



Project no.043386

TRIGS

TRIGGERING INSTABILITIES IN MATERIALS AND GEOSYSTEMS

Sixth Framework Programme (FP6) - STREP

New and Emerging Science and Technology Pathfinder (NEST)

Deliverable n. 5.2.1

Database of timing, size and location of landslides triggered by major earthquakes.

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Organisation name of lead contractor for this deliverable: UJF

Diffusion Level: PU

Revision: final

1_Introduction

This database aims toward providing information for cross analysis of earthquake-landslide interactions. This first step database is built on seismicity and landslide catalogue for time, location and size of events. This is routinely available for earthquake worldwide. The most robust database is the one for USGS (web site). There is currently a lack of such quantitative database in the landslide community. After reviewing the worldwide catalogue, we are able to deliver a well documented landslide triggered by earthquake catalogues for NZ events only. Note that for these “state-of –the –art “database the time accuracy in 2 days. Current contacts with other groups and works on data digging allow us to expect to extend database for Kashmir earthquakes and landslides 2005, Northridge, 1994 California events and Chi-chi 1999 Taiwan events. These new events are expected to be on the database by July 15 2009.

For these 3 events data exist as a density of damaged area form. It is not yet converted in individual landslide catalogues. To be able to better constrain the susceptibility of landslide to forcing, we provide, on the same area where earthquake triggering where efficient to trigger landslide, database for landslide triggered by rainfalls and database for earthquake triggered by earthquakes, i.e aftershocks.

2. New Zealand database for earthquake triggered landslides:

There are 4 files:

M5.1_eq.txt : aftershocks associated with the M5.1 Rotoehu earthquake of July, 18th 2004

M5.1_ldsl.txt : landslides associated with the M5.1 Rotoehu earthquake of

M7_eq.txt : aftershocks associated with the M7 Fiordland earthquake of August, 21st 2003

M7_ldsl.txt : landslides associated with the M7 Fiordland earthquake of August, 21st 2003

rf3oct_ldsl.txt : landslides associated with the October, 3rd 2003 rainfall event

rf4oct_ldsl.txt : landslides associated with the October, 4th 2003 rainfall event

rf18jul_ldsl.txt : landslides associated with the July, 18th 2004 rainfall event

rf16fev_ldsl.txt : landslides associated with the February, 14-16th rainfall event

Key for Reading each file are as follow:

Earthquake database:

1st line: Number of events, number of column

then each line is an earthquake

Column 1: Serial number

Column 2: Date (01/01/0000=0)

Column 3: Magnitude

Column 4: Latitude

Column 5: Longitude

Column 6: Depth

Landslide database:

1st line: number of landslides and number of columns

then each line is a landslide

Column 1: Serial number

Column 2: Date (01/01/0000=0)

Column 3: Volume (m³)

Column 4: Trigger type (1: rainfall, 2: earthquake)

Column 5: Latitude

Column 6: Longitude

Column 7: Material involved:

rock=1 earth=2 debris=3 complex=4 coarse soils=5 fine soils=6 snow ice=7

Column 8: Type of landsliding:

fall=1 slide=2 slump=3 topple=4 flow=5 creep=6 complex=7 avalanche=8

subsidence=9

Column 9: Dynamic ofsliding:

translational slide=10 rotational slide (slump)=11 lateral spread=12

Column 10: Class Volume:

1=V < 10³ m³, 2=10³m³ < V < 10⁶ m³ 3=V > 10⁶ m³

Column 11: Time accuracy

3. New Zealand database for earthquake triggered landslides: main patterns

There are 6 evidences for huge triggering of landslides in NZ on the 1998-2008. Two crises are triggered by M5.1 and M7 earthquake, in the South and the North Island, respectively, and 4 rainfall triggered landslide crises (all in the North Island). Spatial patterns are shown on Figures 1-5.

