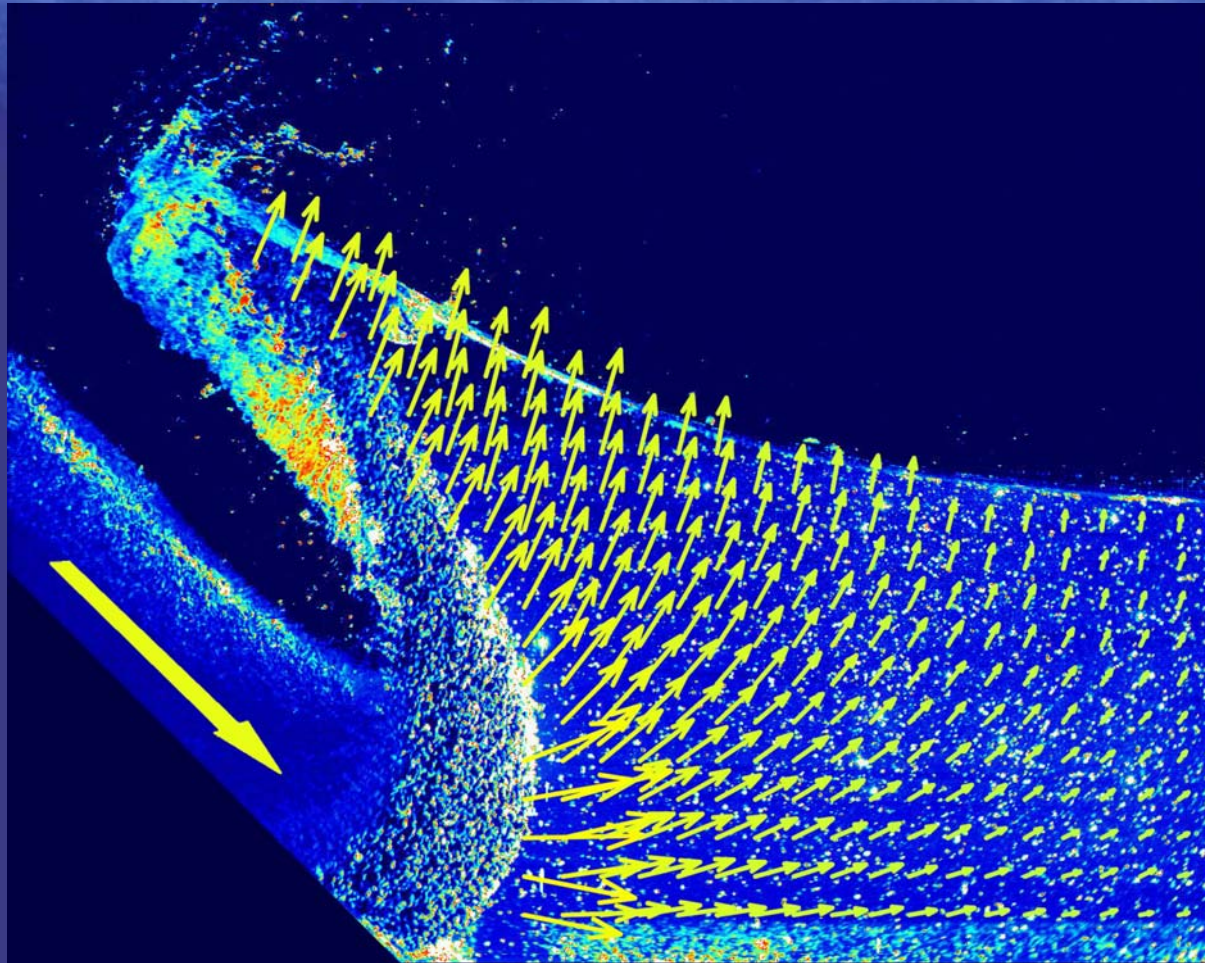


Landslide Generated Tsunami



Dr. Hermann M. Fritz

Georgia Institute of Technology, Savannah

What does a fresh landslide scar look like?



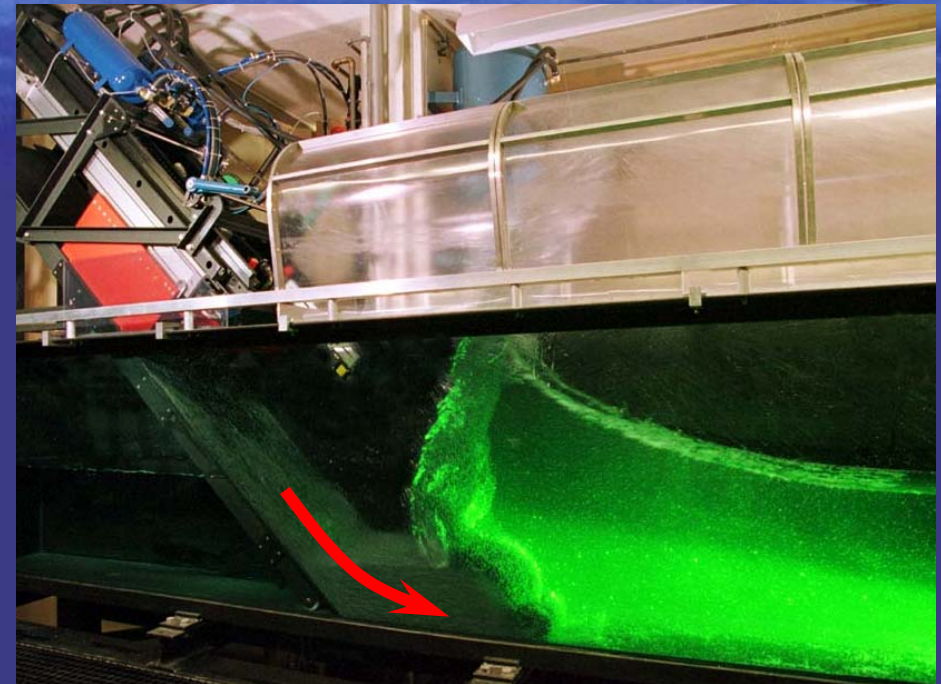
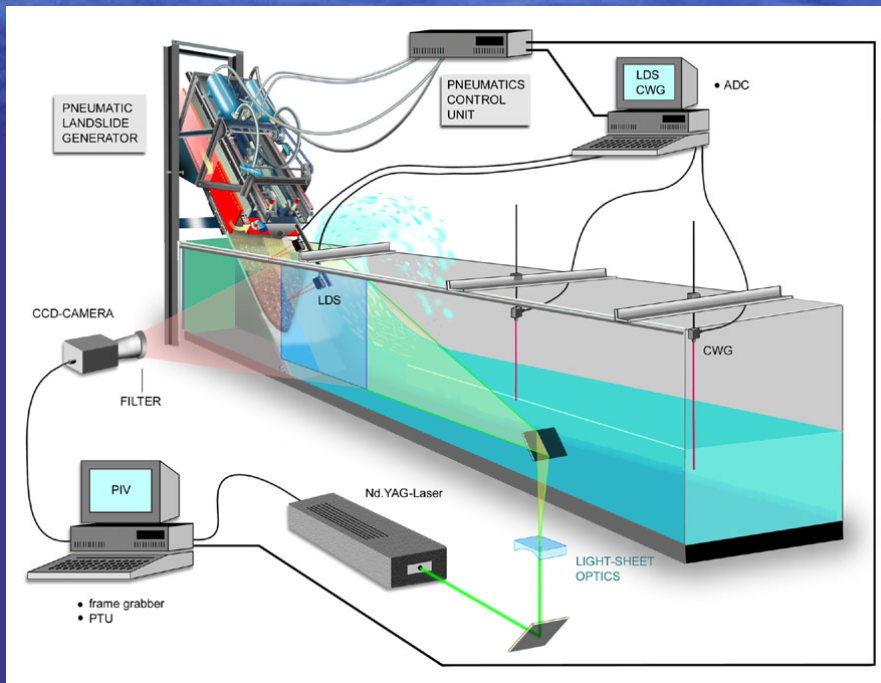
Guaitara, Colombia 2003

