

# 2010 Darfield, New Zealand Earthquake

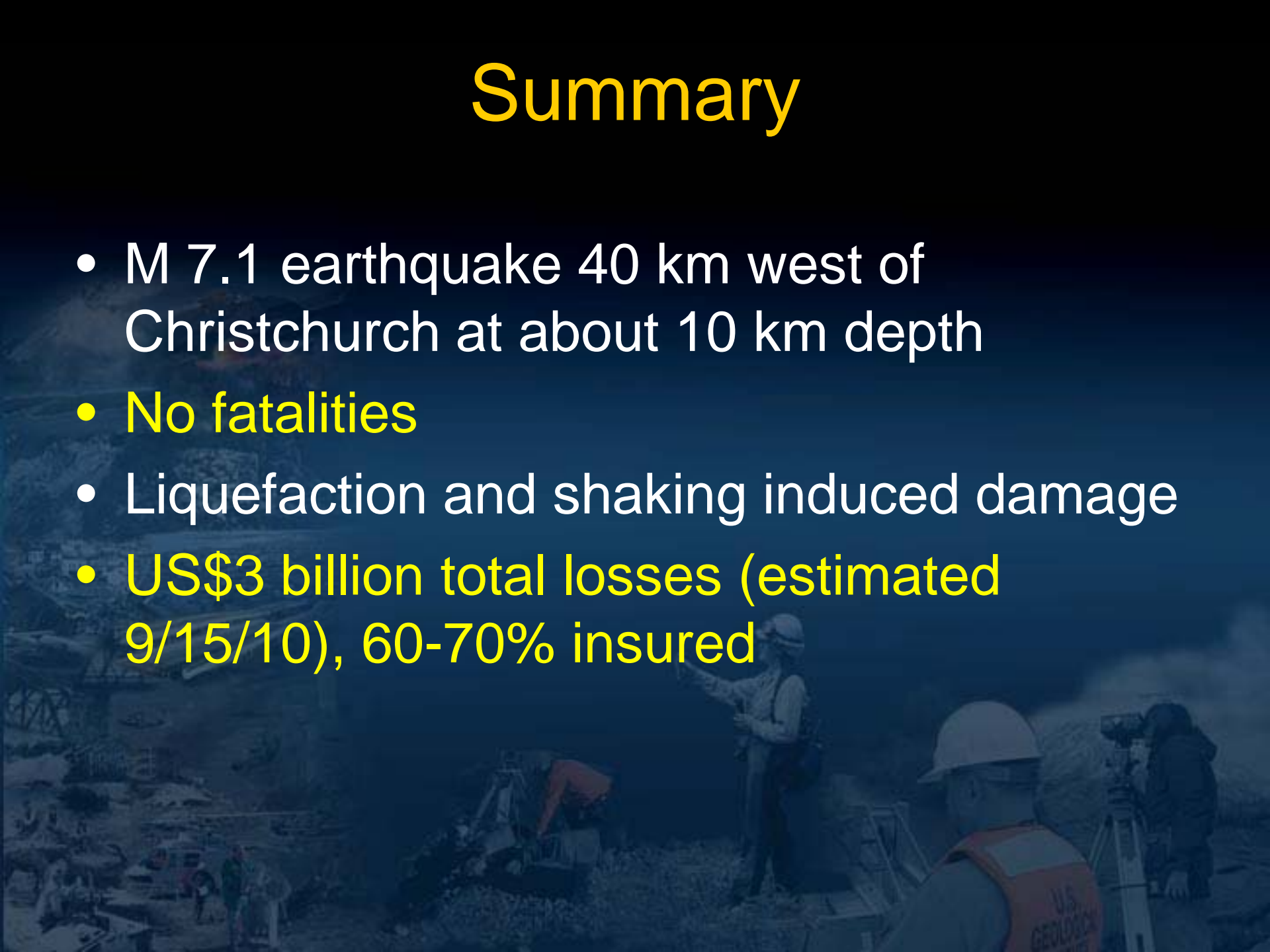
**Oliver Boyd, Ph.D.**  
*U.S. Geological Survey*

