Tsunamis in 3-D Bathymetry

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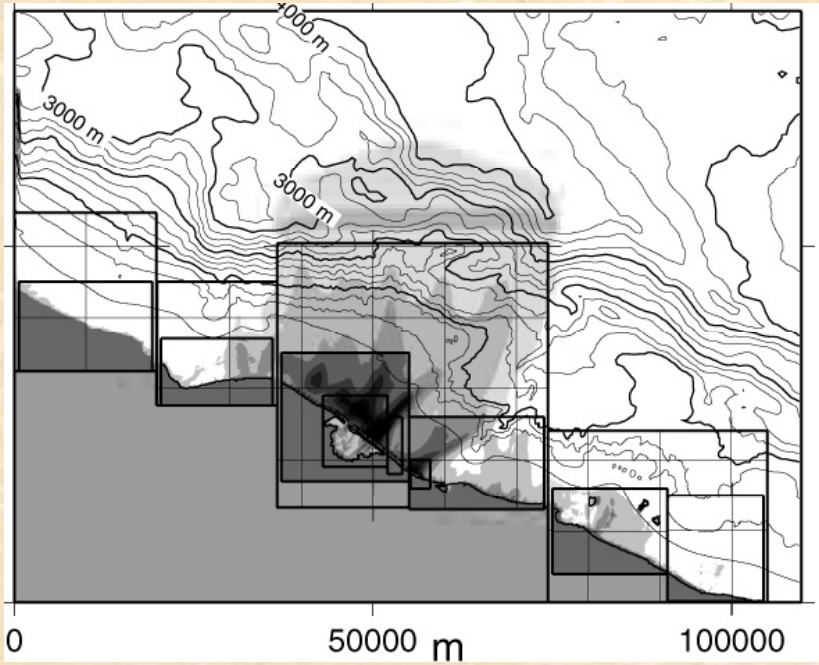
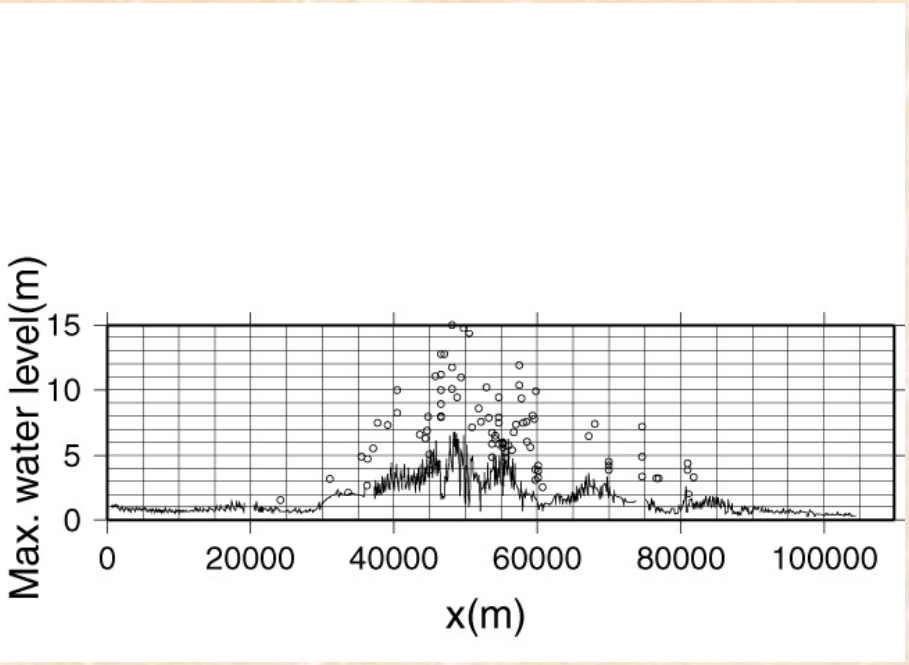
Research Objectives