Lake Uri, Switzerland



Blasting triggered 20'000 m³ of Limestone, 1992

Experimental set-up



- pneumatic landslide generator \diamond controlled initial conditions
- 2 laser distance sensors LDS \diamond slide profiles $\xi(t)$
- 7 capacitance wave gauges CWG \diamond wave profiles $\eta(t)$
- digital particle image velocimetry PIV \diamond velocity vector fields v_p

Slide-Granulate (PP-BaSO₄)



$$d_g = 4 \text{ mm}$$

$$\rho_g = 2.64 \text{ t/m}^3$$

$$n = 39 \%$$

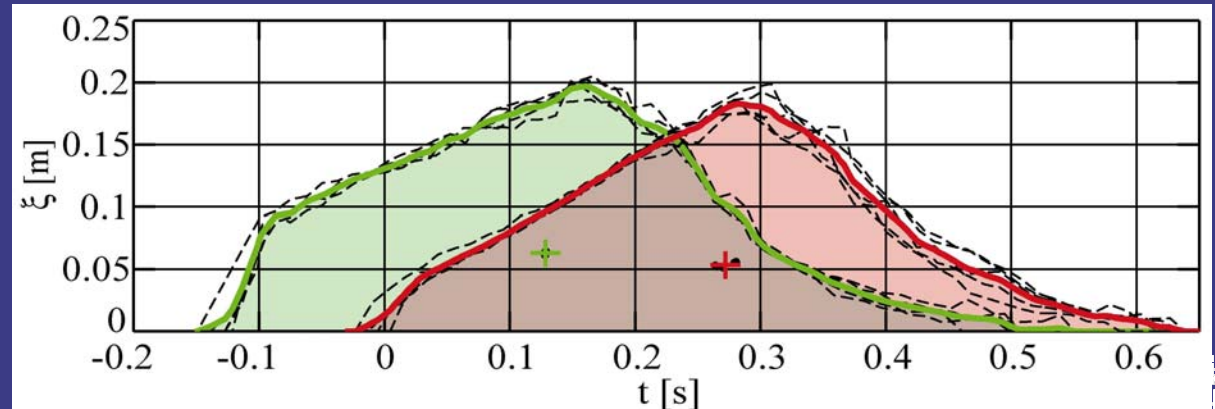
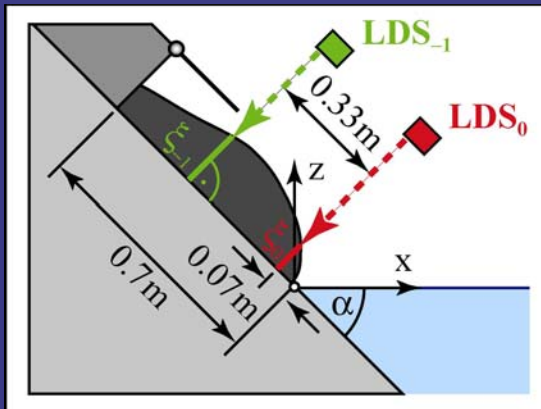
$$\rho_s = 1.62 \text{ t/m}^3$$