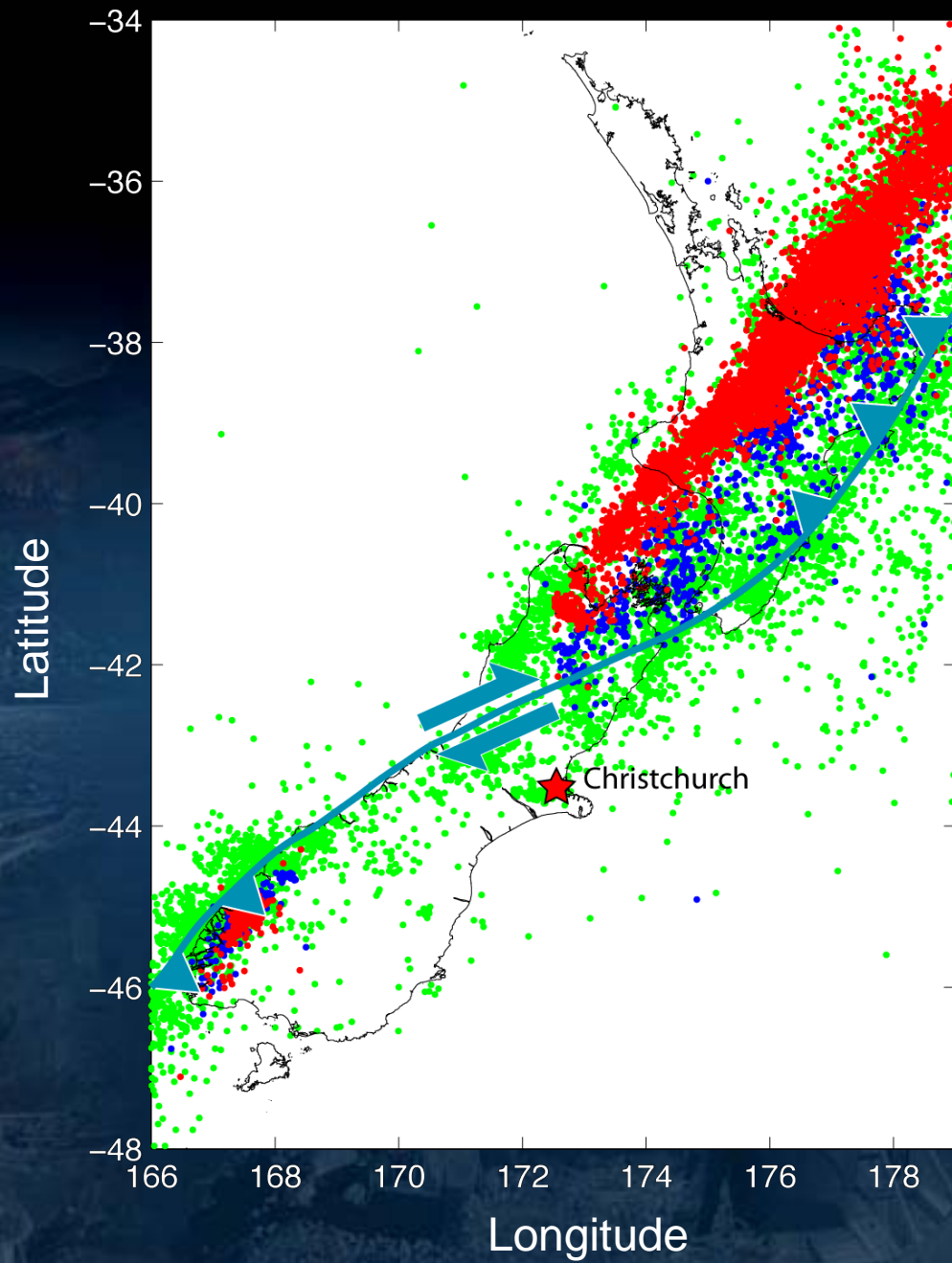
*NEHRP ACEHR Meeting, November 9<sup>th</sup>, 2010*

U.S. Department of the Interior  
U.S. Geological Survey

# Summary

- M 7.1 earthquake 40 km west of Christchurch at about 10 km depth
- **No fatalities**
- Liquefaction and shaking induced damage
- **US\$3 billion total losses (estimated 9/15/10), 60-70% insured**