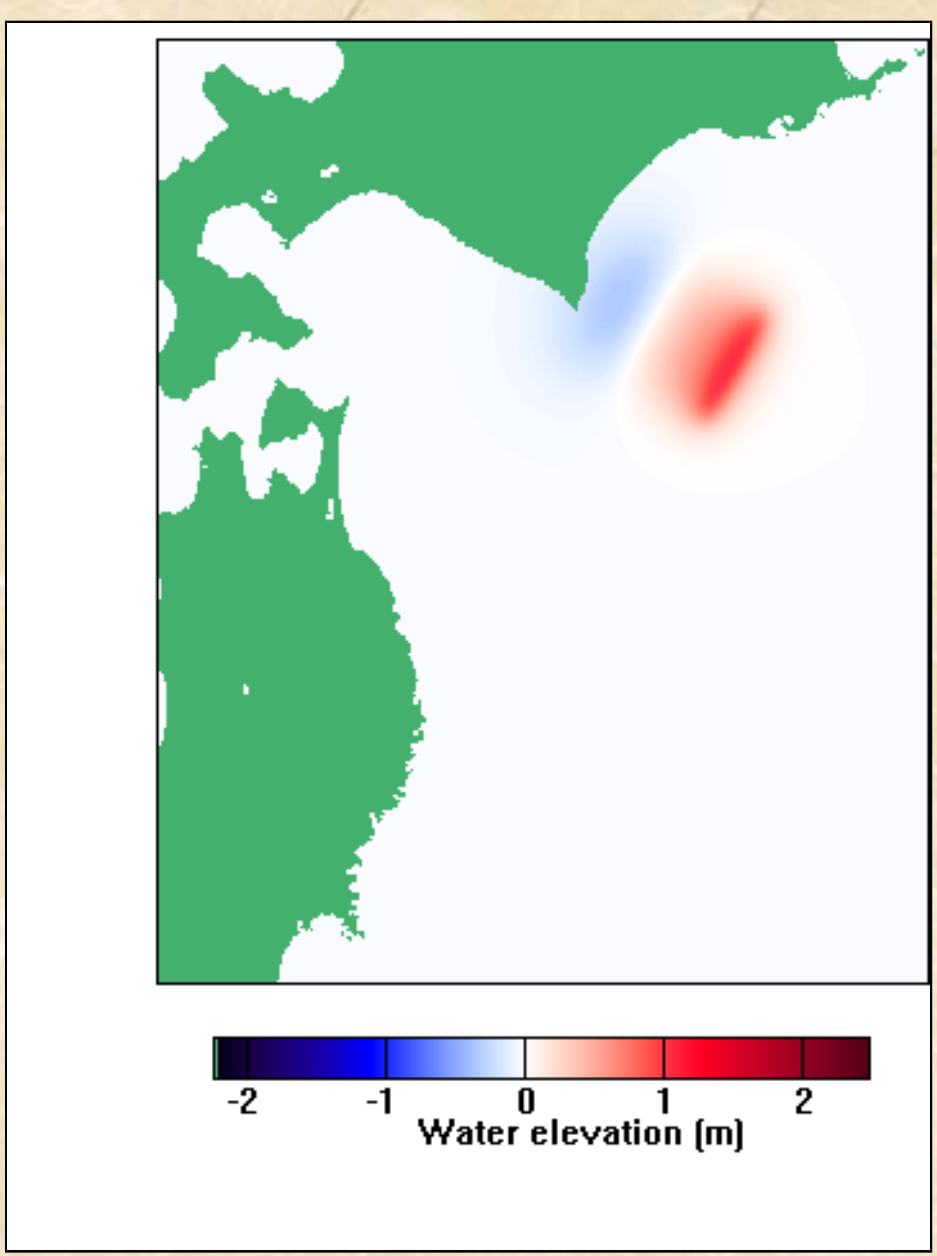
- To determine tsunami behaviors and characteristics in a three-dimensional nearshore bathymetry
  - Water-wave refraction
  - Diffraction
  - Reflection
  - Focusing -- Defocusing

The 1998 Papua New Guinea Tsunami





(Matsuyama & Yeh, 2003)



(ERI, 2003)