$$\phi' = 43^\circ$$

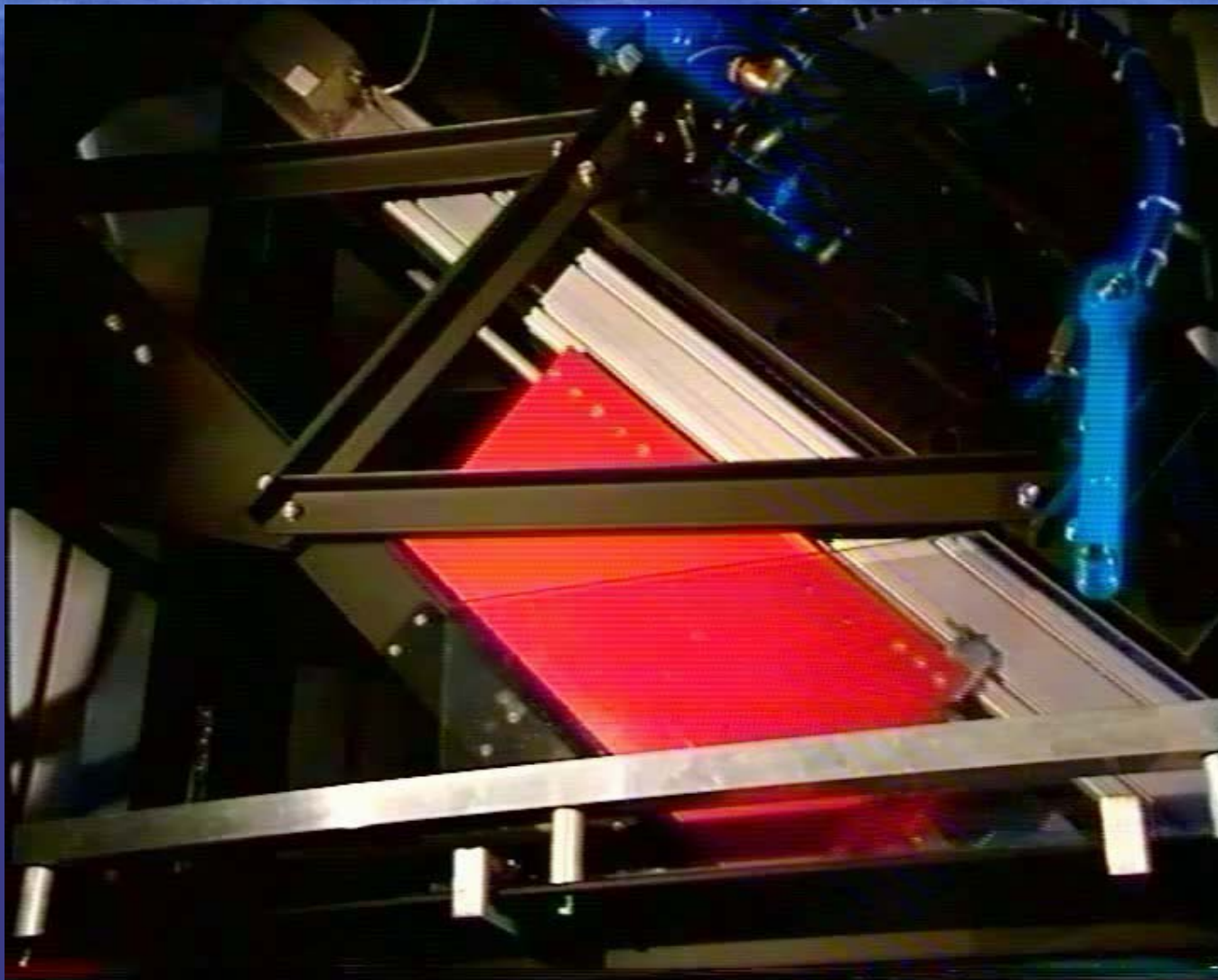
$$\delta = 24^\circ$$



Slide profiles



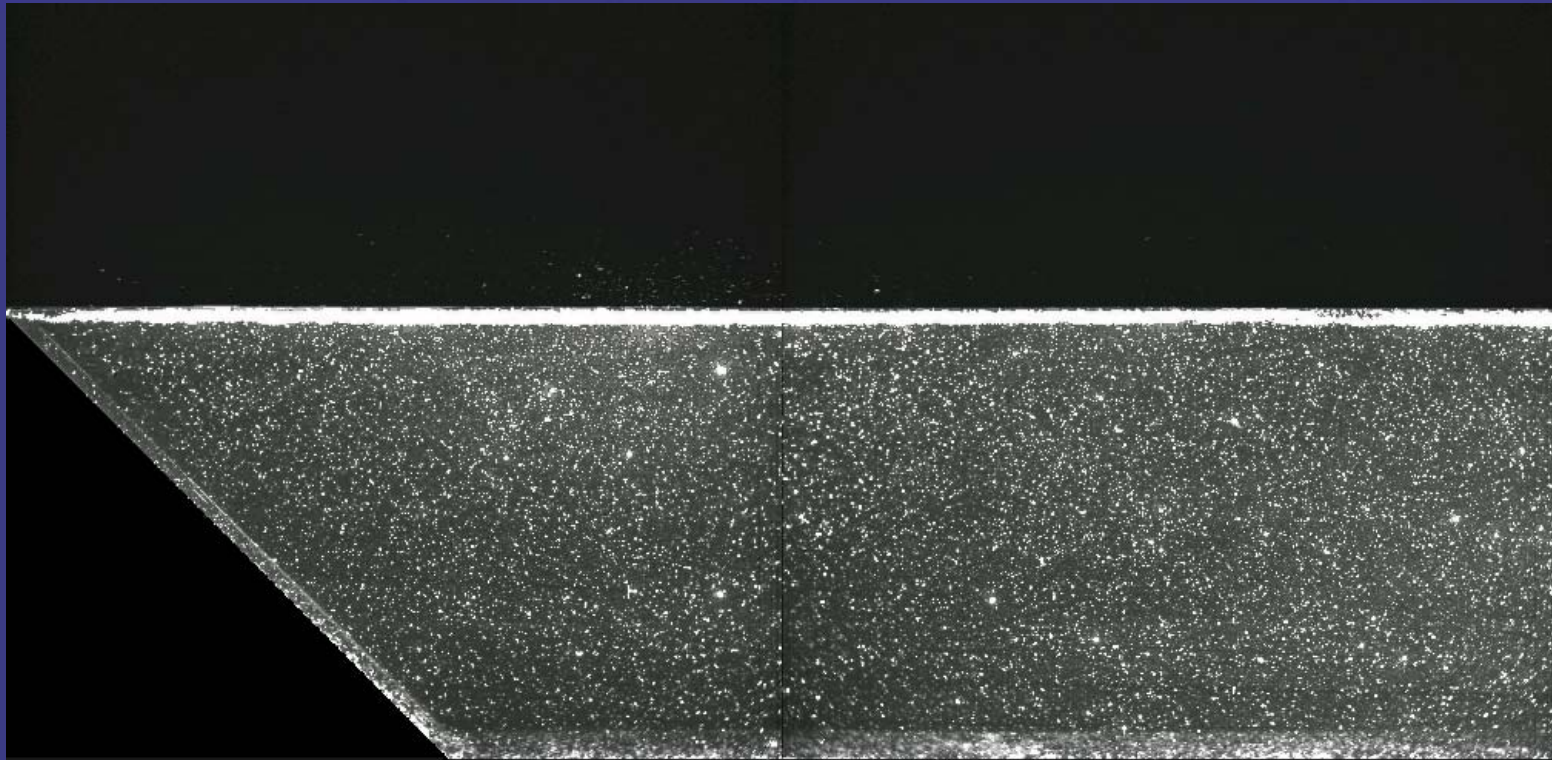
Impact Experiment



$$F = 3.1, \quad m_s = 108 \text{ kg}, \quad h = 450 \text{ mm}$$

