

17th-century uplift in northeast Hokkaido

Speaker

Brian ATWATER, U.S. Geological Survey, Seattle

Contributors include:

FURUKAWA Ryuta

IKEDA Yasutaka

KASHIMA Kaoru

KAWASE Kumiko

Harvey KELSEY

Andrew MOORE

NANAYAMA Futoshi

ODAGIRI Satoko

OTA Yoko

SAWAI Yuki

SATAKE Kenji

SHIMOKAWA Koichi

UMITSU Masatomo

OLD WAVE 1700 Cascadia

Japanese scientists convinced North Americans to expect M9 at Cascadia

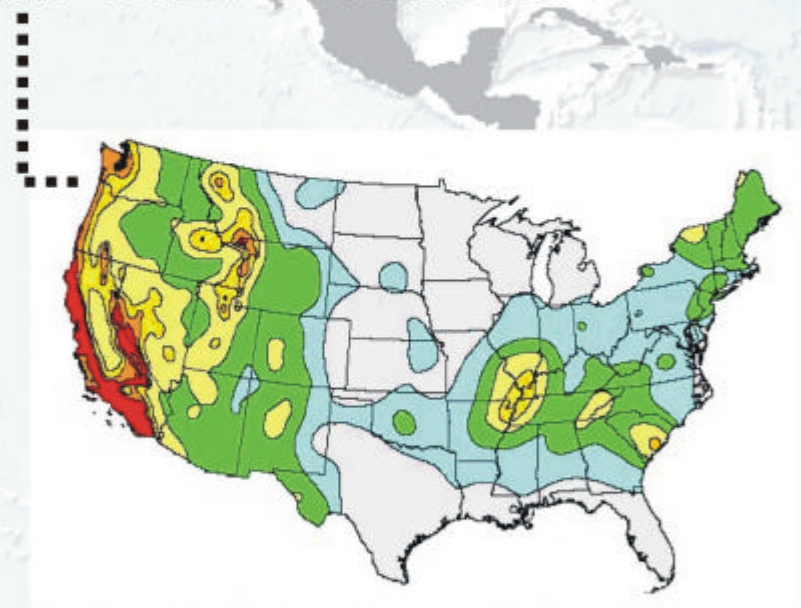
"Morioka-han Zassho"



Description of
flooding and damage
in Ōtsuchi

一、前年井大堰浦玄八日、秋九、時大波上
町金裏、因細狭、橋、水、或、新、後
冷、二、工、破、損、は、水、石、橋、中、と、右、南
岸、井、之、妻、細、所、戸、中、と、

M9 hazard included



OLD WAVE

1960 Chile

Public-safety booklets in U.S. and Chile

Universidad de Tokio

Prepared with
help from
Todai and GSJ

Onagawa on U.S. covers

~40,000 printed



NEW ANALOGY

Hokkaido resembles Chile and Alaska?

