

# 断層変位評価に関する課題

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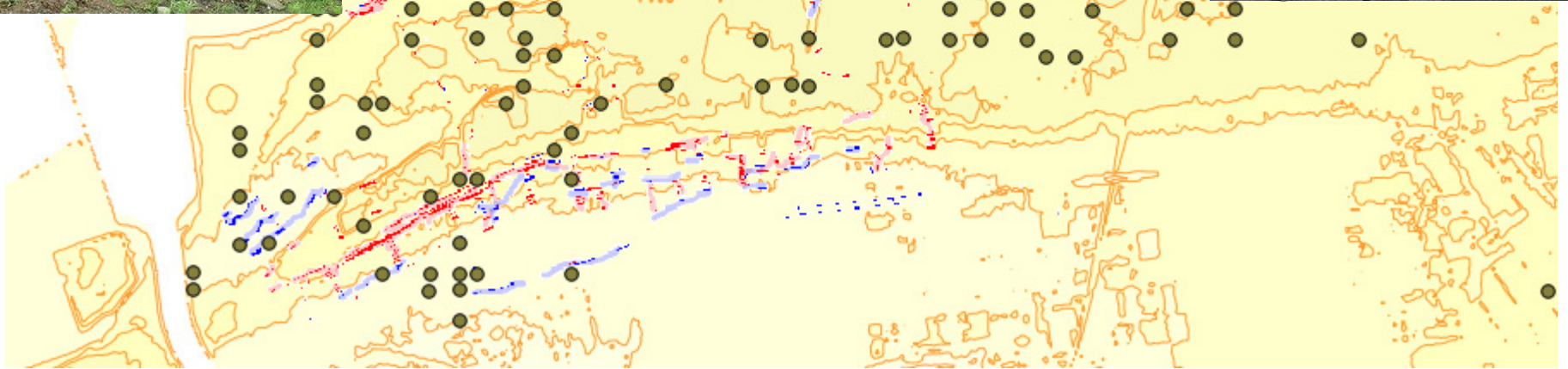
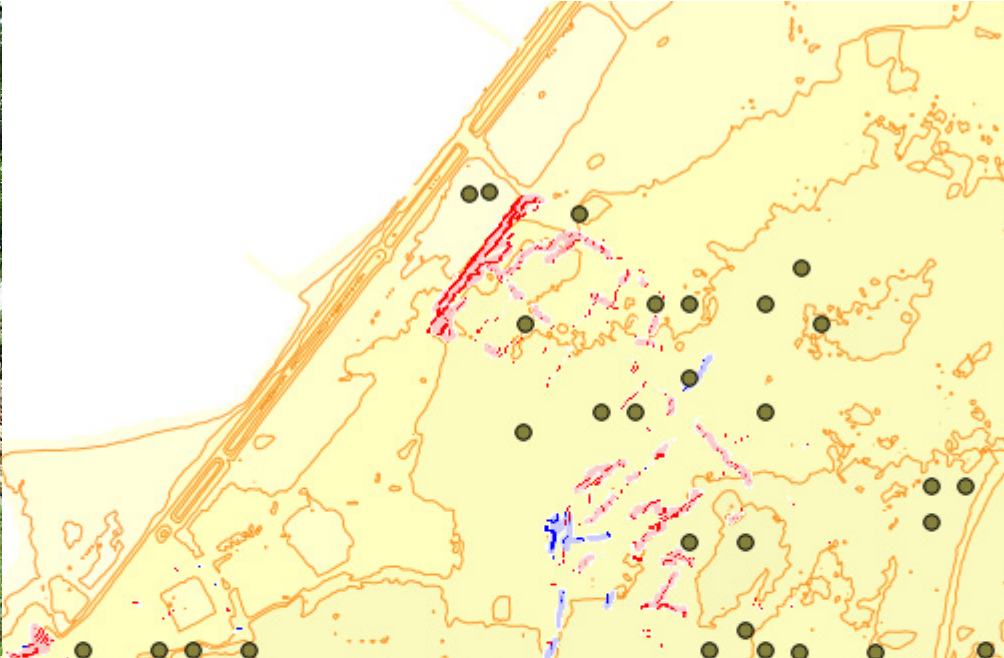
地震記録のない  
調査から…



# 1. 地盤に刻まれた痕跡探し

地形変形を使った地震工学・防災工学への展開

# 2007年中越沖地震 柏崎市内



2007.07.18 クローズアップ現代

# 2004年中越地震



- ◆ Area of heavy snowfall
- ◆ 40% of landslide mass movements are reported in snow-melting seasons
- ◆ Two major rivers, Shinano and Uono, flow through the low-rised mountainous area