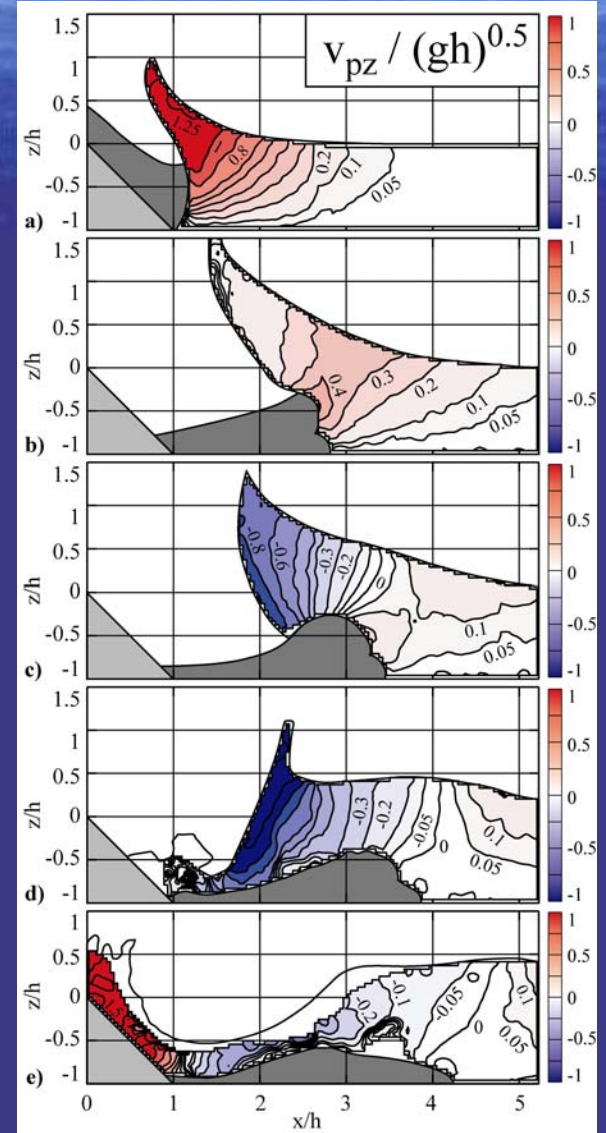
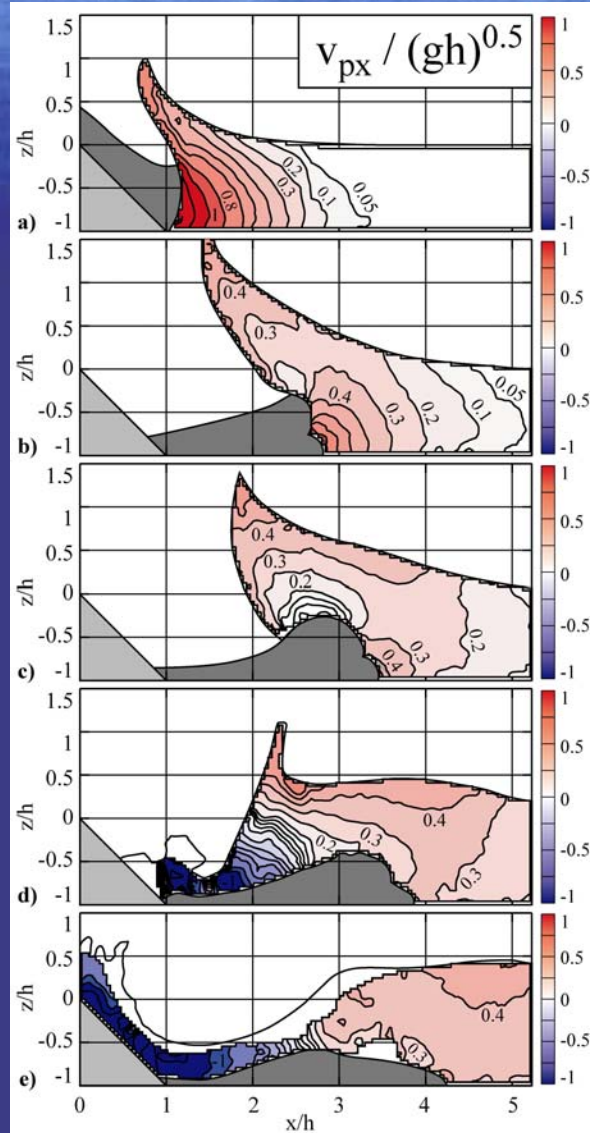
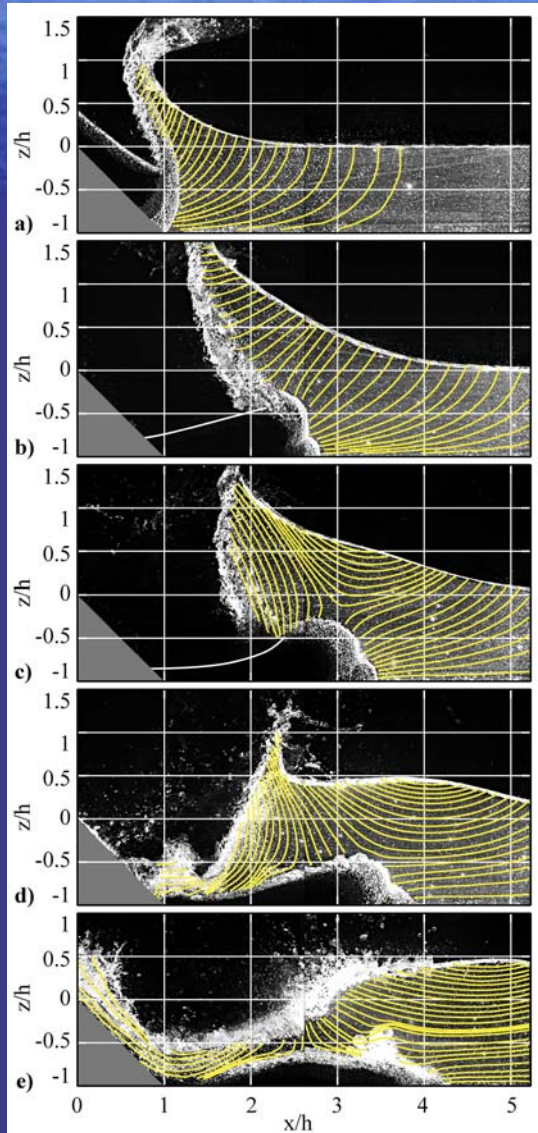
raw PIV-sequence

Total area of view (AOV) = 1.6 m × 0.8 m
2 adjacent AOV's from repeated runs mounted