During
giant
quake

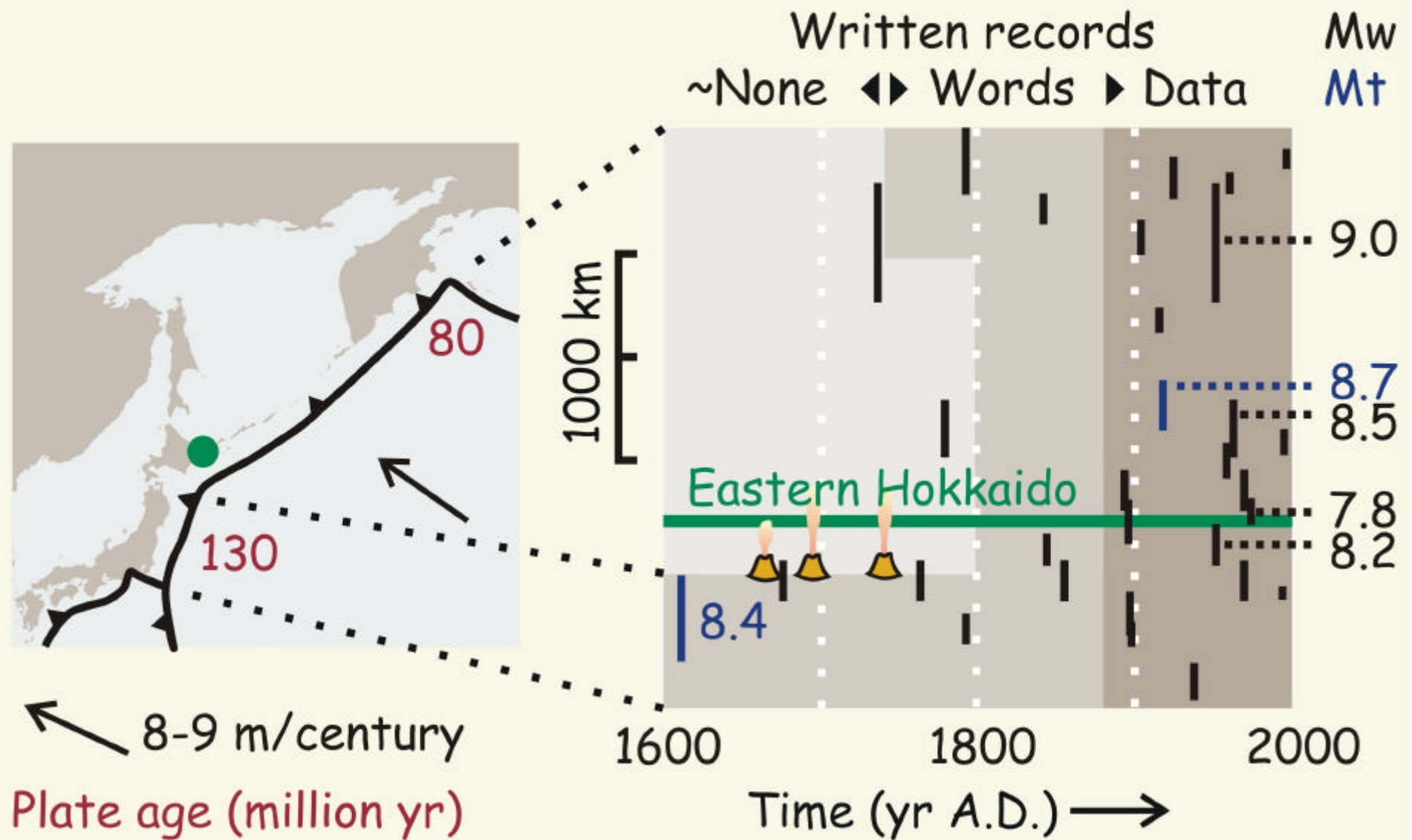
Coast over forearc mantle



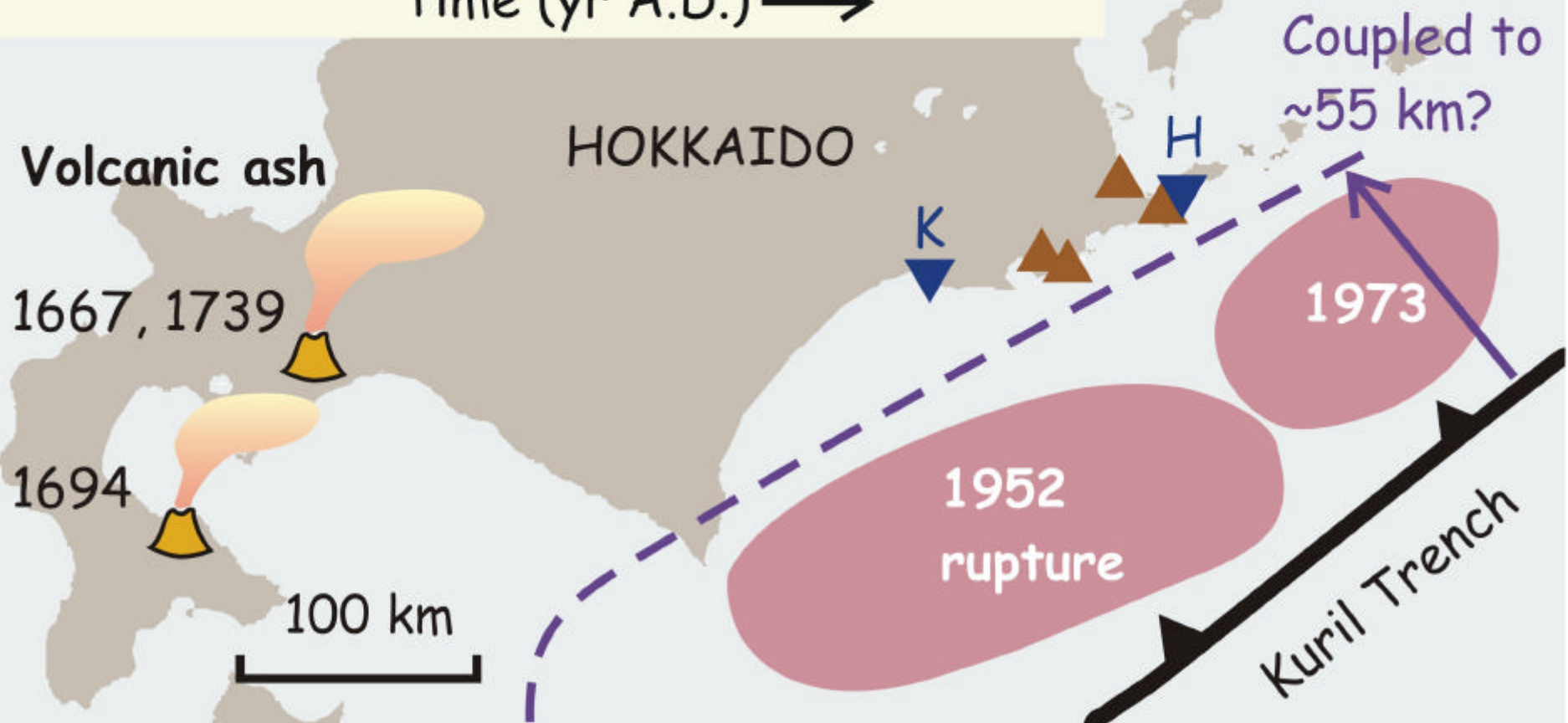
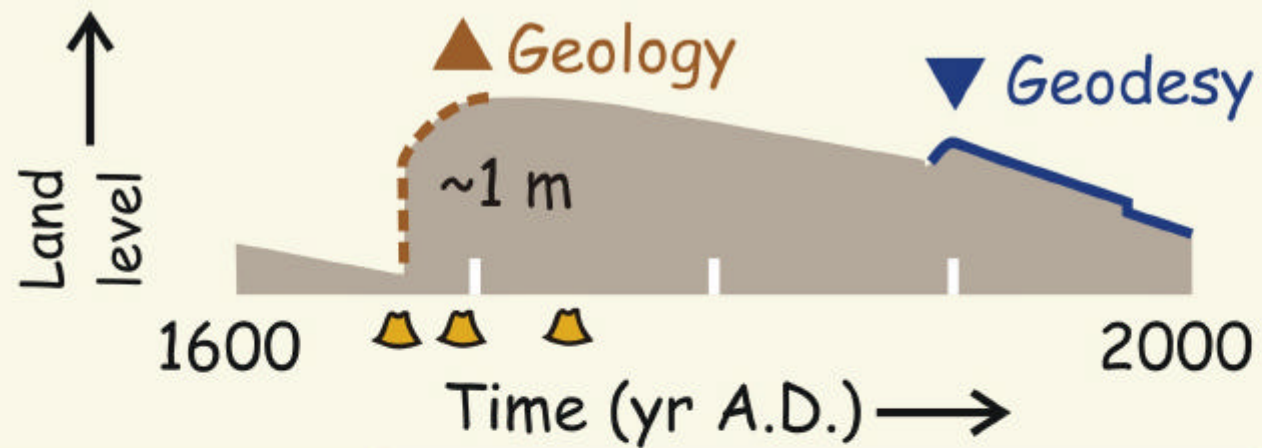
Minutes
before
and for
decades
after