Research Plan

- **Obliquely incident tsunamis onto a beach; Edge Bores –** Group Meeting in Oct. 2003
- Tsunamis incident onto a sinusoidal shoreline;
- Tsunami interactions with conical and elliptical shaped mounds;
- Obliquely interacting tsunamis arising from reflections and diffraction.
- Collaboration with Focused Research Groups (FRG) in the Mathematical Sciences (DMS-NSF)

Laboratory Apparatus

- The laboratory apparatus is a 1/8th scale model of the large tsunami basin at Oregon State University
- Unlike the NEES basin, the small basin will be elevated so that the bottom floor is located about 1m above the laboratory floor, and it will have a glass bottom and sidewalls.
- A precise XY-traversing system on the sidewall frames will enable in-situ wave-gage calibrations and measurements in a traveling frame of reference over the wave field.
- The model facility will play a complementary role in the NEES related research activities

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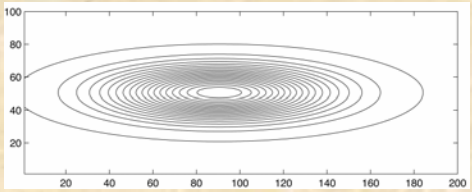
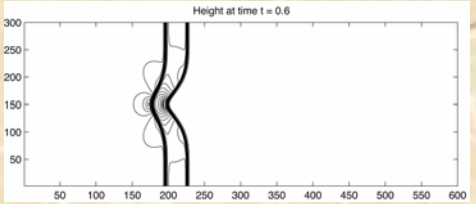
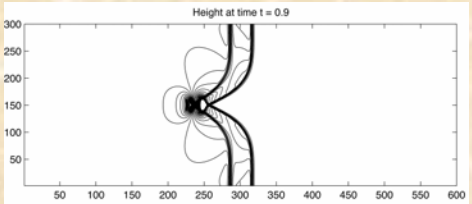
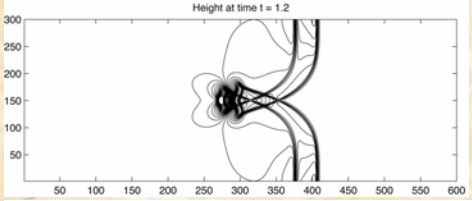
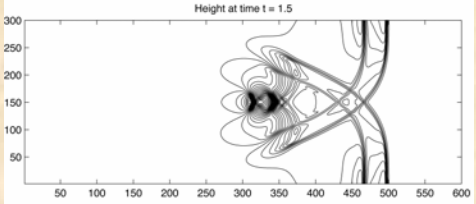
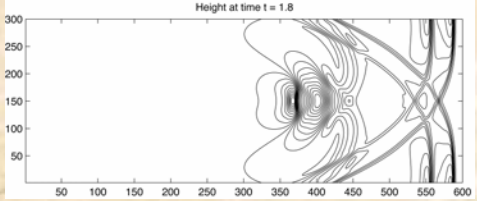