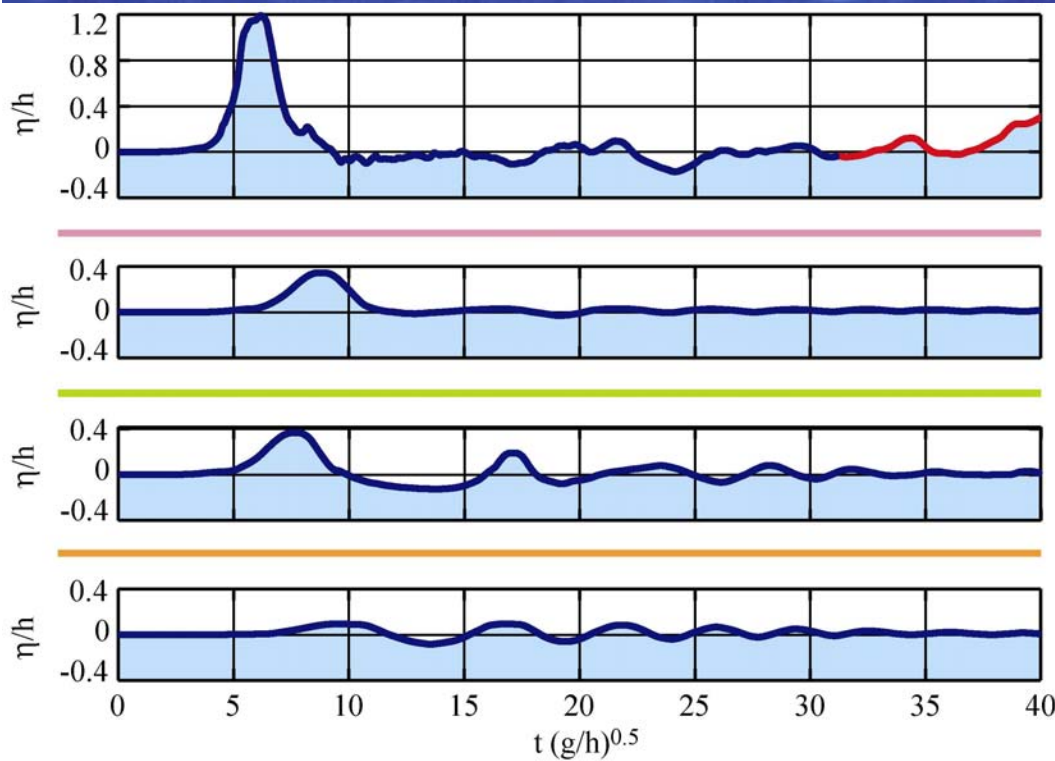
$F = 1.9$, $m_s = 108$ kg, $h = 450$ mm

Outward collapsing crater: v_{px} , v_{pz}

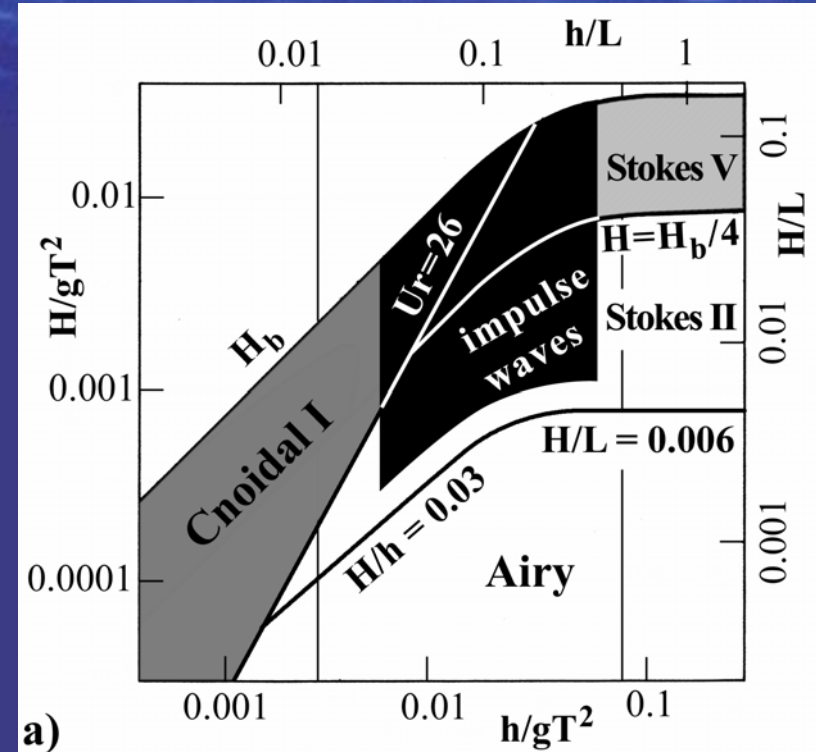


$F = 3.2, V = 0.79, S = 0.31, h = 0.3 \text{ m}$

Comparison with wave theory

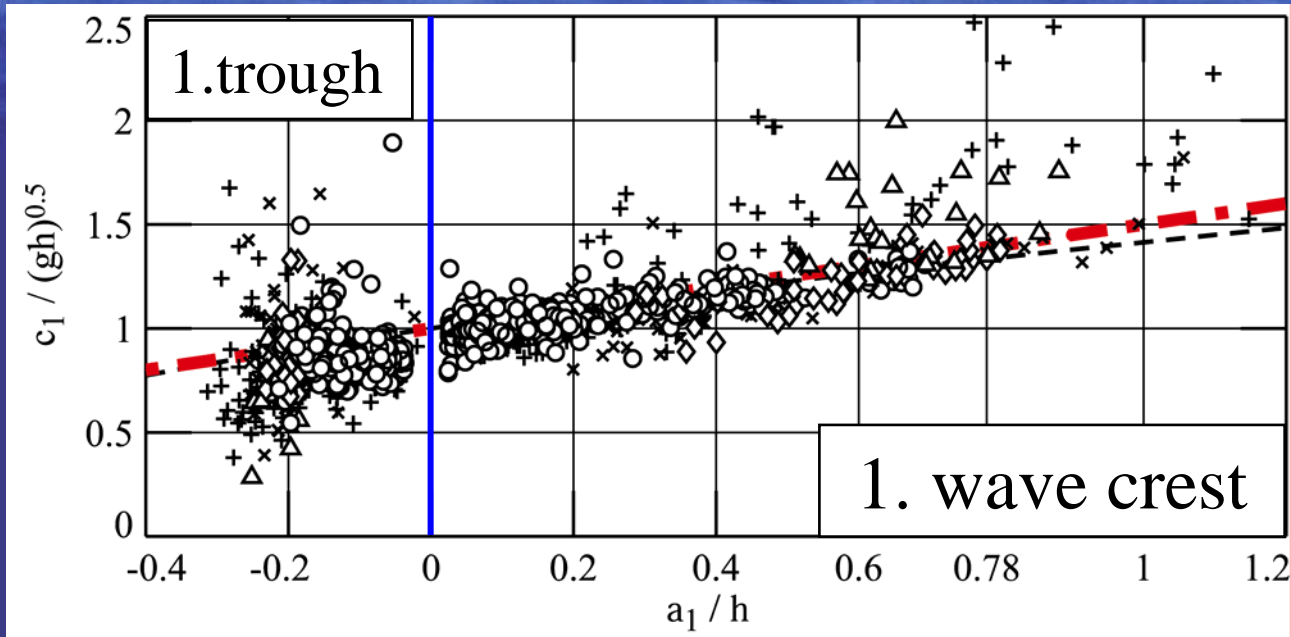


Observed wave profiles



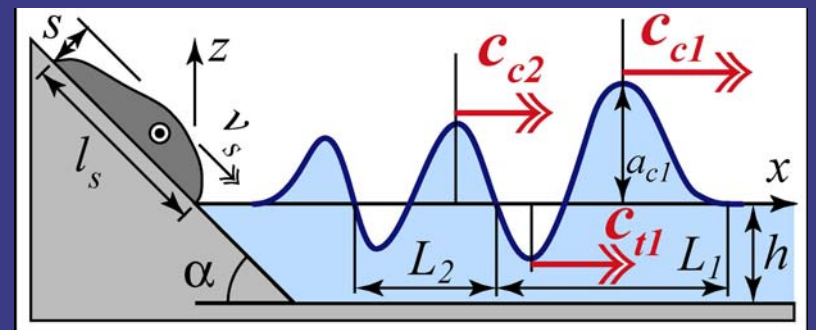
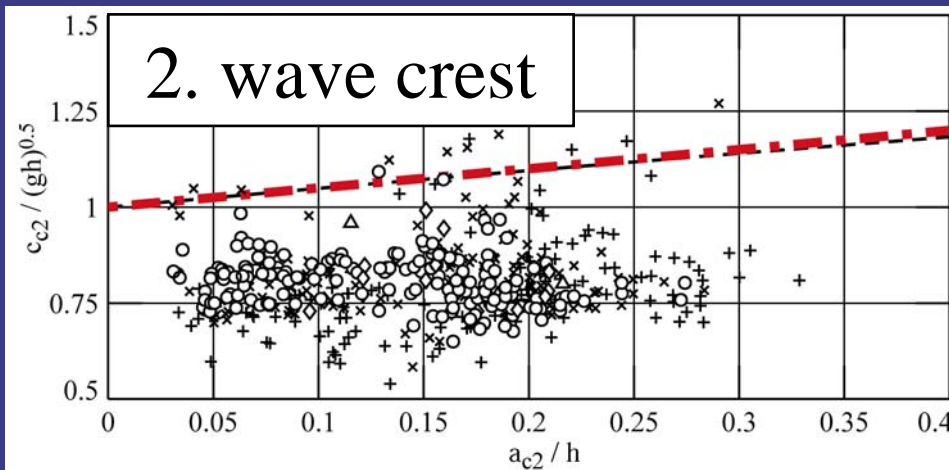
Recommended ranges after Le Méhauté (1976)