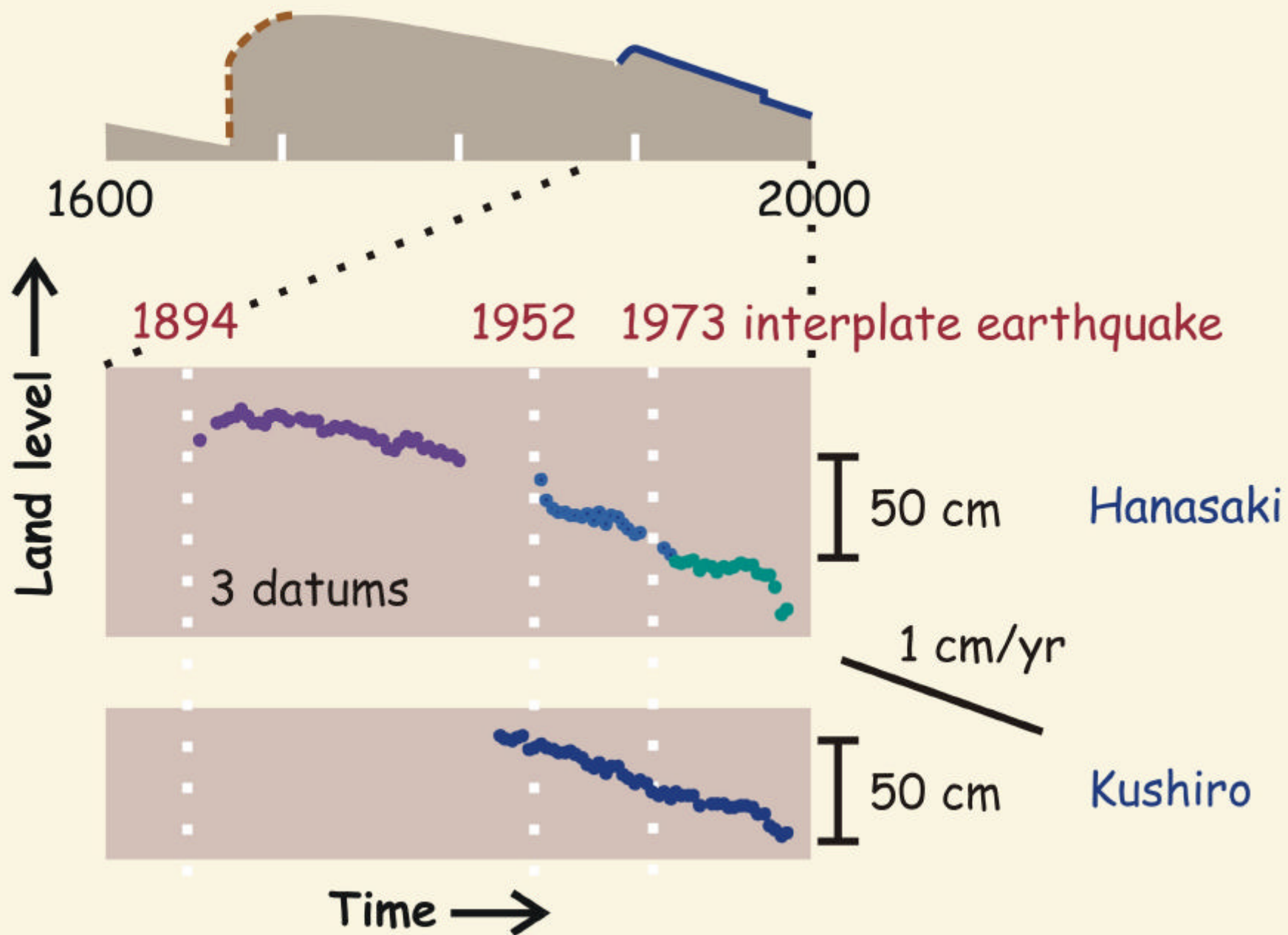
NE JAPAN: IMMUNE TO EARTHQUAKES OF $M_w \gg 8.2$?



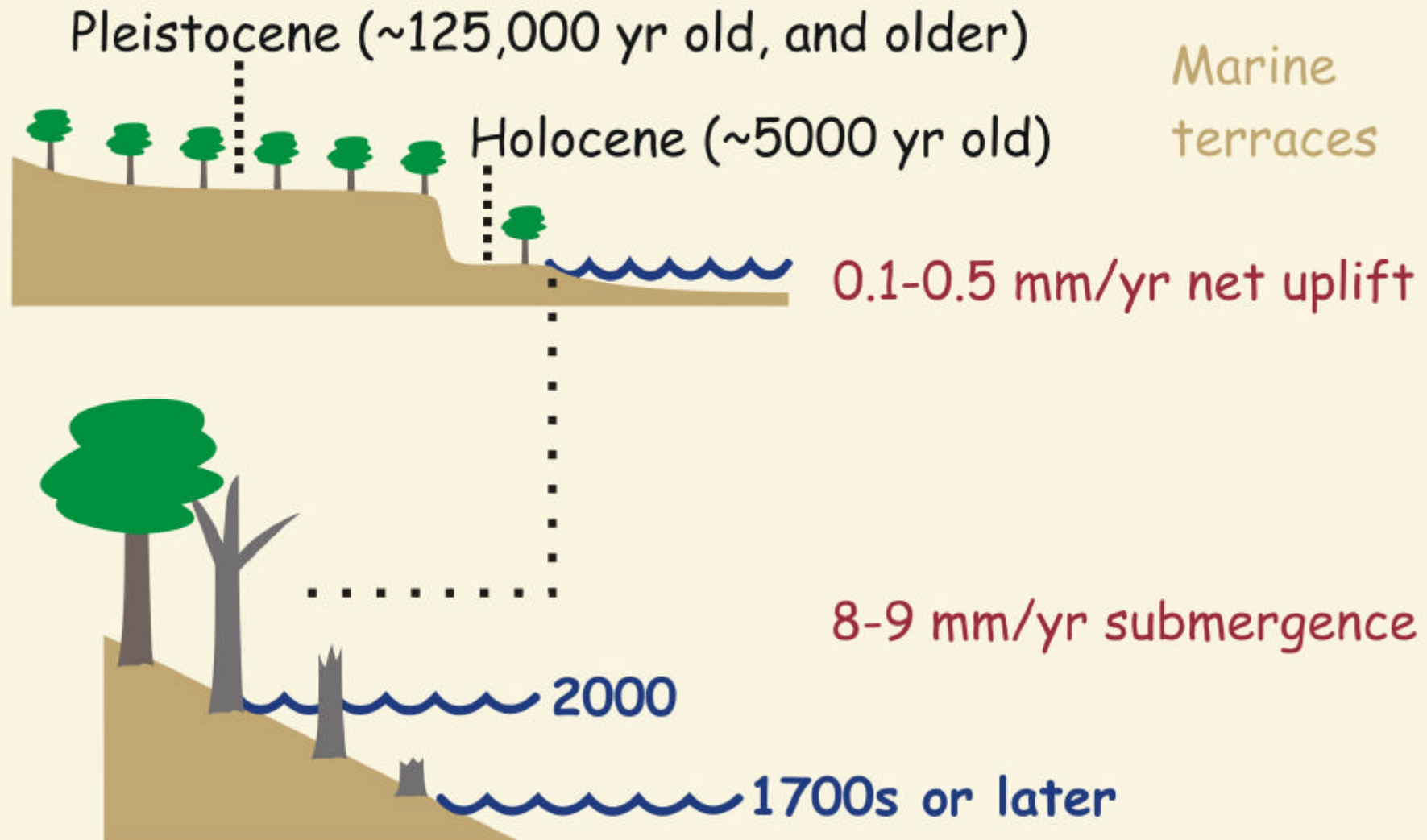
ARMAGEDDON CYCLE?