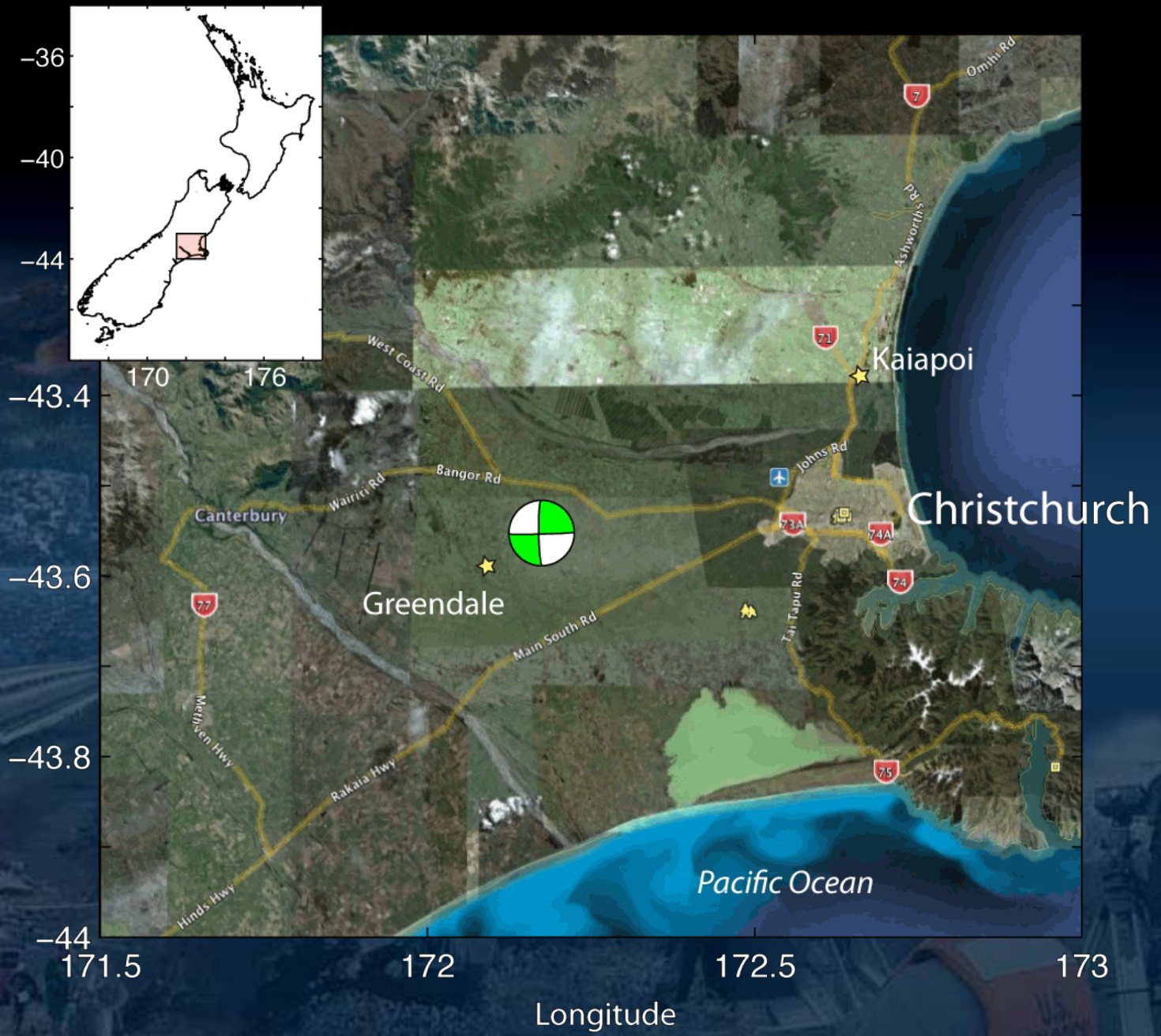




# The Earthquake

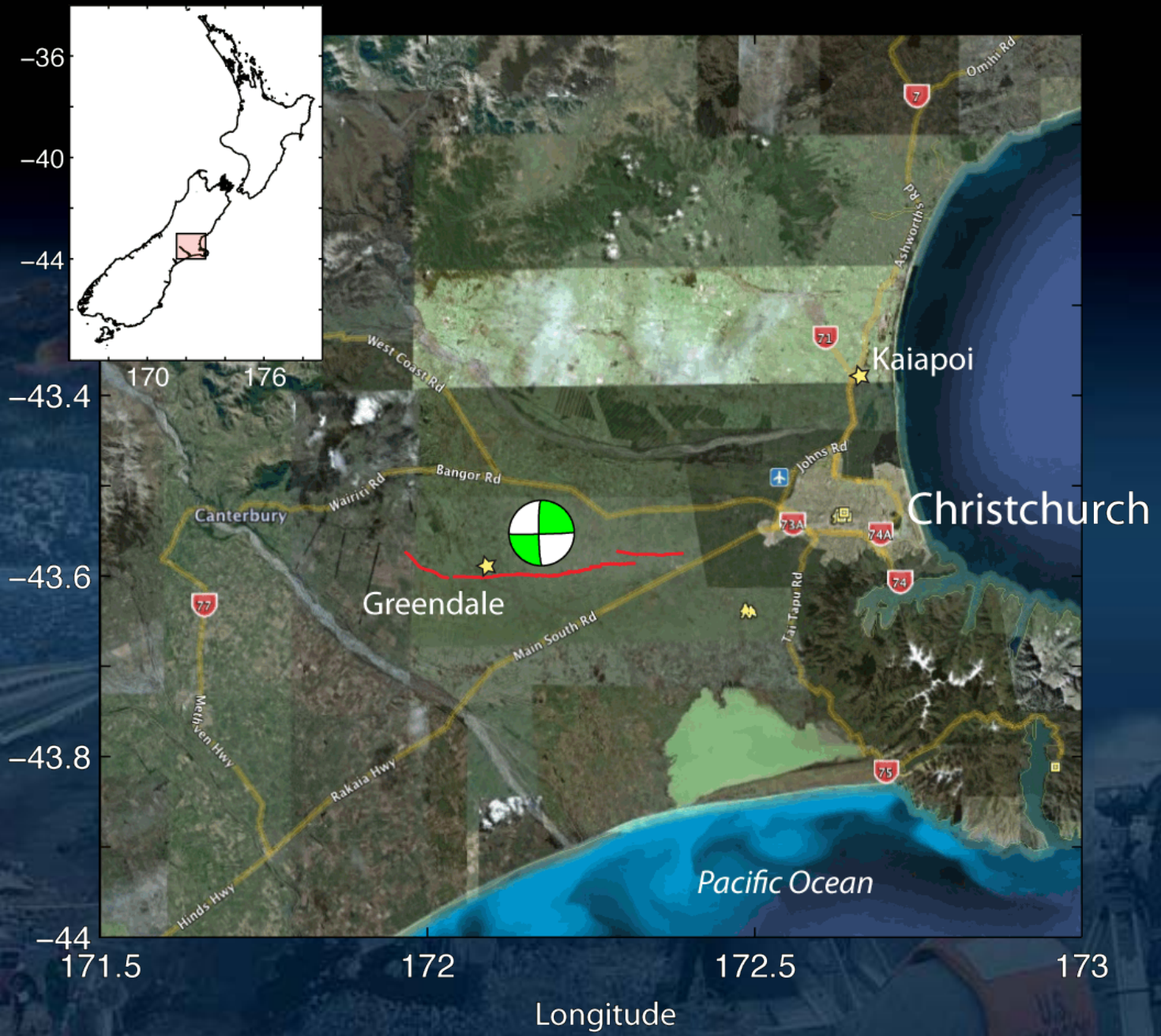


Latitude

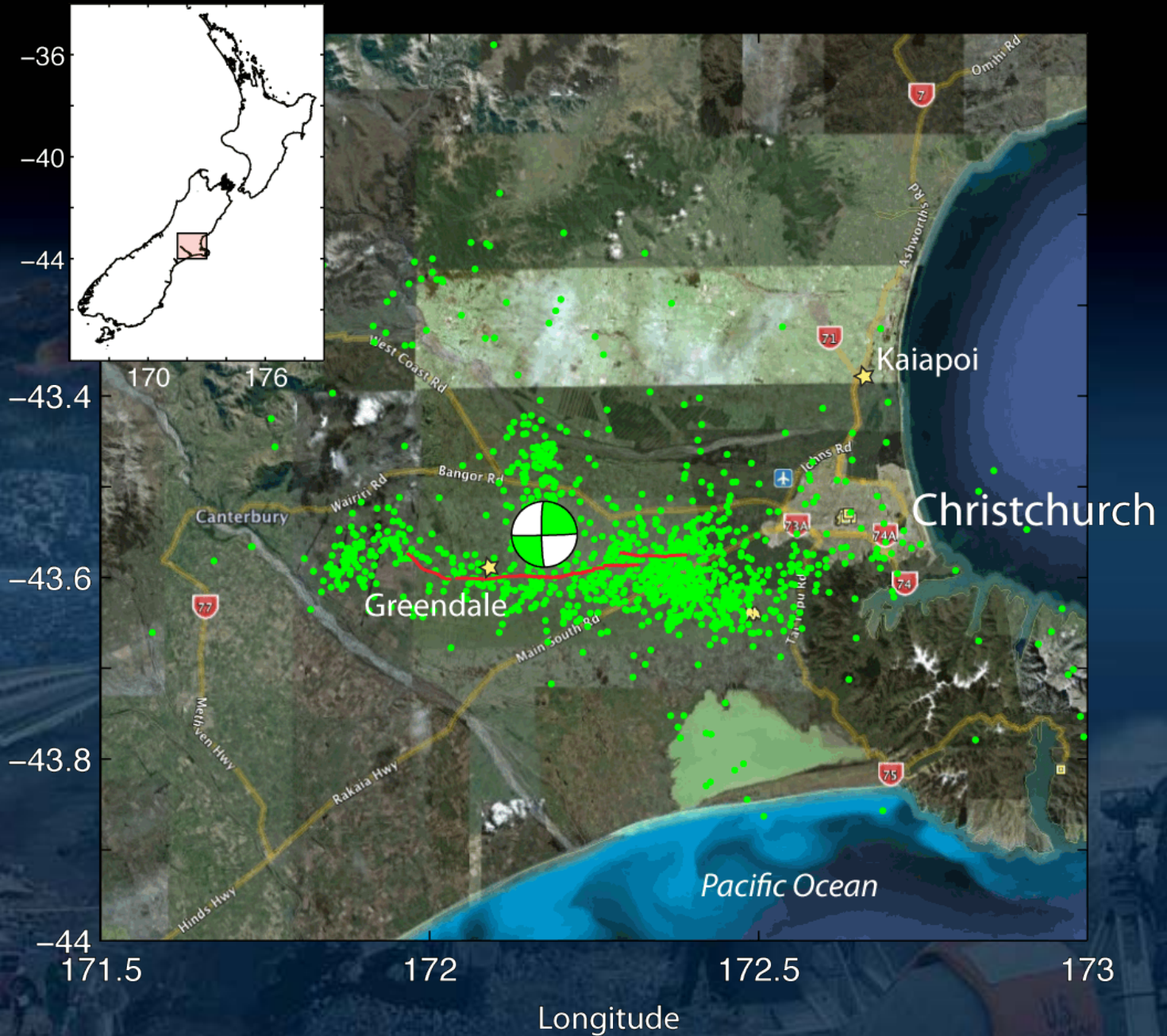


Longitude

Latitude



Latitude



-36

-40

-44

-43.4