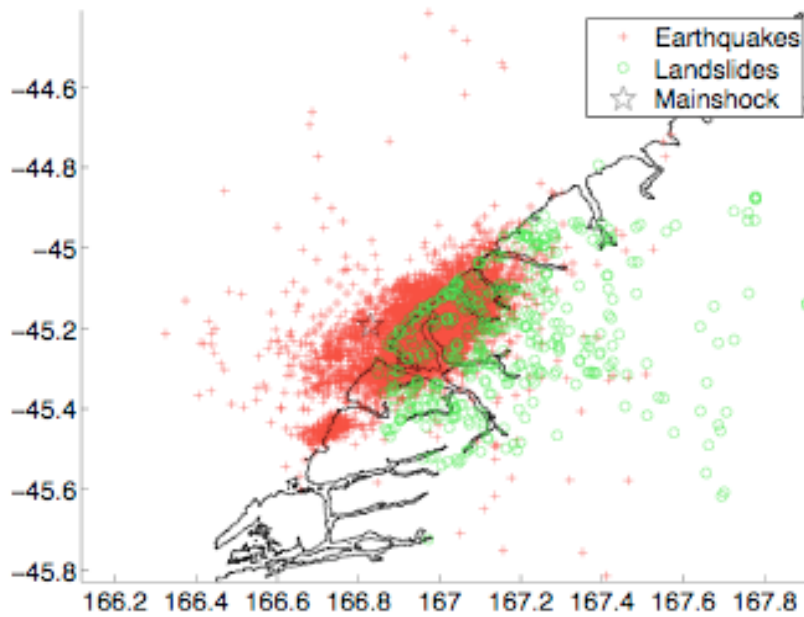


Figure 1: Map of M7, 2003, Fjordland earthquake (black star) and sequence of triggered seismicity (red cross) and triggered landslide (green circle).

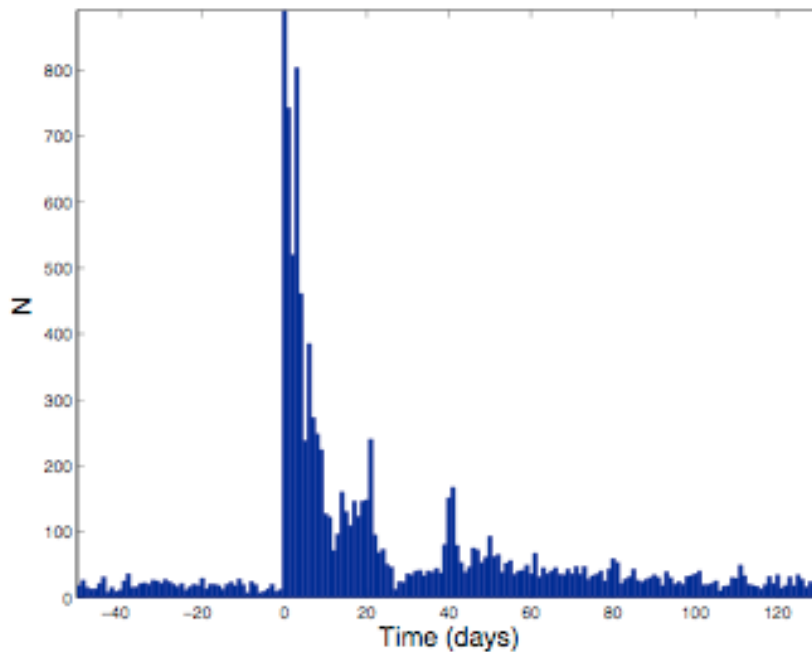


Figure 2: daily seismicity 50 days before and 130 days after the M7 NZ earthquake

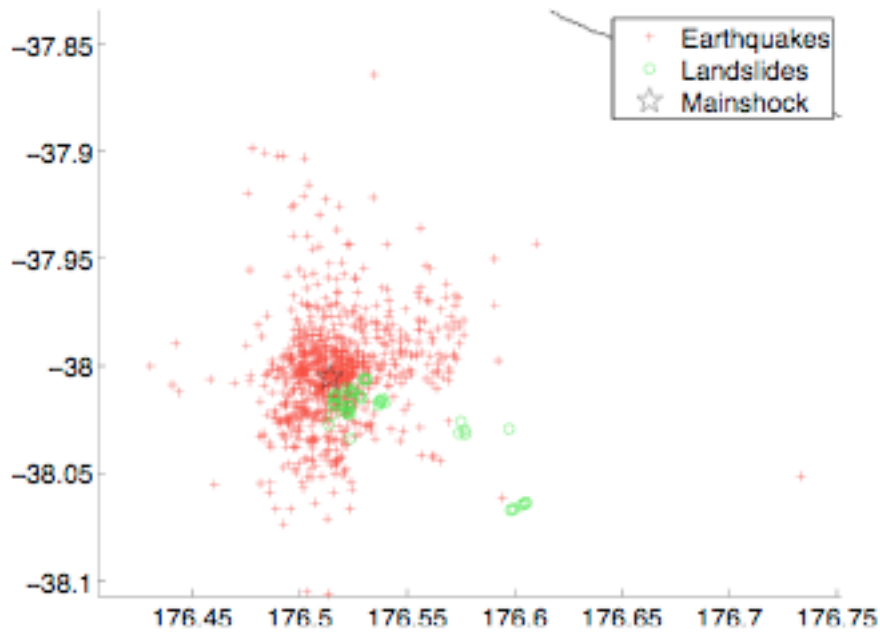


Figure 3: Map of M5.1, July 2004 earthquake (black star) and sequence of triggered seismicity (red cross) and triggered landslide (green circle).