Wave celerity



$$c = \sqrt{gh} \left(1 + \frac{a}{2h} \right)$$

$$\approx \sqrt{g(h+a)}$$



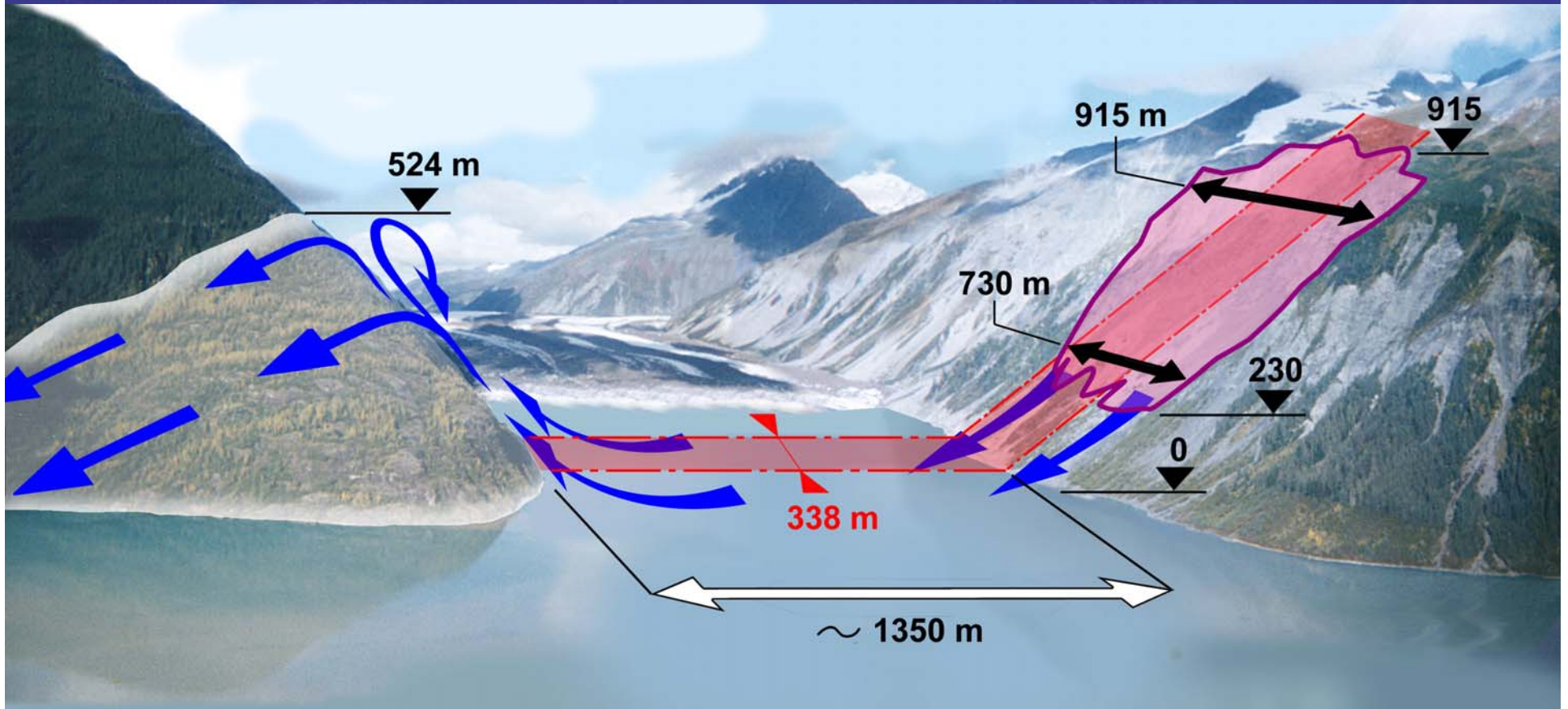
Lituya Bay, devastation 1958



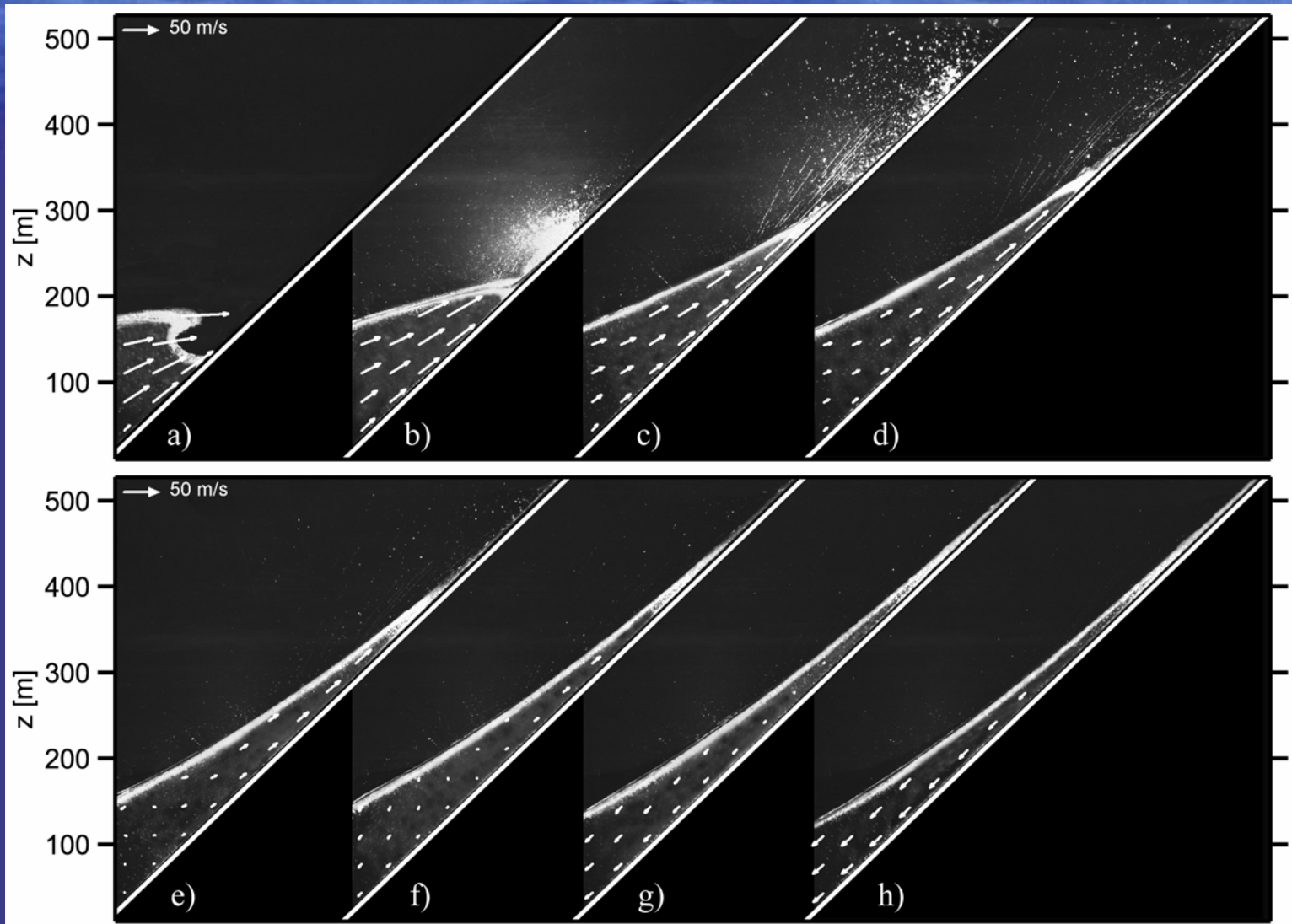
Courtesy: BBC, Horizon "Megatsunami"