-43.6

-43.8

-44

170

176

171.5

172

172.5

173

Longitude

Greendale

Kaiapoi

Christchurch

Pacific Ocean





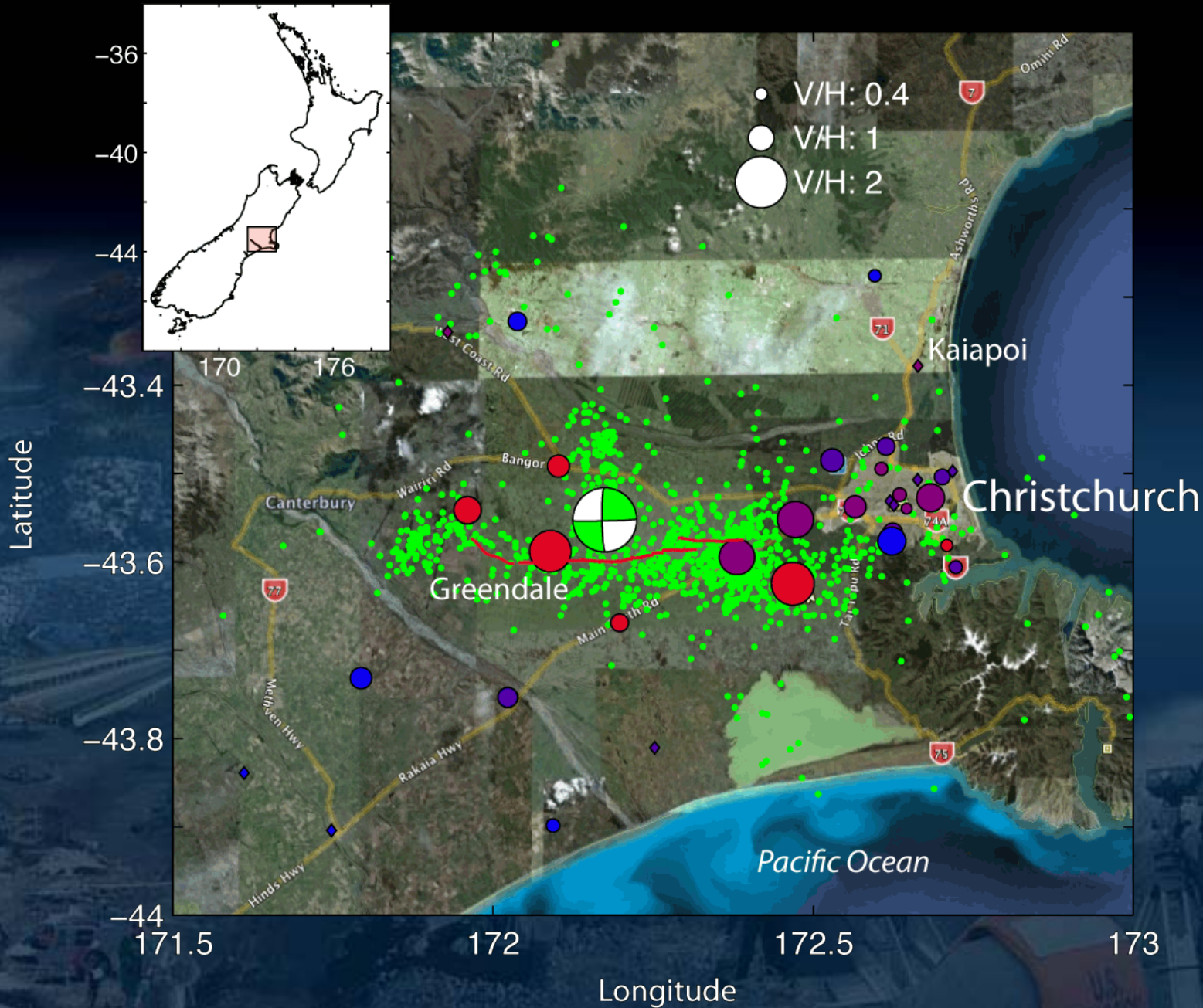






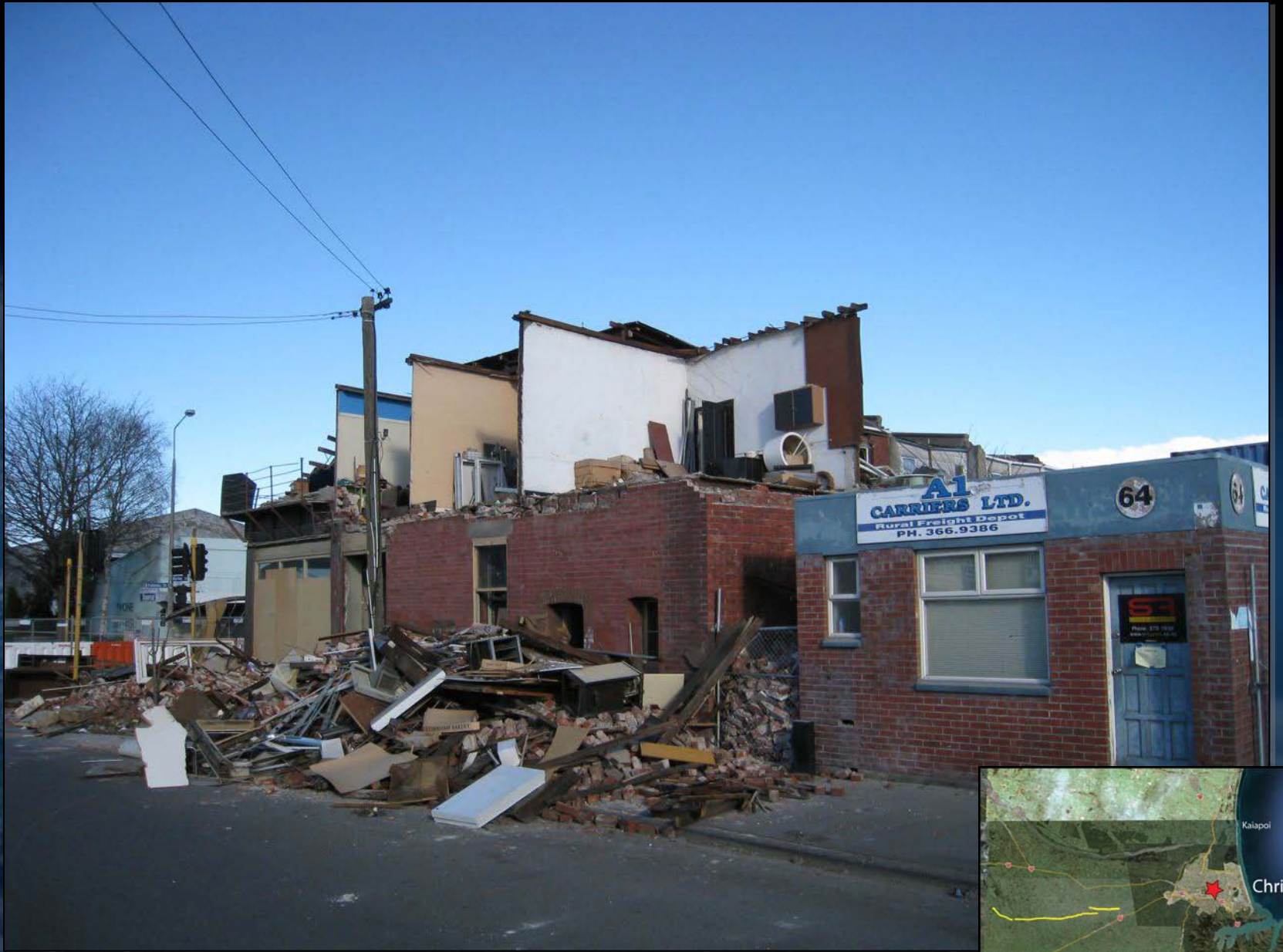