Tsunamis Scour

CMS - 9978399

Susan Tonkin,

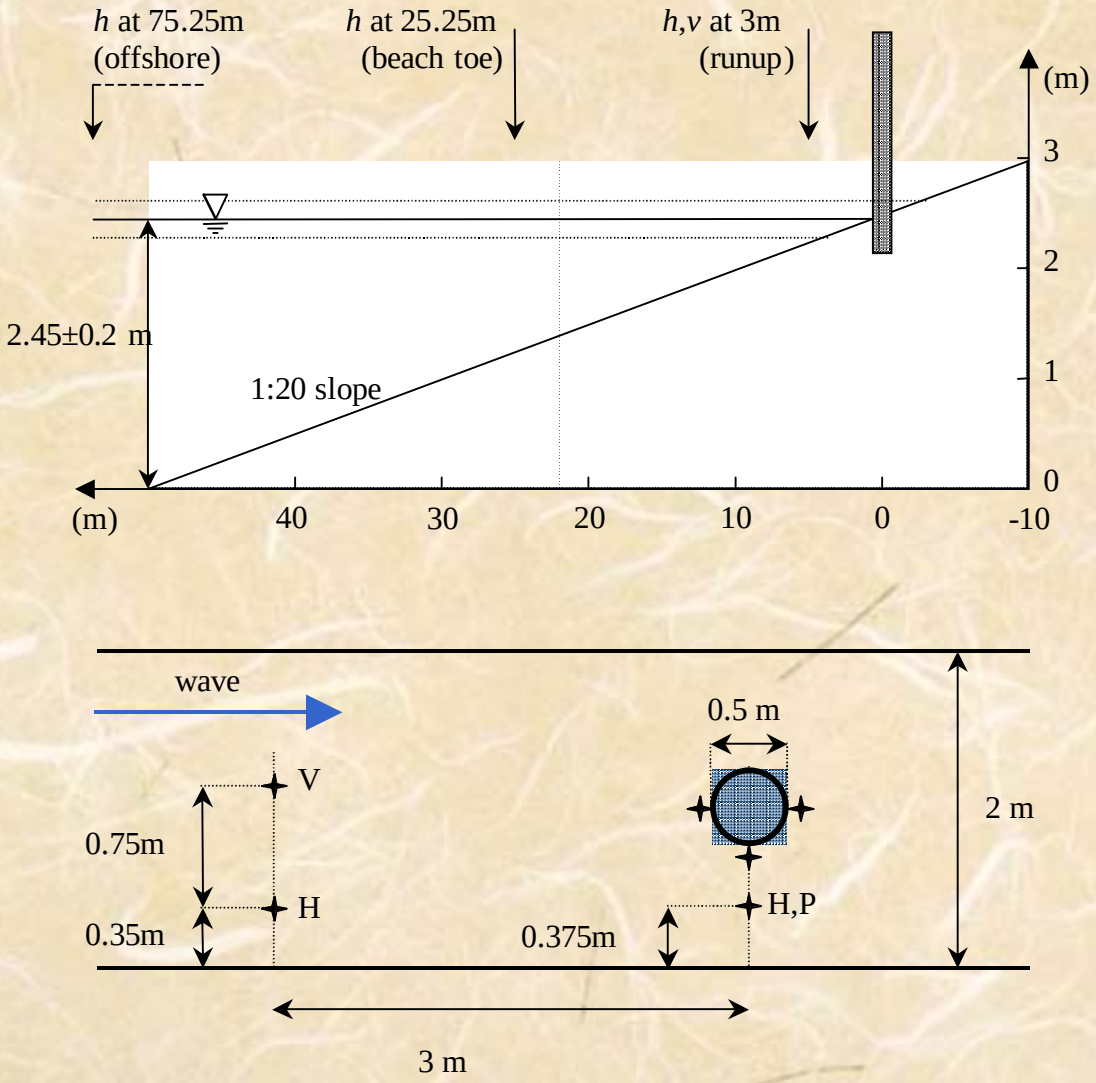
Fuminori Kato