▼ TIDE GAUGES



LONG-TERM UPLIFT OF RECENTLY SINKING COAST





Live trees on uplifted
Holocene terrace

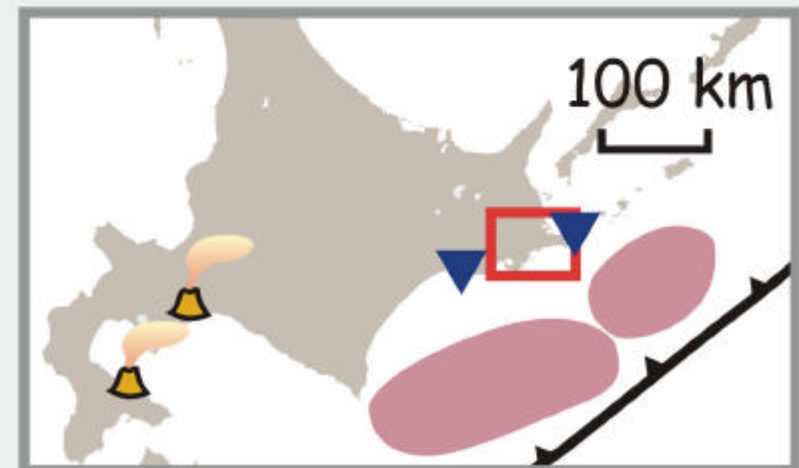
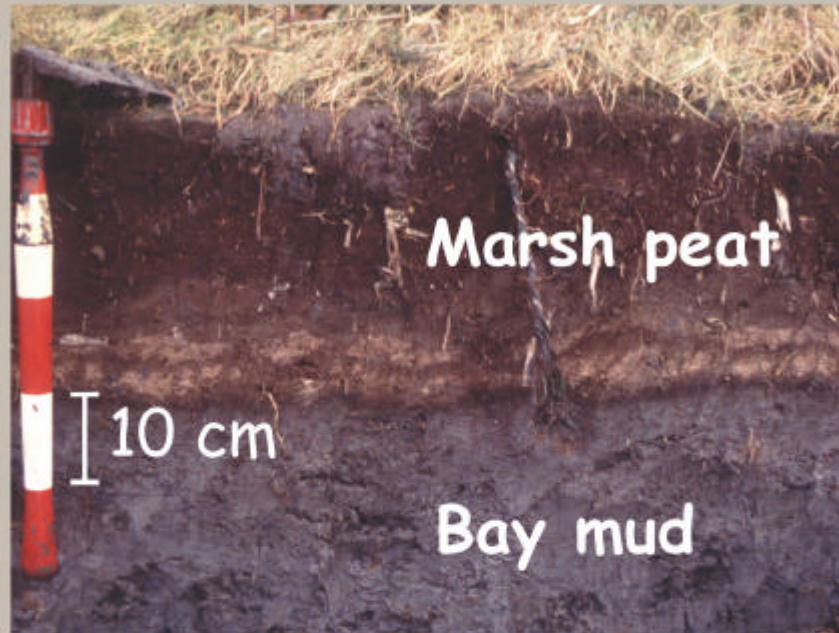
Uplifted Pleistocene terrace



Subsided trees in salt marsh

**THIS SUBSIDENCE IS GEOLOGICALLY TEMPORARY.
WHAT KIND OF EVENT WILL REVERSE IT?**

▲ RECORDED GEOLOGICALLY



△ FOUR EVENTS RECOGNIZED



From
SAWAI Yuki

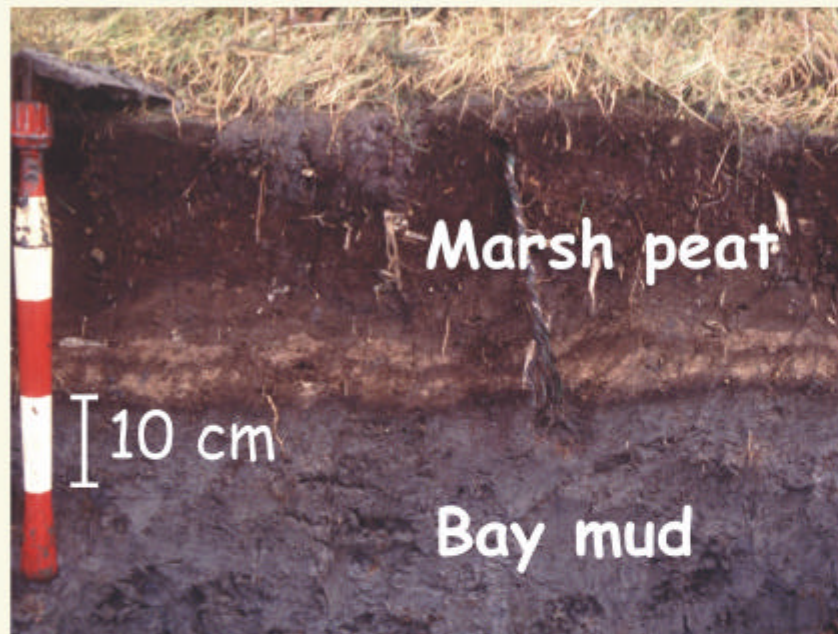
Age range

B.C./A.D.