# Ground Shaking



















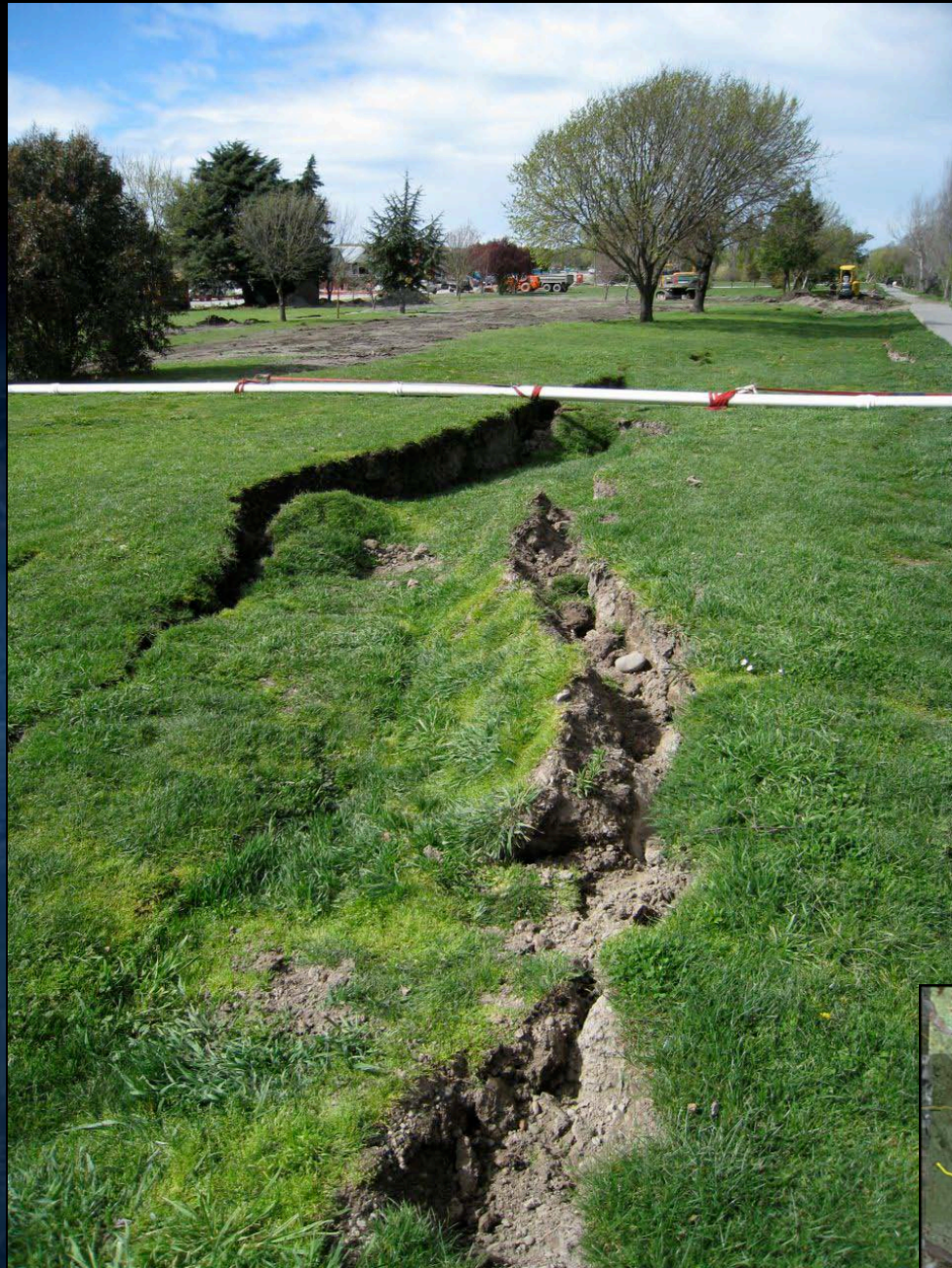
Google



# Liquefaction















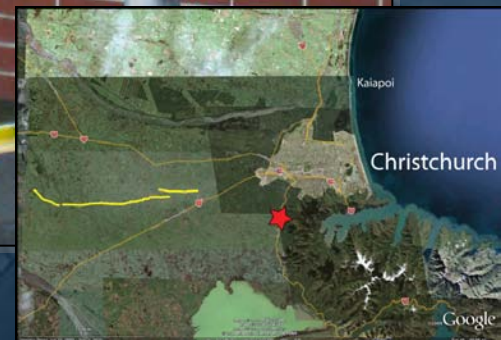














# Ancillary damage







Photo courtesy of Lincoln library