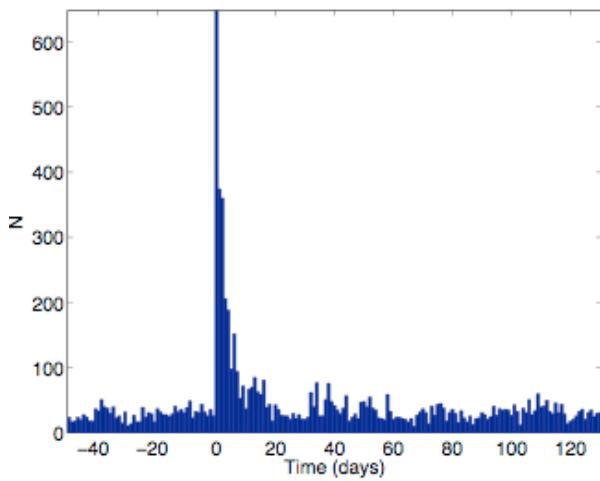


Figure 4: daily seismicity 50 days before and 130 days after the M5.1 NZ earthquake

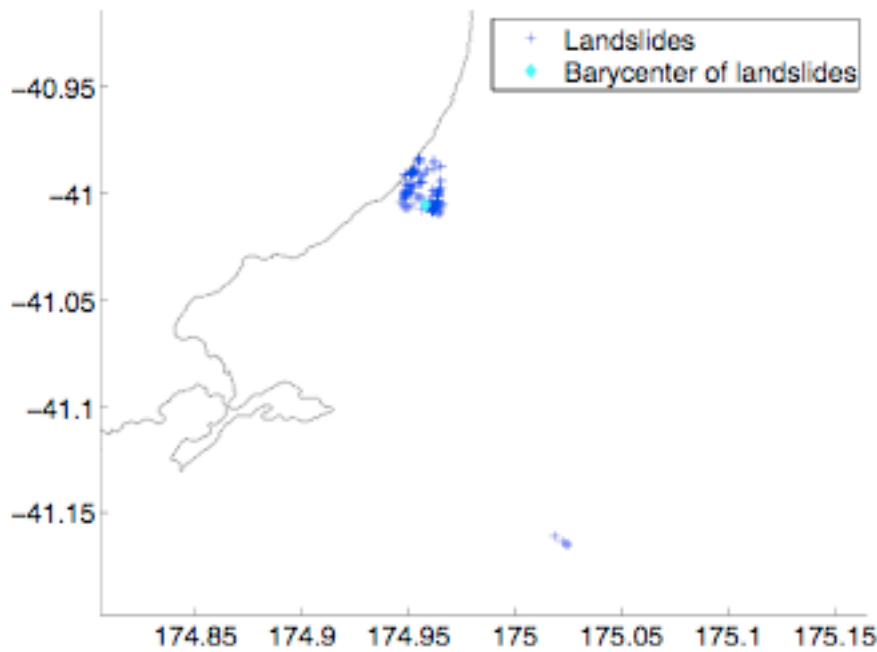


Figure 5: Map of October, 3rd 2003 rainfall triggered landslides (blue crosses) and barycentre of landslides (cyan diamond).

Preliminary data analyses focus on the distributions of the distances between the landslides and the mainshock forcing and we compare them to the distributions of the distances between the aftershocks and the mainshock, for each crisis.

For the two crisis triggered by earthquakes, we recover similar rough behavior in space between triggered earthquakes and triggered landslides (figure 6,7)

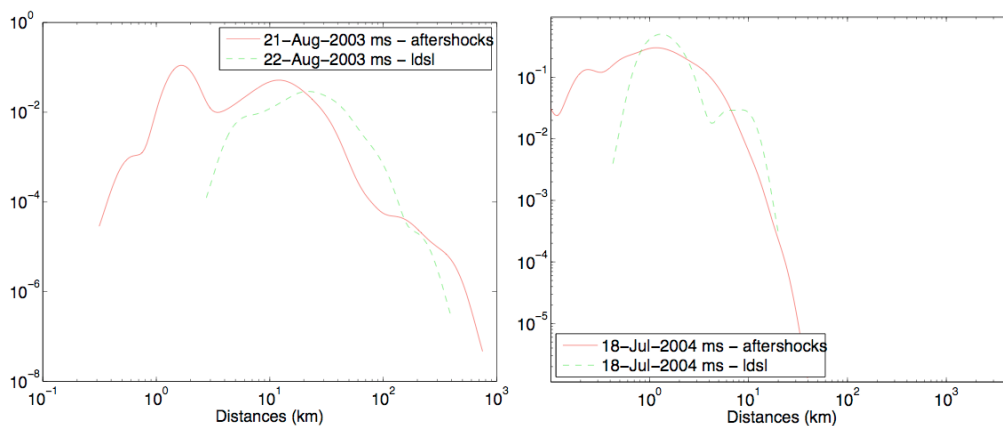


Figure 6: Probability Distribution Functions of mainshock- aftershock distances (red line) and mainshock- landslide distances (green dashed line). Left, events triggered by the M7 2003 earthquake; Right, events triggered by the M5.1 2004 earthquake. PDFs were computed using a log binning and convolved with a Gaussian kernel.