1000

2000

▲ MOST RECENT: LATE 1600s



Land level
relative to sea



High tide

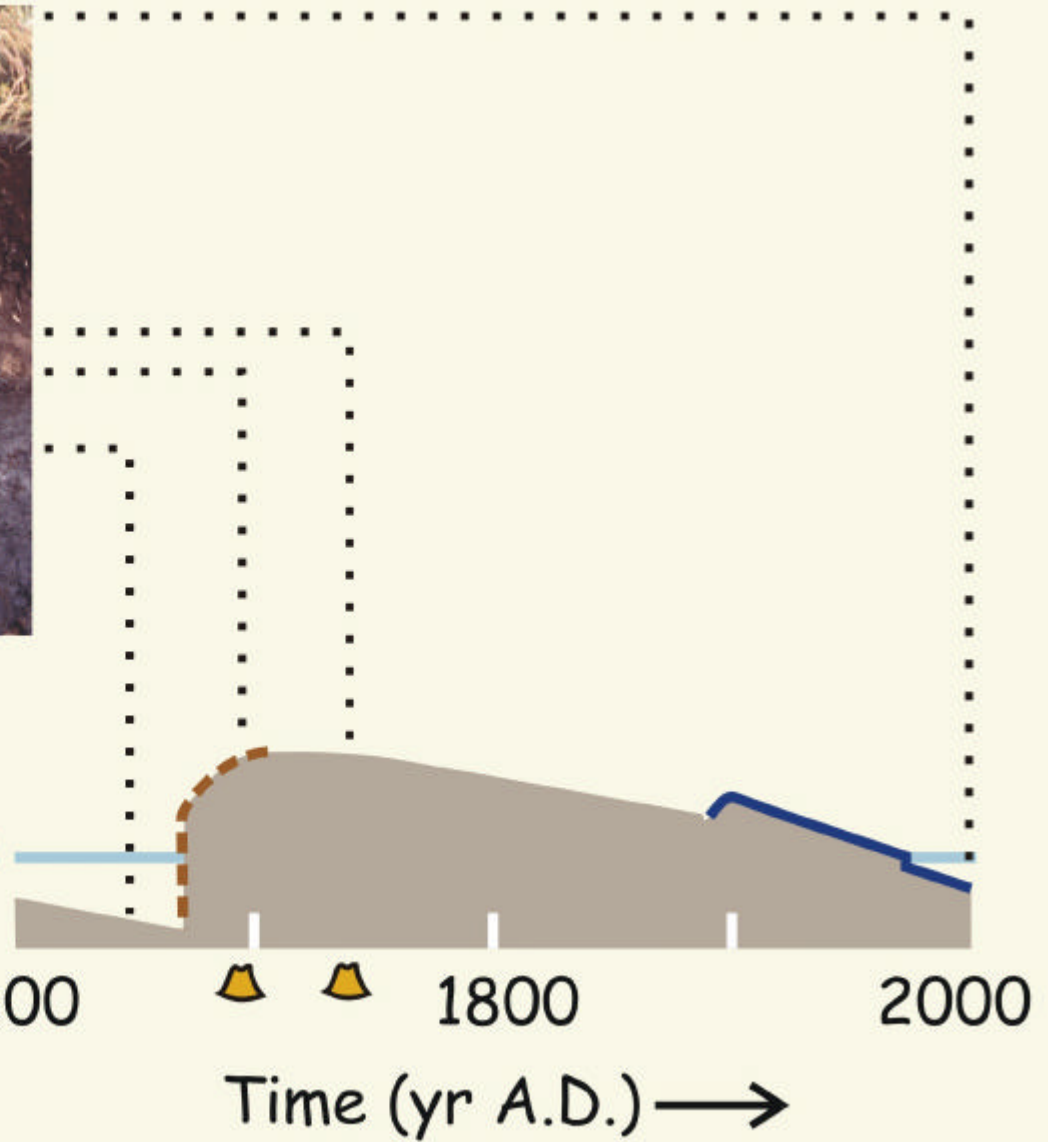
1600



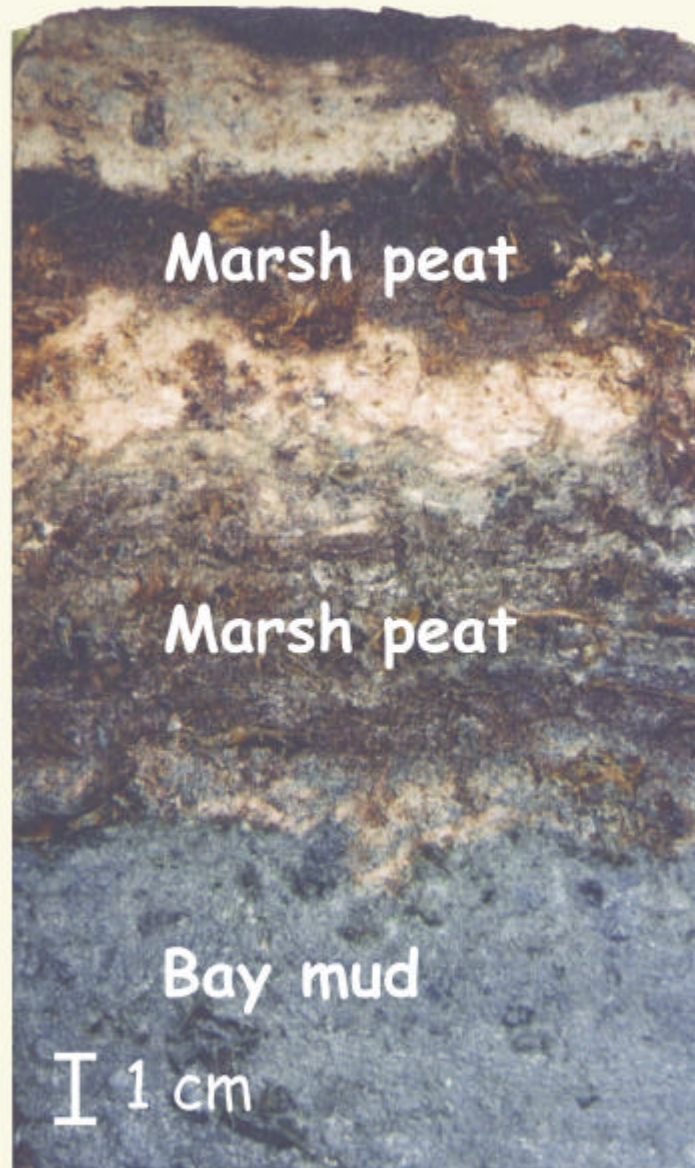
1800

2000

Time (yr A.D.) →



▲ UPLIFT IN LATE 1600s NOT $\gg 1$ m



▲ 1739

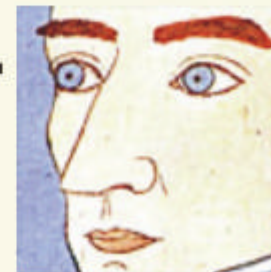