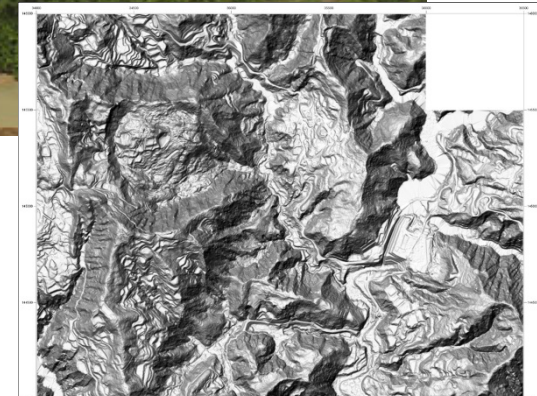
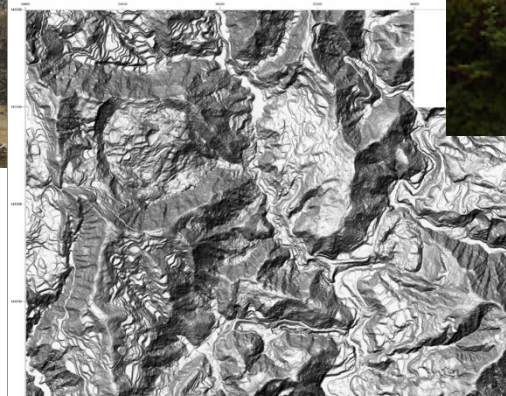
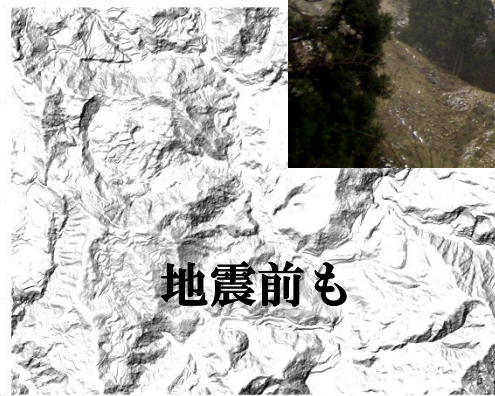
# 刻々変化する地形の詳細データ収集

振興調整費事業（中核機関：土木学会）

**Dec.17,2004**



**June 29,2005**



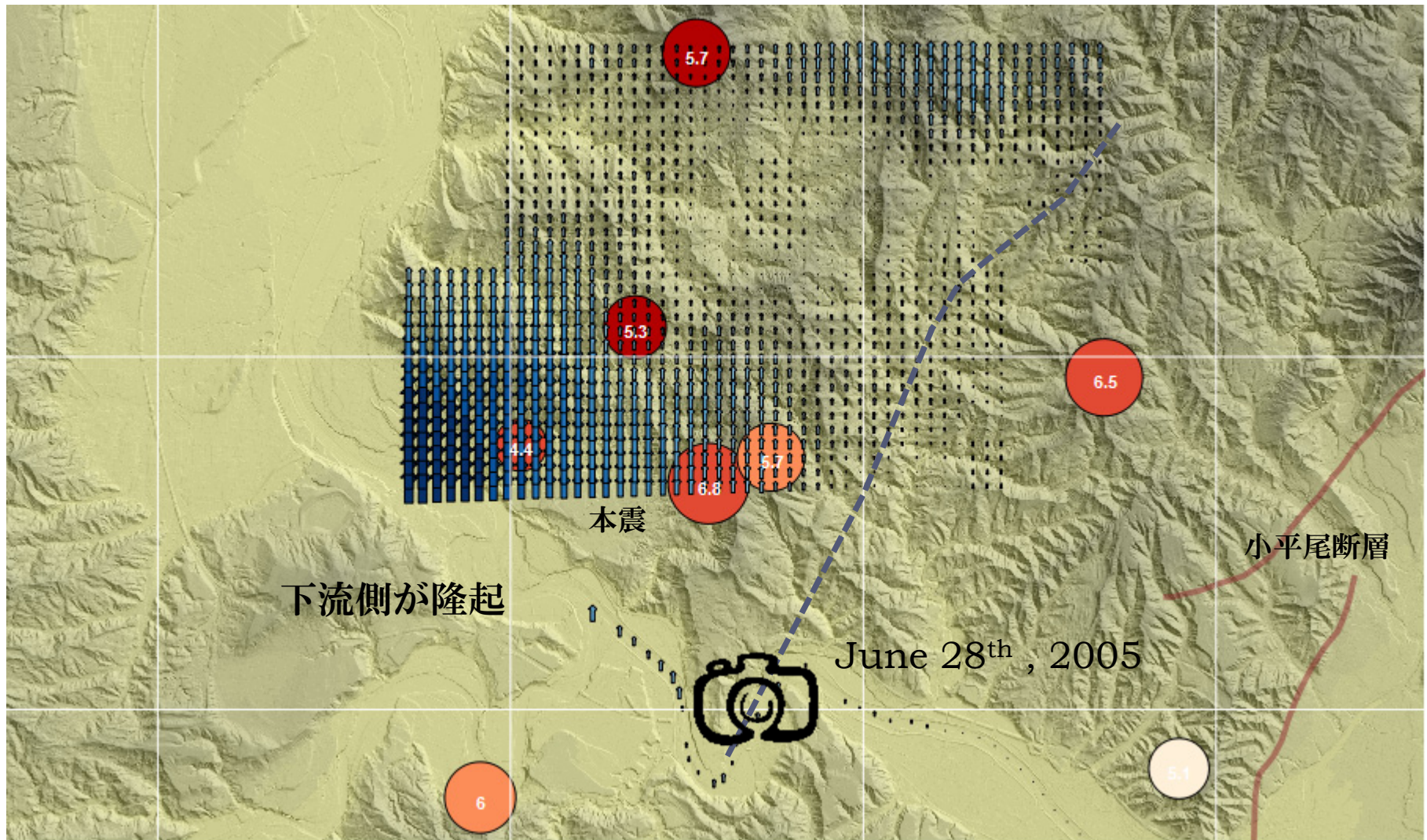
- ▶ If landslide masses would move again in snow-melting seasons discouraging all attempts for quick rehabilitations.