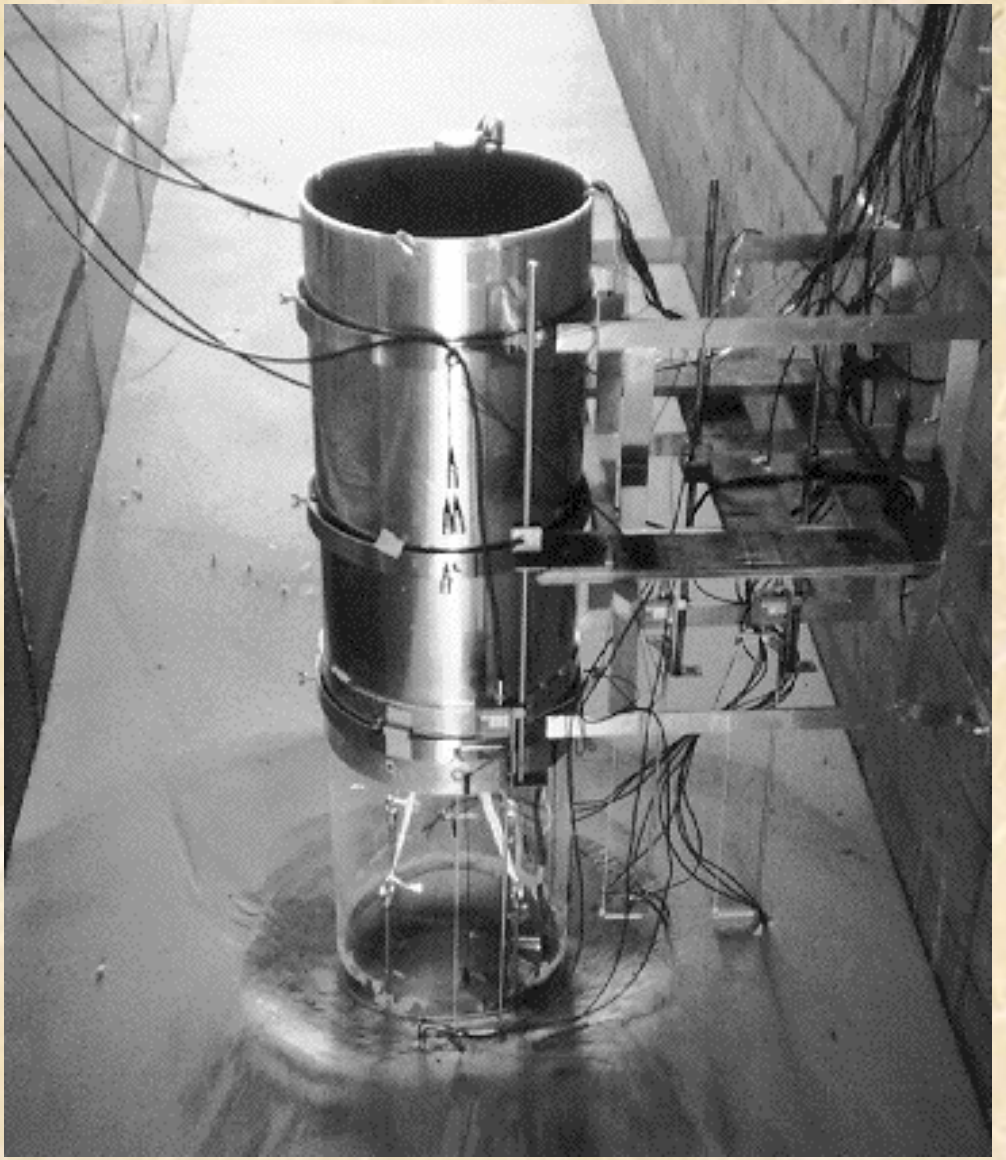
Shinji Sato

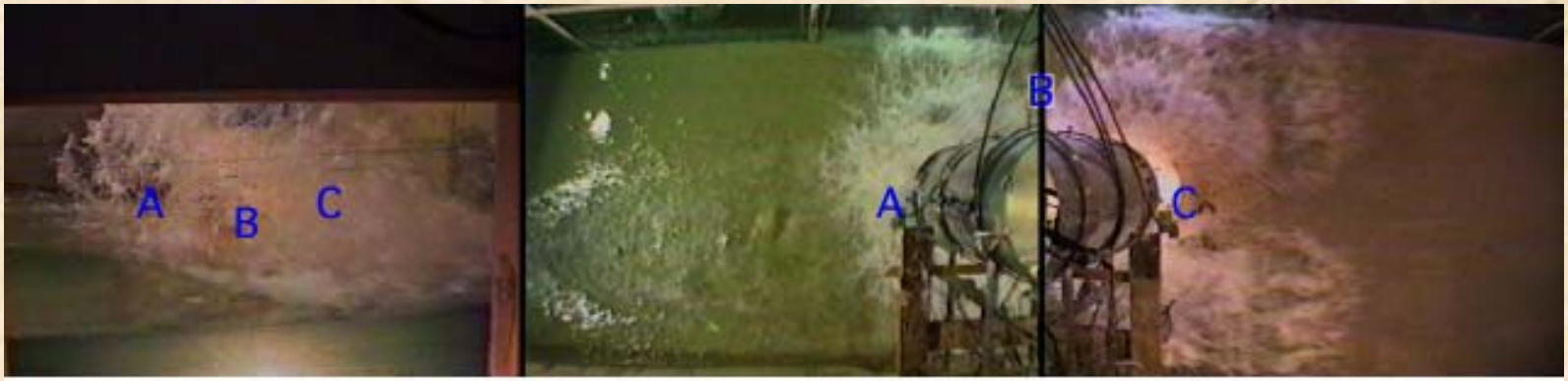
Harry H. Yeh