1700

▲ 1694

▲ 1667

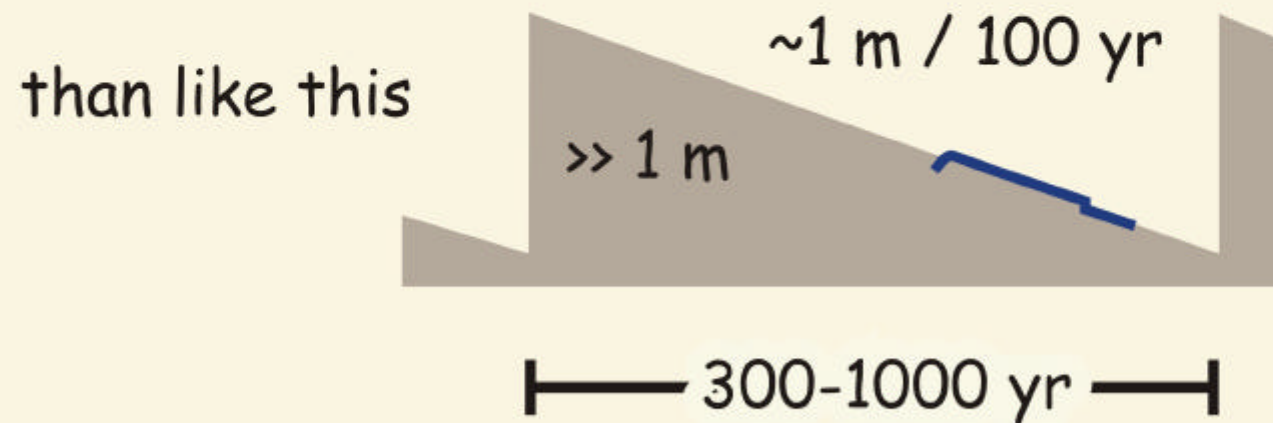
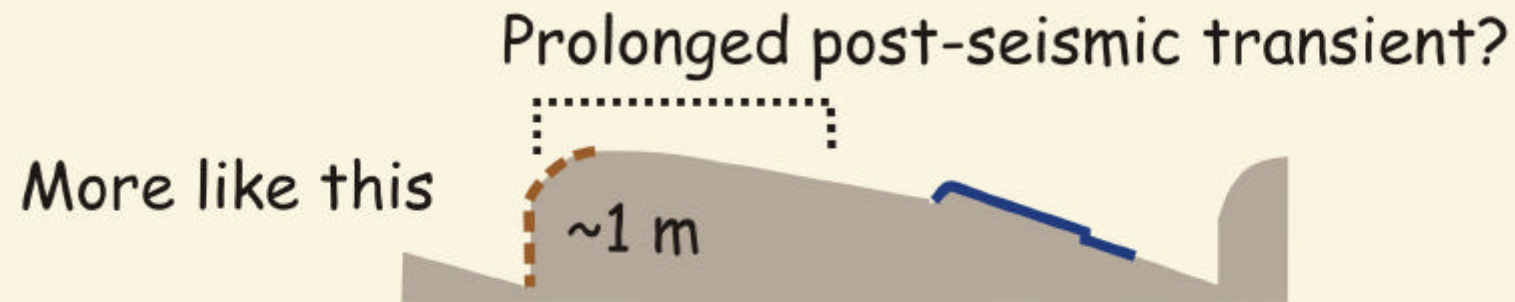
1643

Genroku kuni-ezu



Dutch depths:
"2, 3, 4 feet"

▲ SAWTEETH PROBABLY NOT SHARP

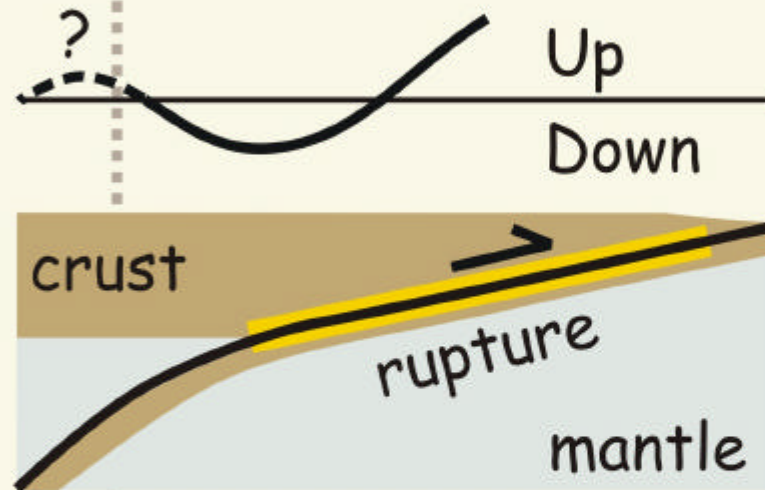


HOKKAIDO RESEMBLES CHILE (infrequently)?