うーん、それだけの  
精度を出すの  
は・・・

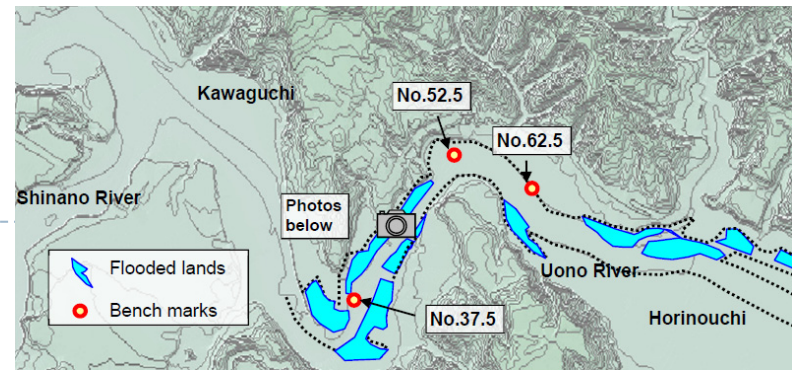
（朝日航洋村上さん）

# 検出されたやや深い地盤の変位





# 地震後に2度の冠水

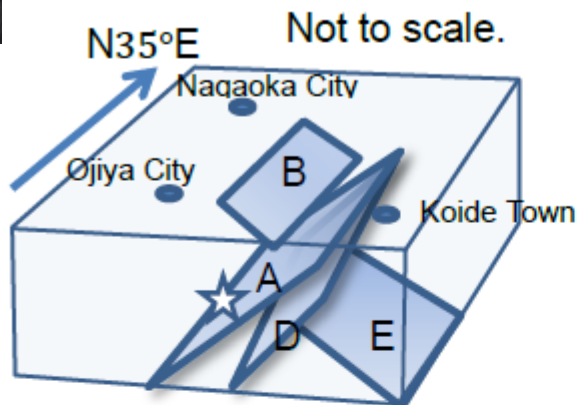


下流部隆起と洪水の因果関係を解明

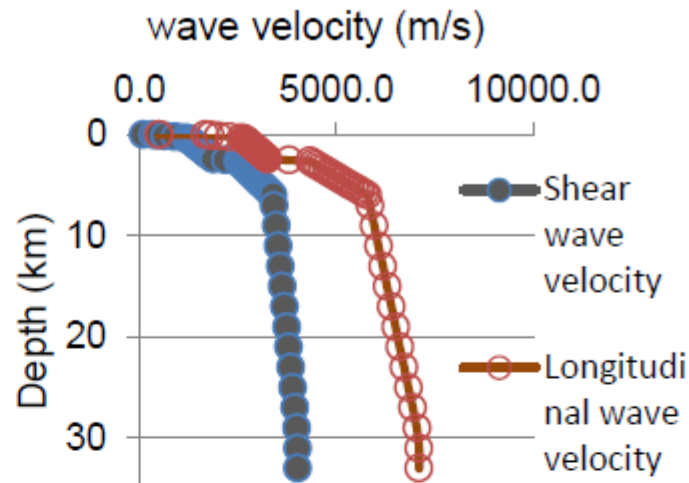
Aug. 4th, 2011 Photo by Konagai



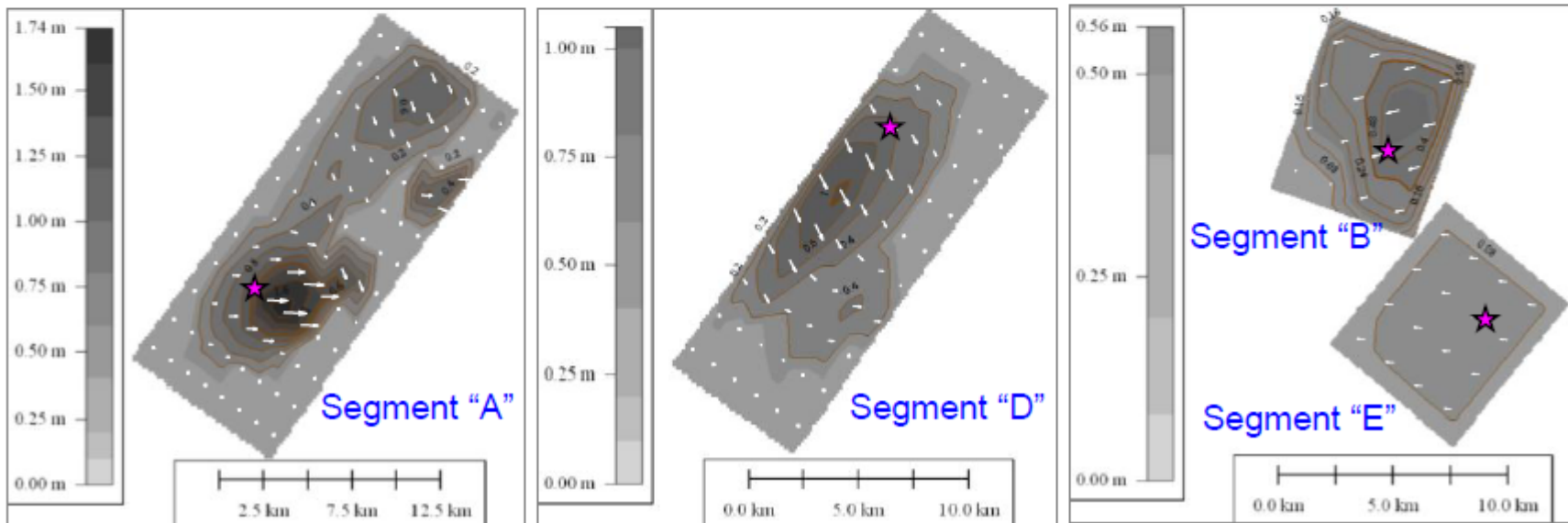
# 断層面上のすべりを逆解析



(a)



(b)



(c)