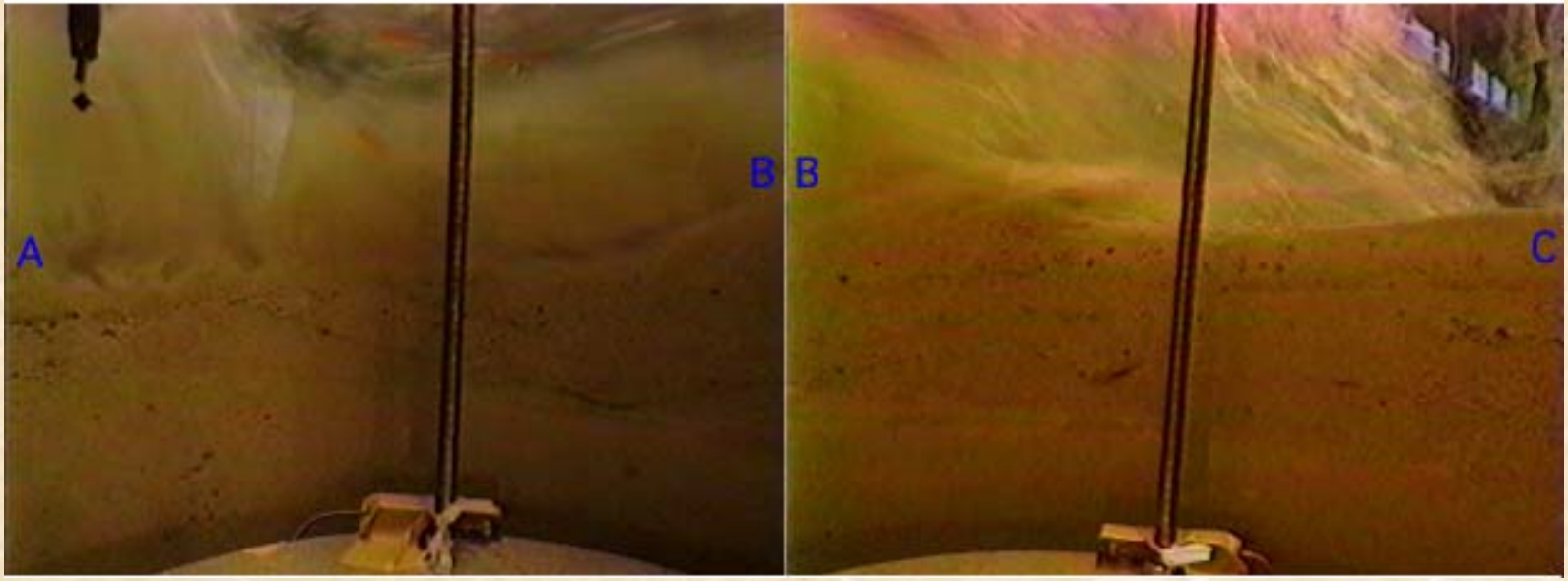
(George Carrier, Philip Liu, Peter Raad, Catherine Petroff, Jane Preuss, Costas Synolakis)