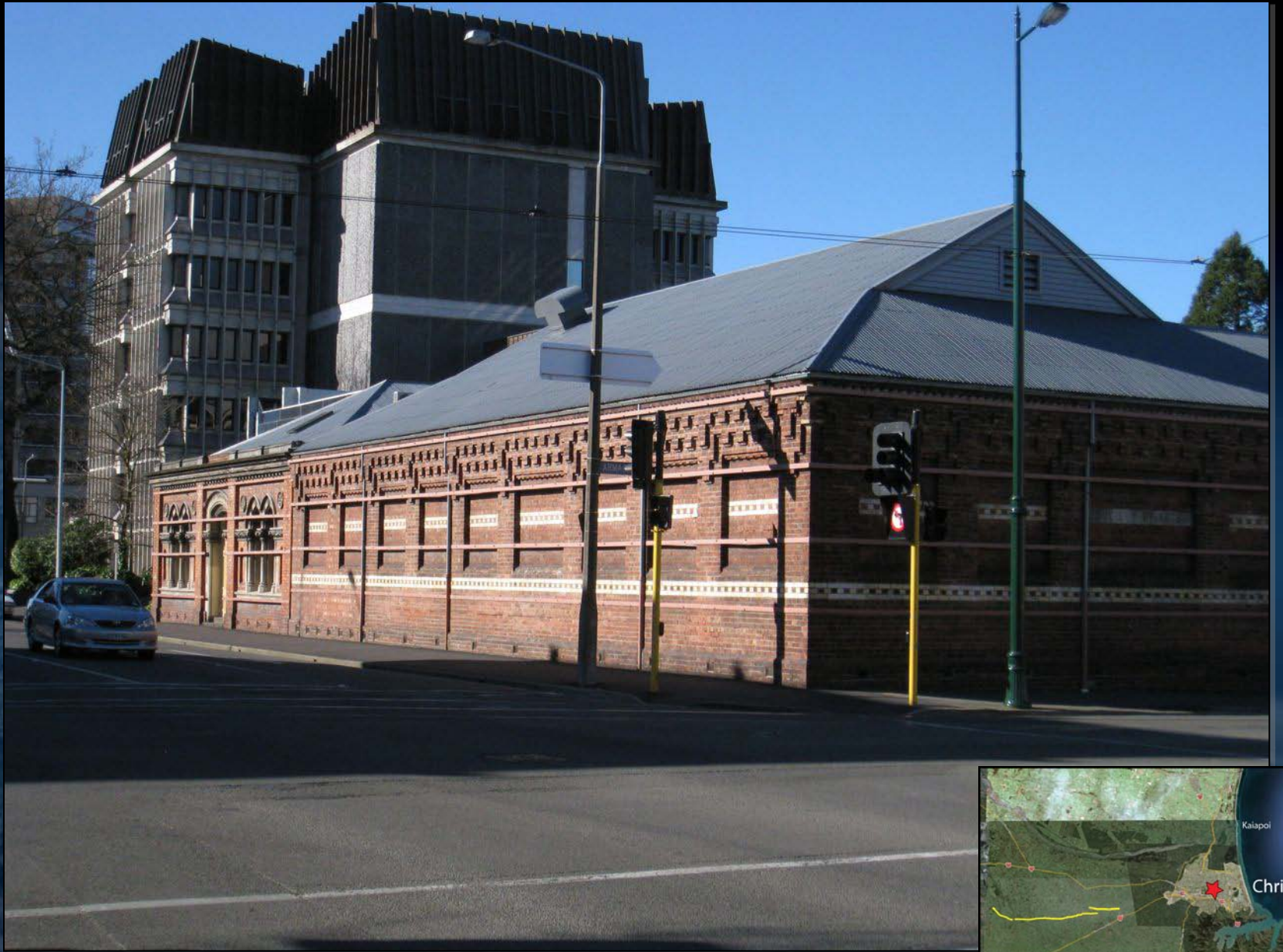


# Stevens



# Mitigation







# Summary:

## *Earthquake*

- M 7.1 earthquake 40 km west of Christchurch at about 10 km depth
- Occurred at 4:36 in the morning
- Resulted in 30 km east-west surface rupture with up to 4 m of right-lateral horizontal offset and 1 m down-to-the-north vertical offset
- Occurred on a fault that hadn't produced surface rupture in ~16,000 years