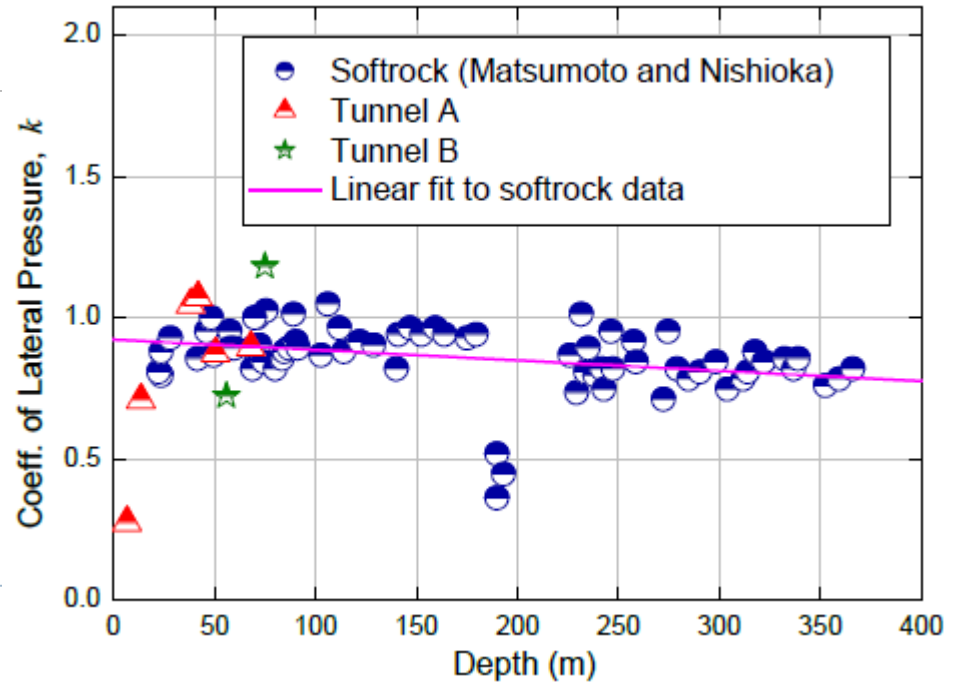


# 地中の応力を求めるには地震前の応力状態も必要

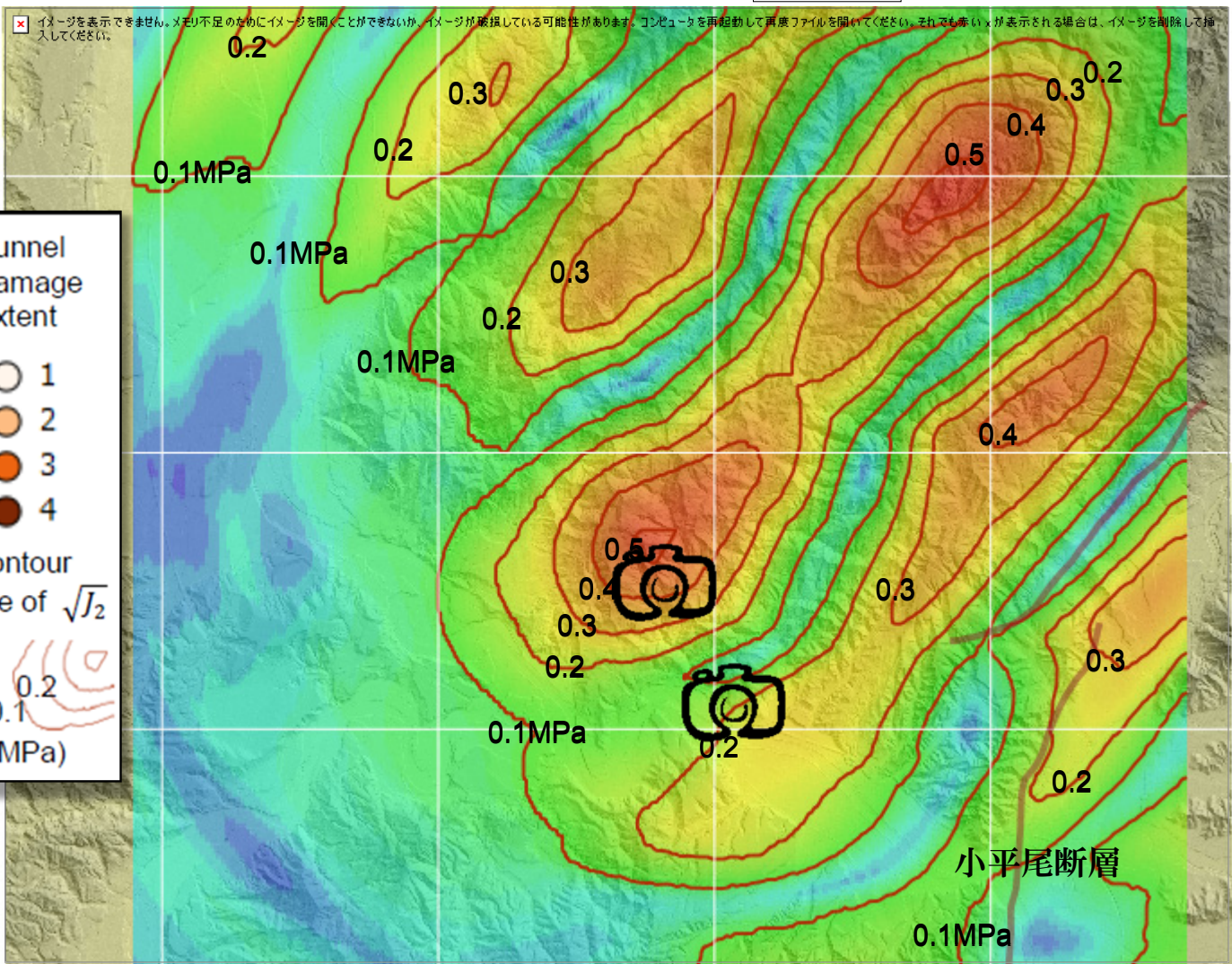
× イメージを表示できません。メモリ不足のためにイメージを開くことができないか、イメージが破損している可能性があります。コンピュータを再起動して再度ファイルを開いてください。それでも赤い×が表示される場合は、イメージを削除して挿入してください。



× イメージを開くことができないか、イメージが破損している可能性があります。コンピュータを再起動して再度ファイルを開いてください。それでも赤い×が表示される場合は、イメージを削除して挿入してください。



$$\sqrt{J_2}$$



地表から75mの深さで



# JR上越新幹線 魚沼トンネル



Nov. 4, 2004, Photo by Konagai K.



# JR上越線 和南津トンネル



Nov. 14, 2004, Photo by Numada M.



Nov. 14, 2004, Photo by Konagai K.

$\sqrt{J_2}$  (  ) と  $I_1$  (  )