Lituya Bay

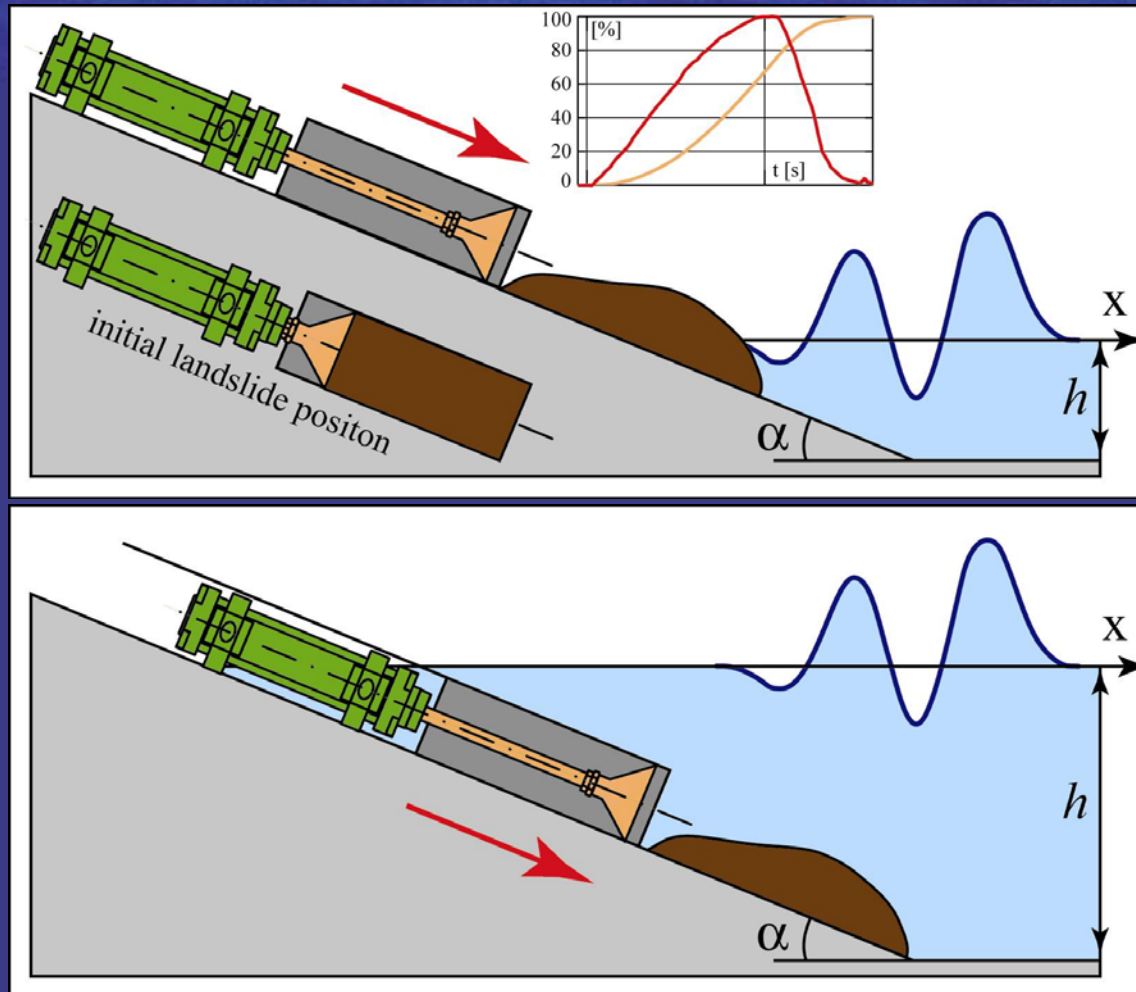
impact and run-up site



530m Tsunami Wave Run-up

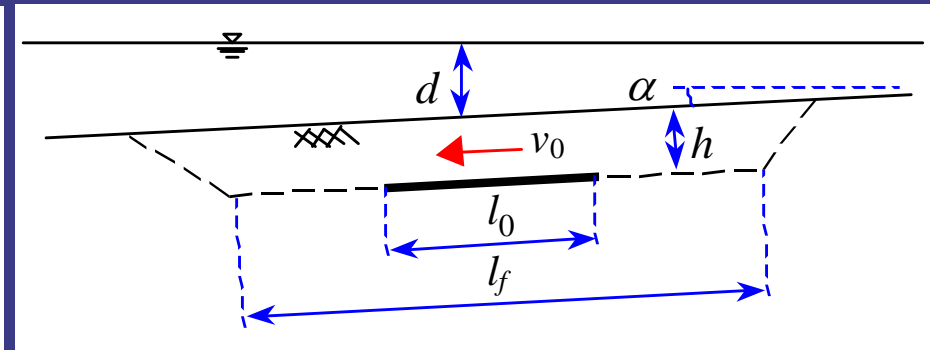
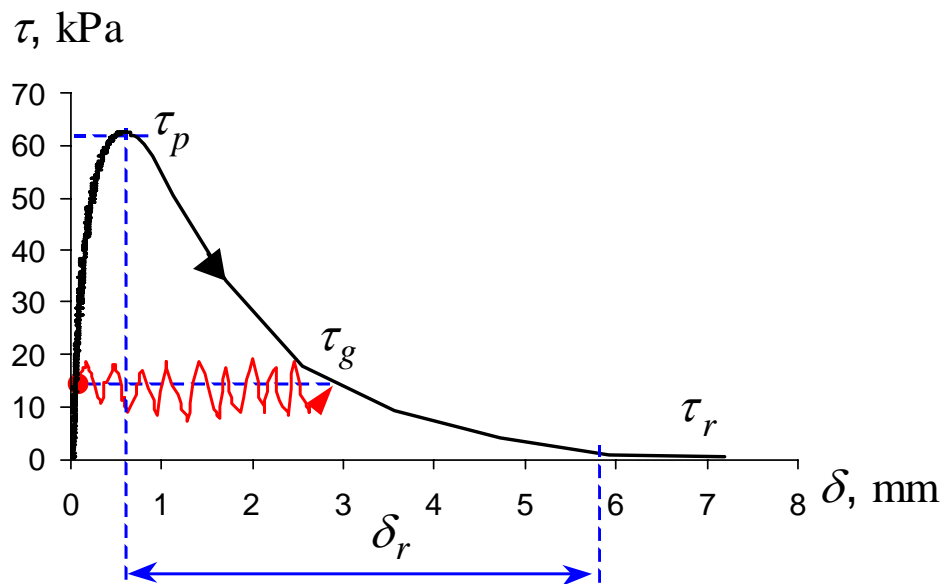


3D-Subaerial / Submarine Landslide Tsunami Generator



NSF NEES Sponsored II-Project

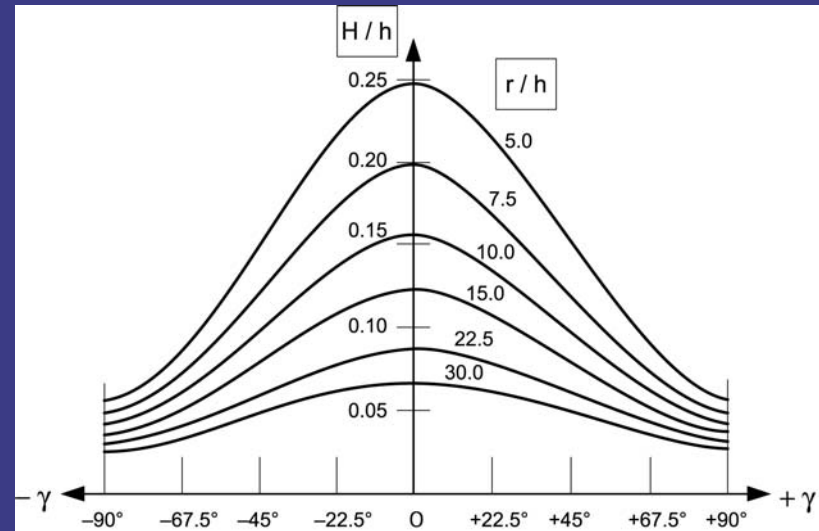