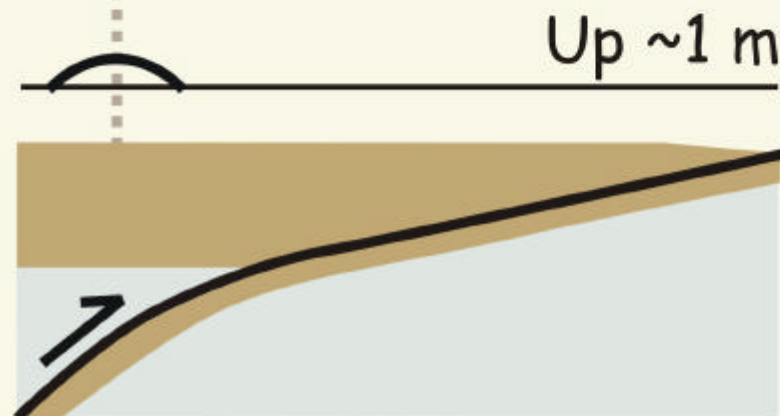


During
giant
quake

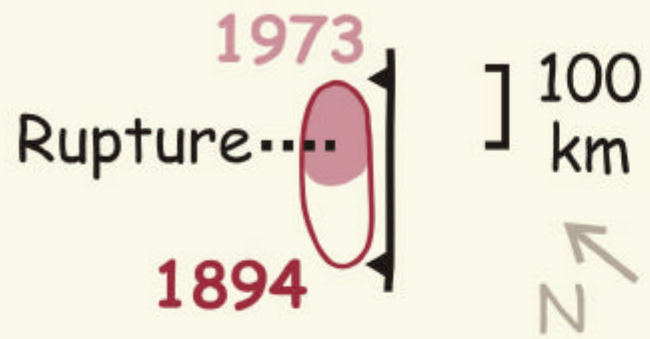
▲ Coast over forearc mantle



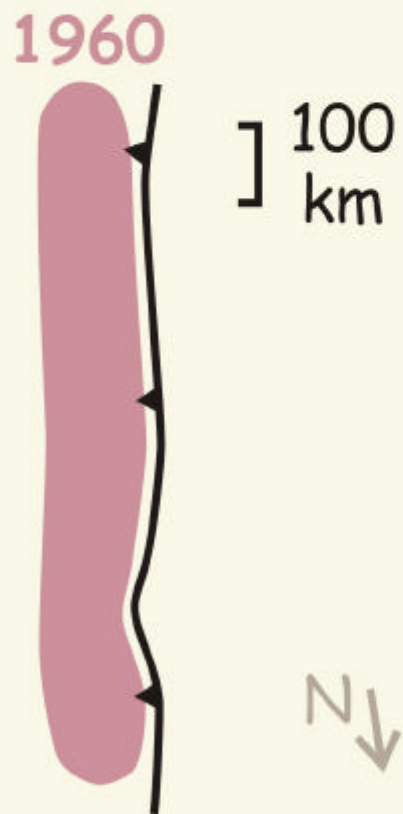
Minutes
before
and for
decades
after



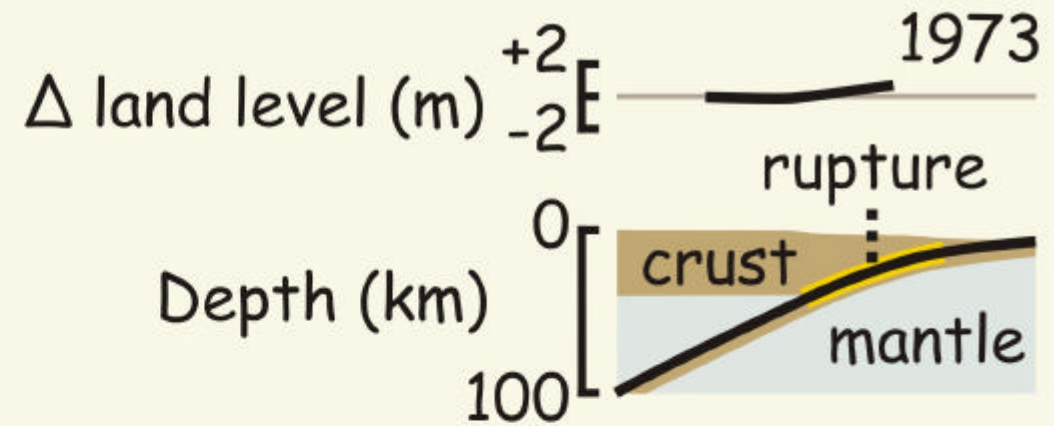
HOKKAIDO



CHILE



HOKKAIDO

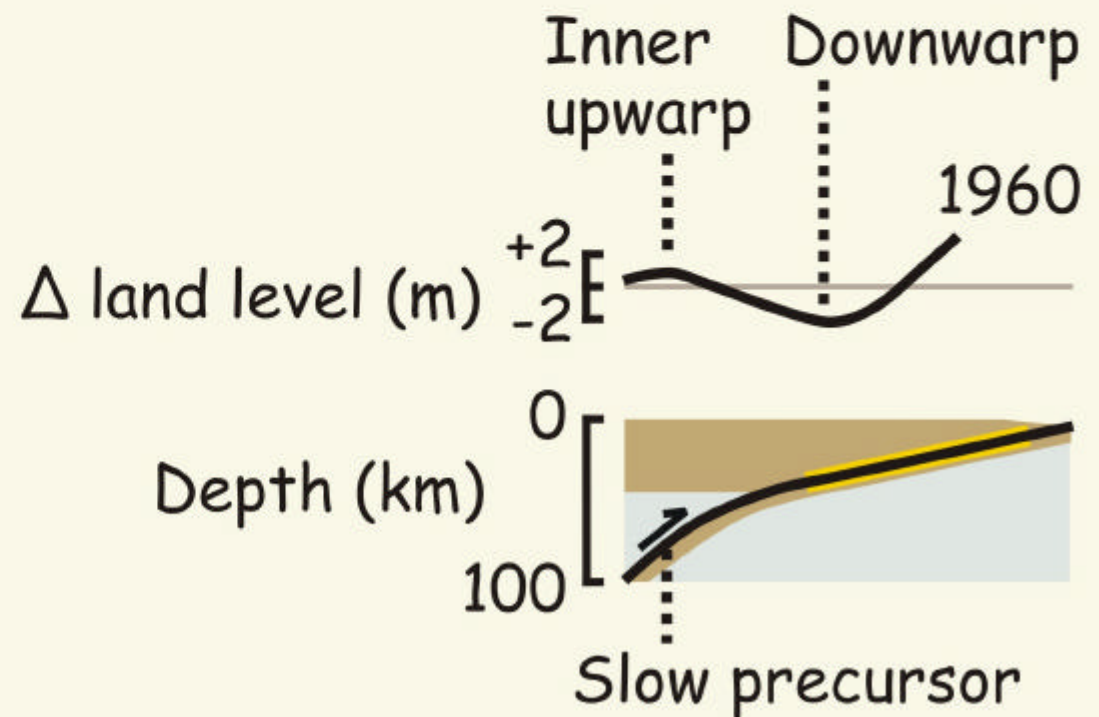


CHILE

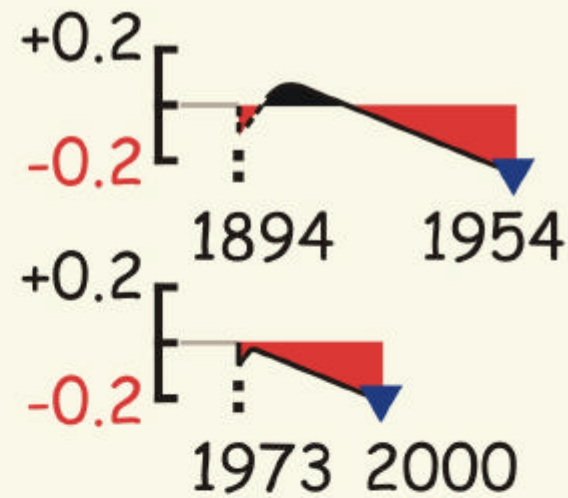
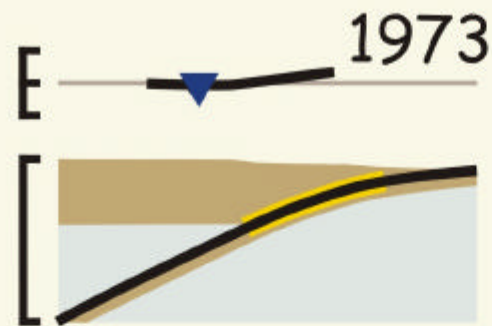
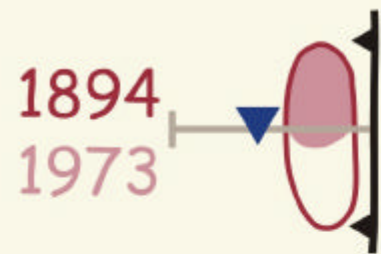
Inner upwarp

Observed.....