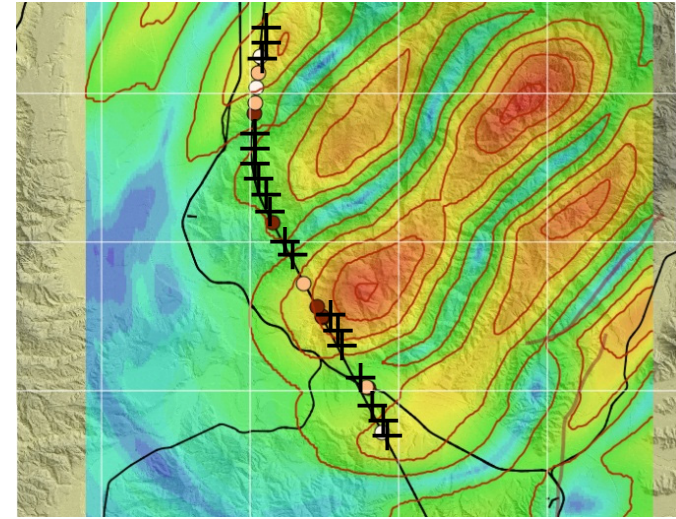
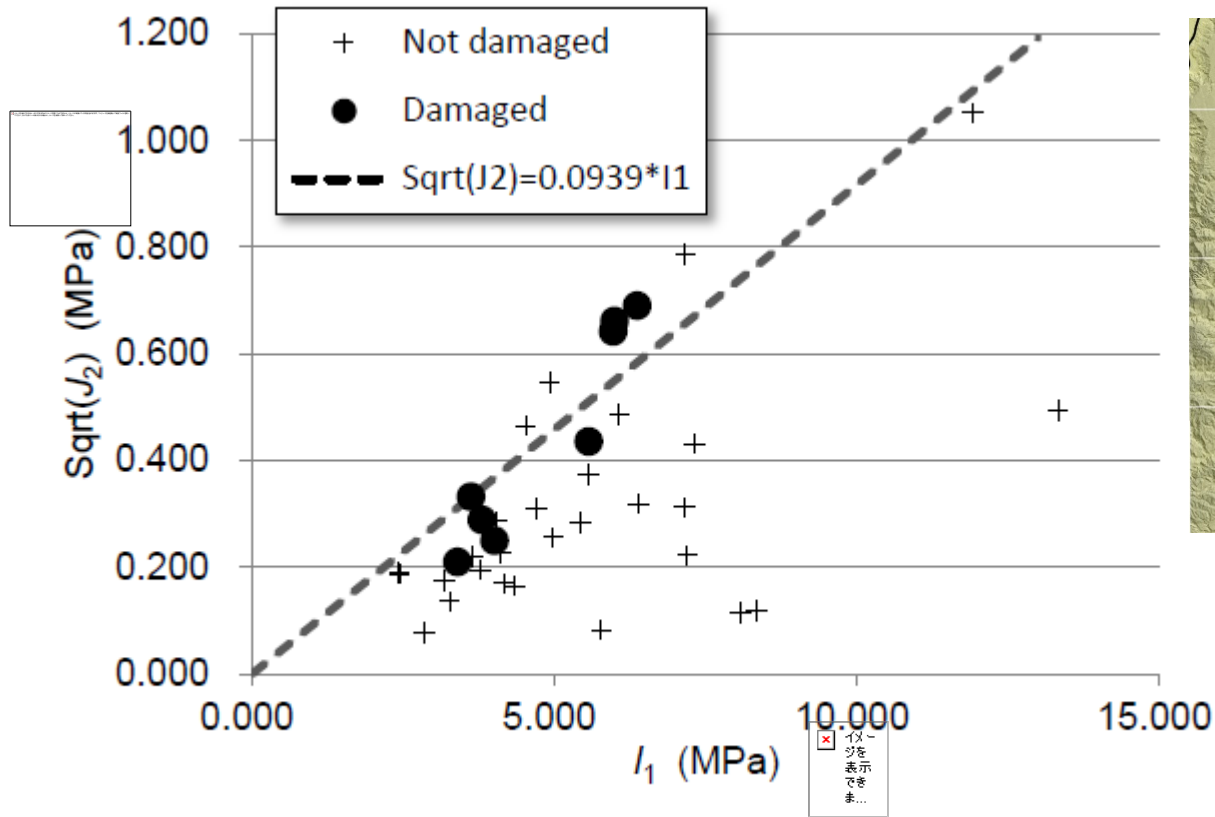