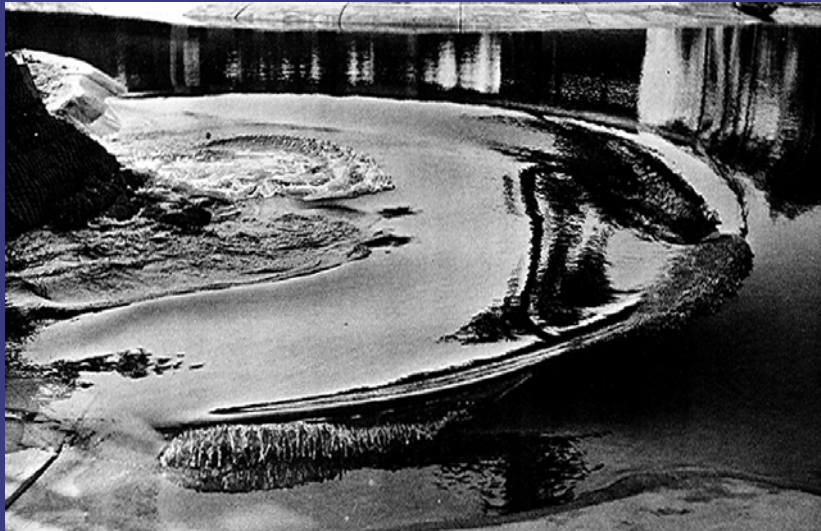
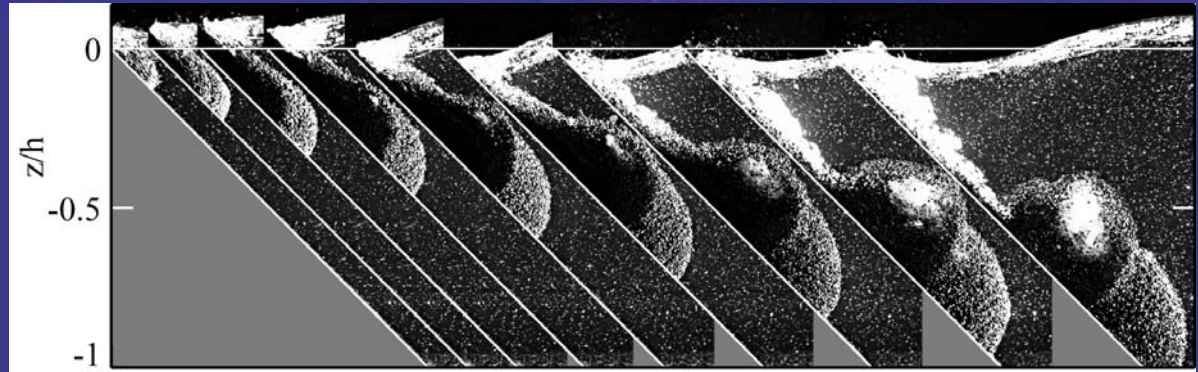
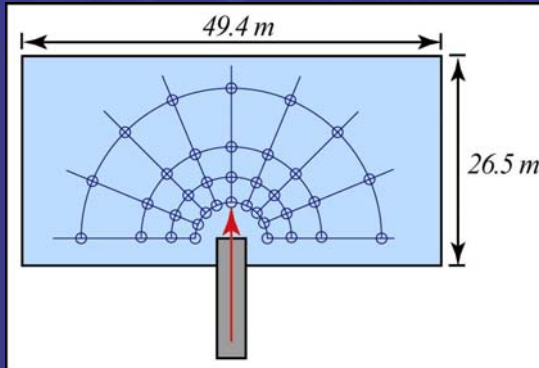
Initial Mechanisms of Tsunamigenic Landslides



Shear Band Propagation

Puzrin and Germanovich, GT (2004)

3D Landslide Tsunami Experiments at OSU-NEES facility



NSF NEES Sponsored II-Project

Questions ?