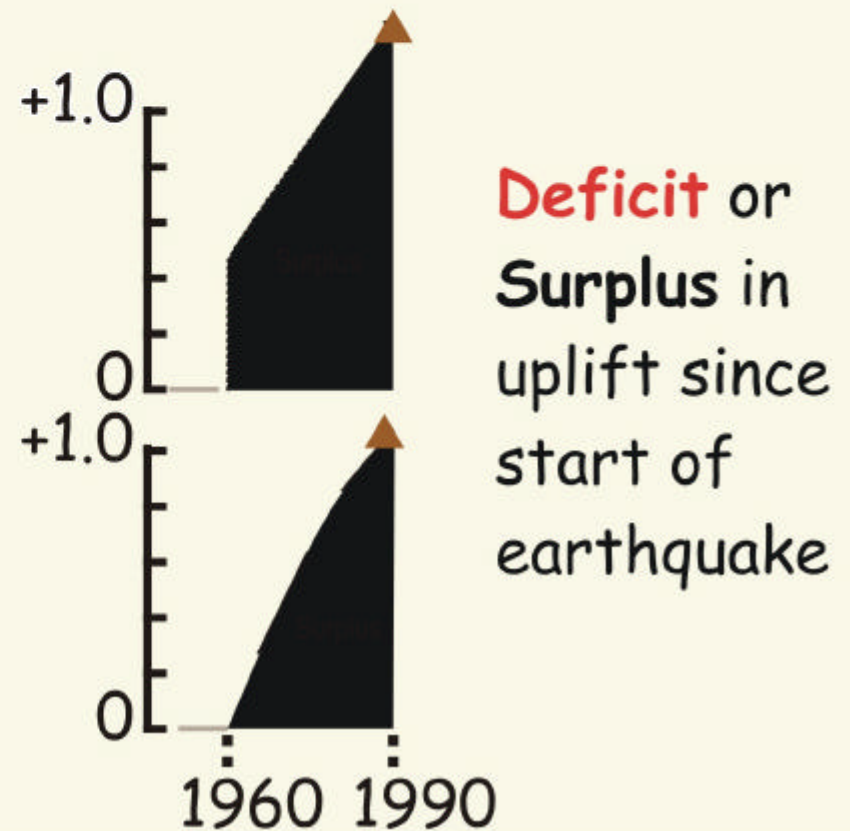
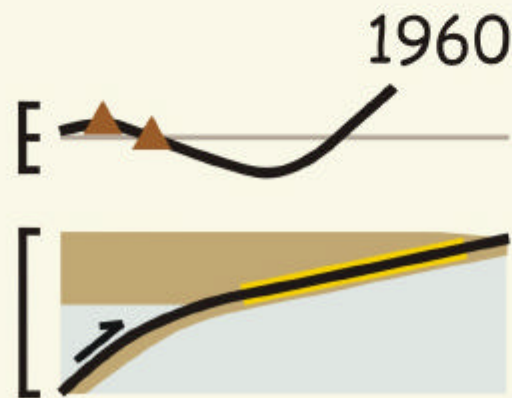
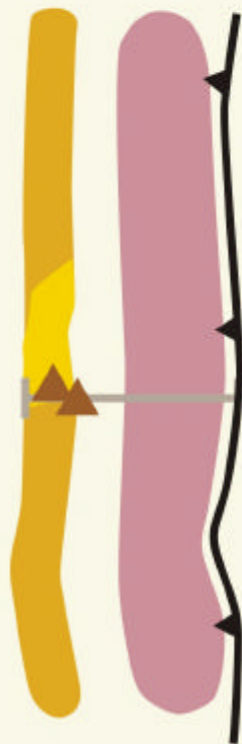
Inferred.....



HOKKAIDO

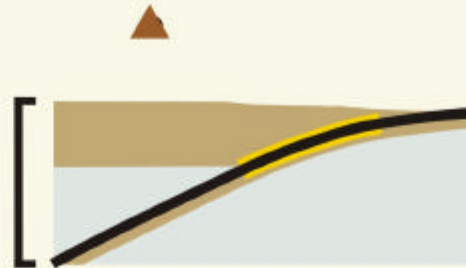
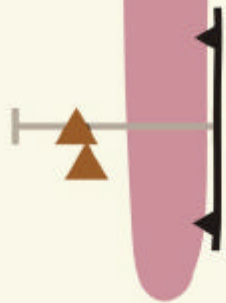


CHILE

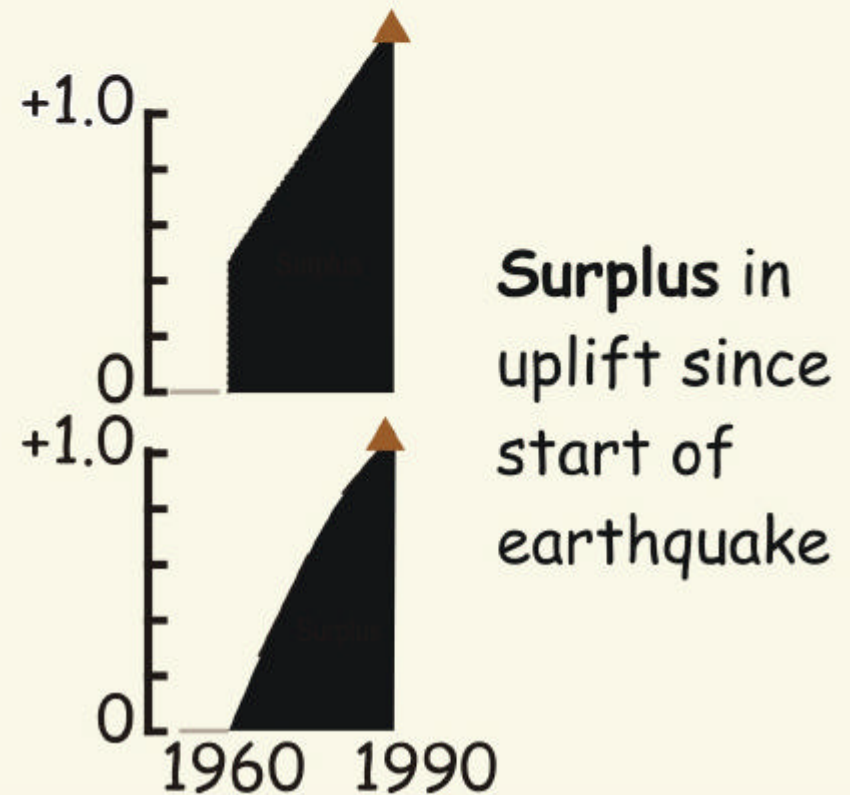
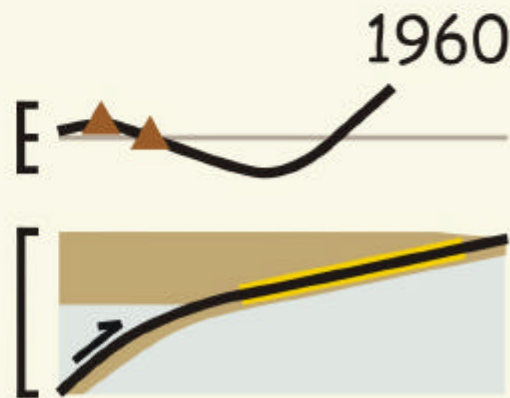
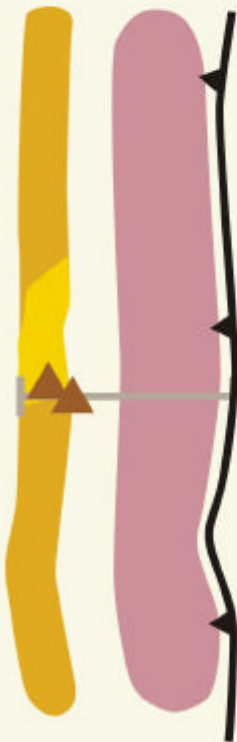


HOKKAIDO

..... Big rupture allows big postseismic transient?



CHILE



FAR-FIELD INTENSITY?