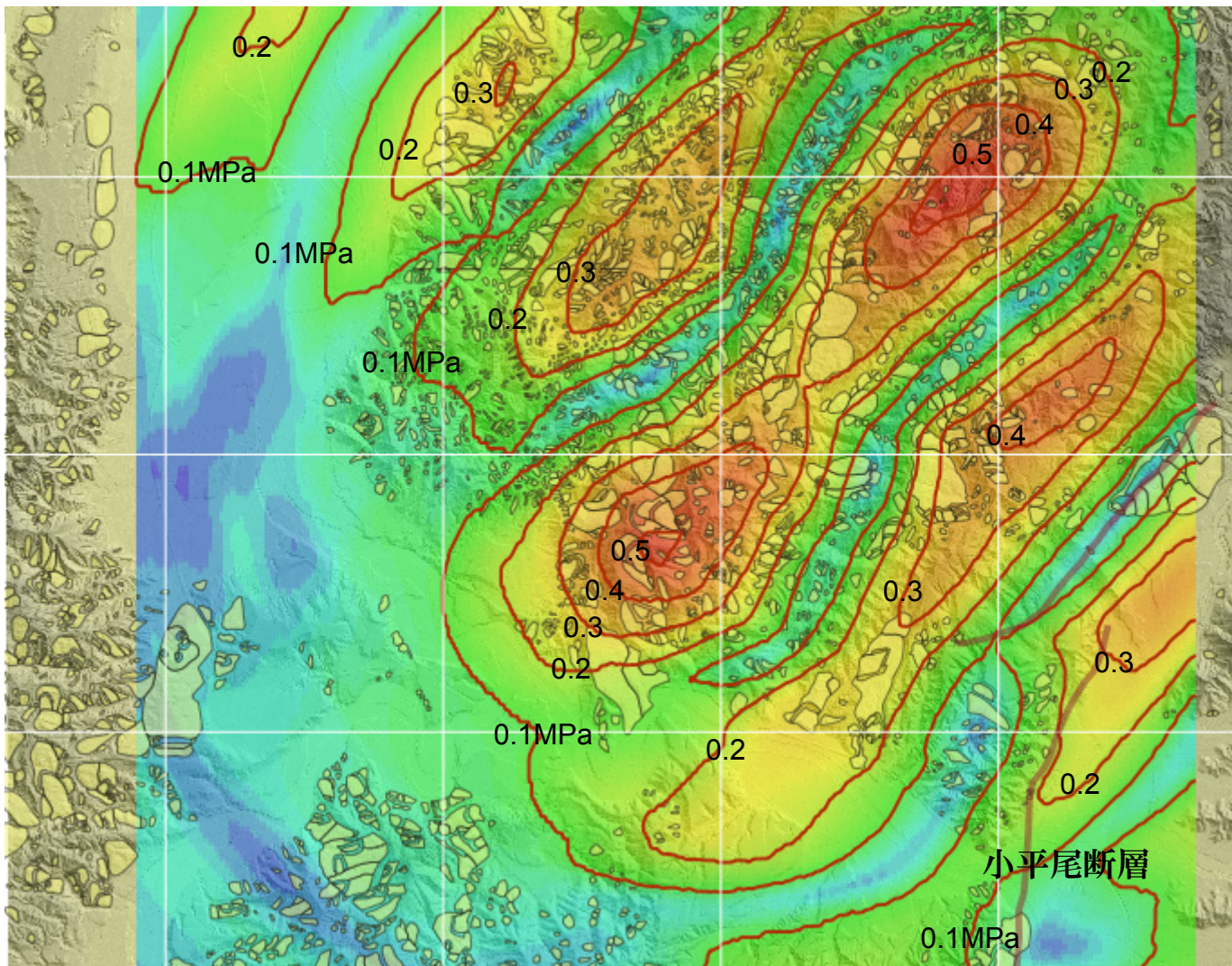