Schematics of the experimental setup






A
B
C
A
B
C


A
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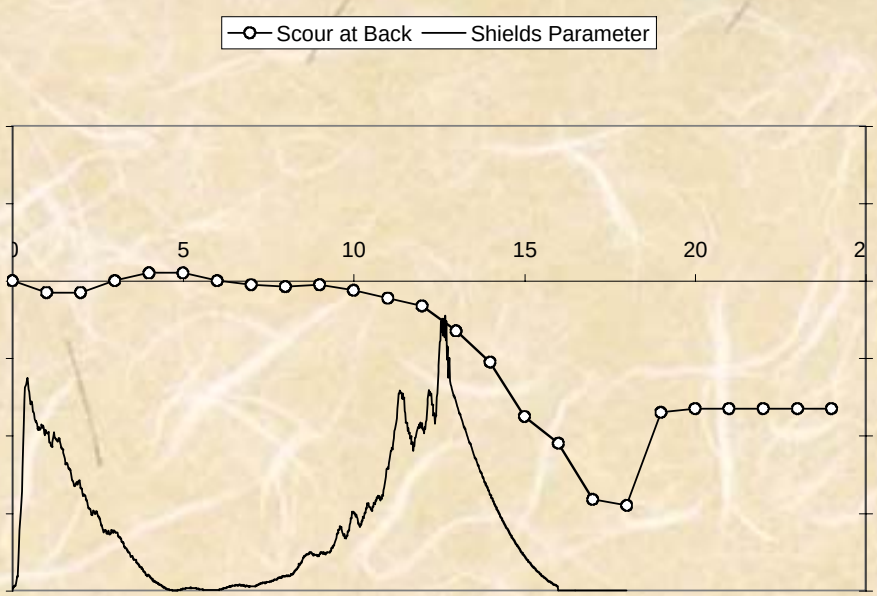
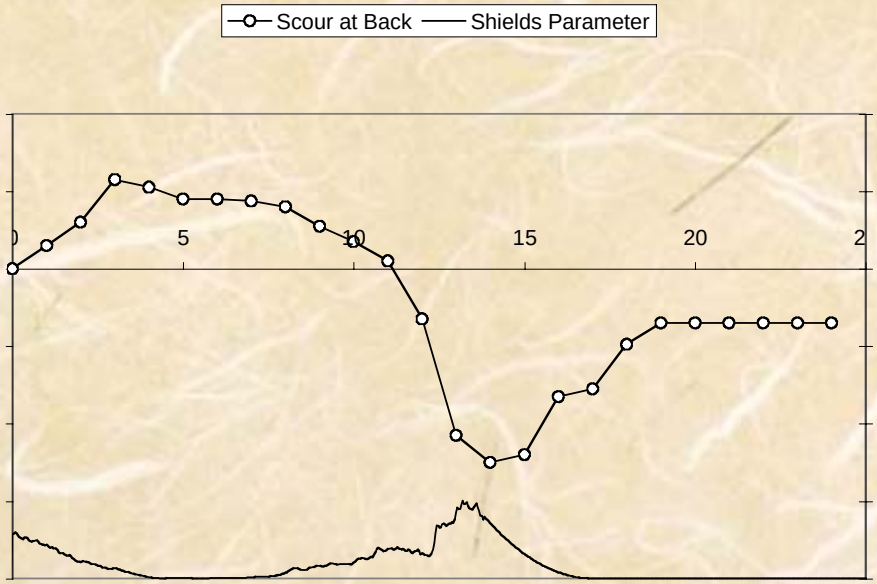
QuickTime™ and a
Video decompressor
are needed to see this picture.

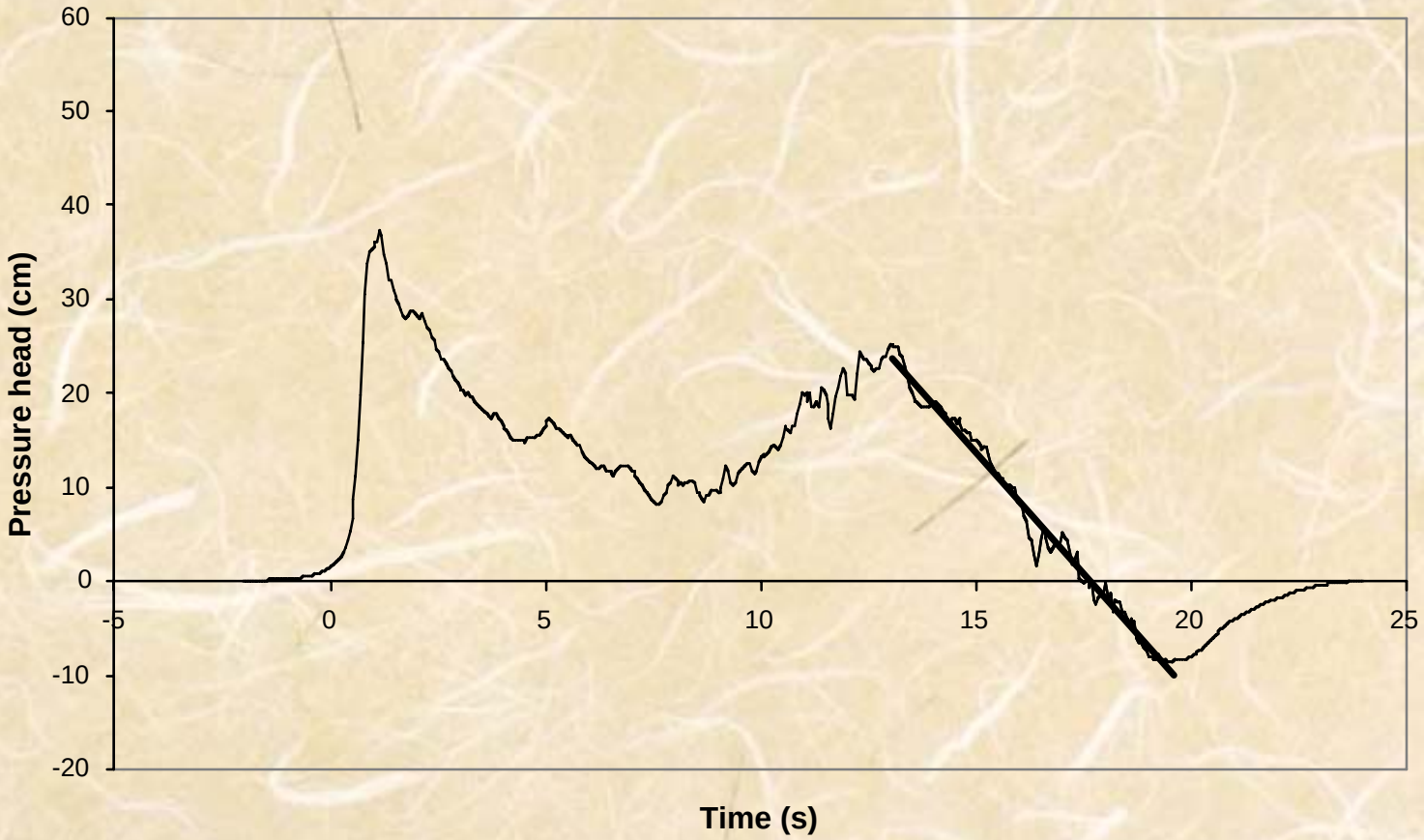
Sand


Scour at Back
Shields Parameter
5
10
15
20

Gravel


Scour at Back
Shields Parameter
5
10
15
20

Linear fit to the drawdown portion of the pressure at the back of the cylinder



- A measure of whether any enhanced scour at all is expected:

$$\Lambda = \frac{2}{\sqrt{\pi}} \frac{\Delta p}{\gamma_b \sqrt{c_v \Delta T}}.$$

- A measure of whether enhanced scour is expected at depth d_s is given by

$$\Lambda = \frac{\Delta p}{\gamma_b d_s}\left(1 - 4\mathrm{i}^2\mathrm{erfc}\left[\frac{d_s}{2\sqrt{c_v \Delta T}}\right]\right).$$

The critical value of $\Lambda = 0.5$.