Figure 13 Scatter diagram of  $I_1$  and  $\sqrt{J_2}$  along tunnels

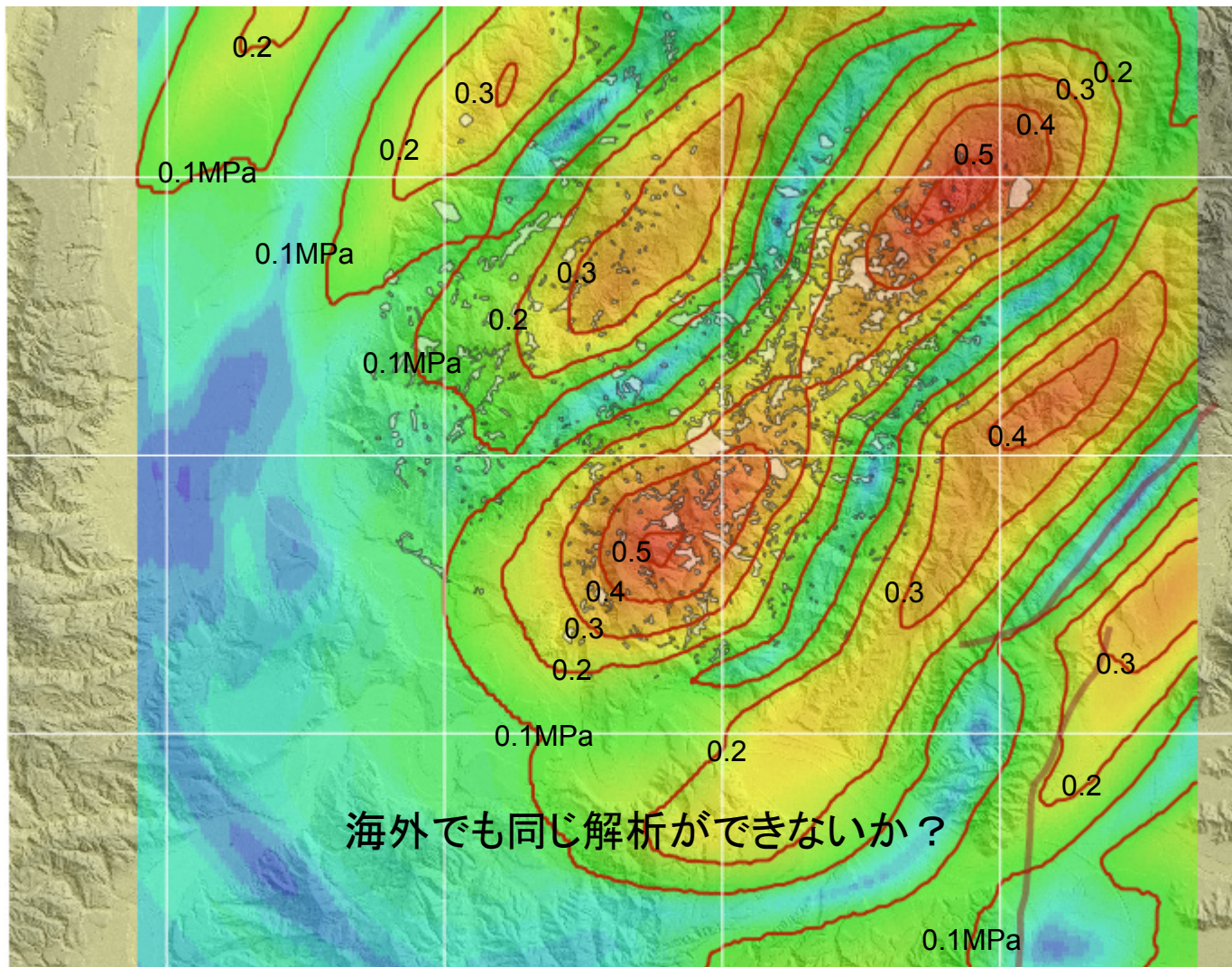
$$\sqrt{J_2}$$



防災科学技術研究所判読による斜面崩壊地分布（2001年）

- ▶ 2004年中越地震の前から同じことが繰り返し起こっていたのでは？

$$\sqrt{J_2}$$



ちなみに2004年中越地震による斜面崩壊地を重ねると・・・



## Disaster preparedness

From the Newspaper | 31st January, 2012

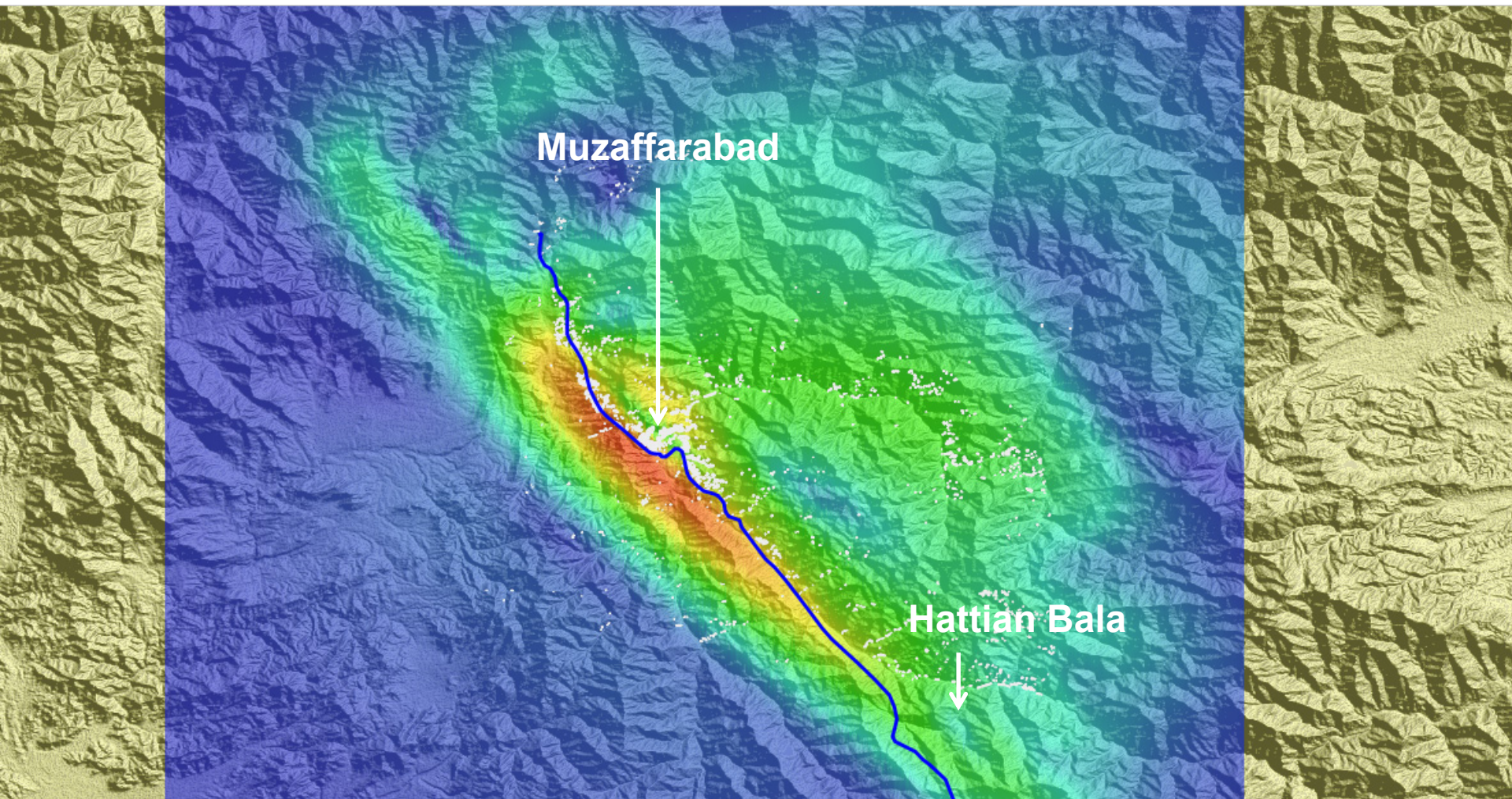


**THAT around 30 of the 62 seismometers in Pakistan are not transmitting data in real time to the national seismic activity monitoring network speaks volumes for the level of official apathy where disaster preparedness is concerned. The reason for this, as reported in this newspaper, is shocking: the meters are offline because the Met office has been unable to pay their monthly connectivity cost, ranging from Rs2,000 to Rs5,000. Collecting and analysing accurate data is an essential part of disaster preparedness, but the relevant authorities here don't seem to think so. In general, our attitude towards preparing for and managing disasters is ad hoc and shambolic. This is quite troubling considering the fact that various parts of Pakistan are prone to seismic activity. For example, major earthquakes struck Balochistan in 2008 and 2011, while it has been reported that six minor quakes were recorded in Karachi in 2010, along with a few recent tremors. The devastation caused by the 2005 quake in northern Pakistan has still not been forgotten.**

While it is true that after the 2005 quake there has been greater awareness about disaster management both in the public and private spheres, there is much room for improvement. For example, while masons have been trained in different parts of the country — through UN help — to build safer structures, building codes, especially in cities, are routinely flouted and structures not conforming to safety standards approved. Also, earthquake drills in schools and workplaces are almost non-existent, though experts say that considering our seismically active neighbourhood such drills should be routine. It is better to be prepared now in order to minimise damage rather than grapple with the consequences of being unprepared when disaster does strike. For a start, the disconnected seismometers should be brought online immediately.



# 2005年パキスタン・カシミール地震での $\sqrt{J_2}$



$\sqrt{J_2}$   
displacements