# Summary:

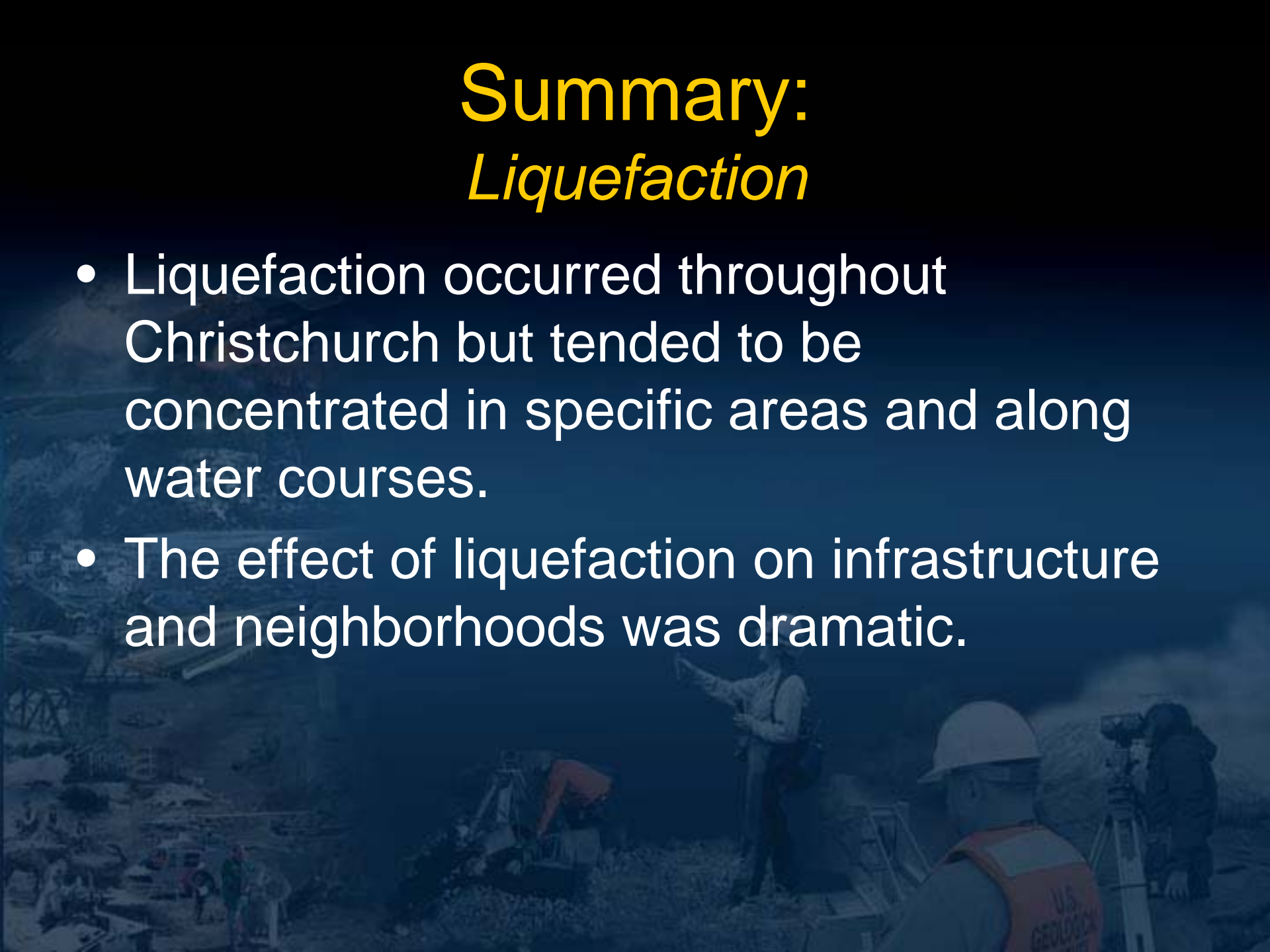
## *Ground shaking*

- Over 1.2 g vertical PGA and nearly 0.8 g horizontal PGA near the surface rupture. 0.2 – 0.3 g PGA in Christchurch.
- Ground accelerations in Christchurch were about 70% of the design values for periods less than 1.5 s, and 100% of the design values at longer periods.
- Retrofitted structures and structures built to code generally fared well.

# Summary:

## *Liquefaction*

- Liquefaction occurred throughout Christchurch but tended to be concentrated in specific areas and along water courses.
- The effect of liquefaction on infrastructure and neighborhoods was dramatic.



# Summary: *Costs*

- No fatalities
- US\$3 billion total losses (estimated 9/15/10), 60-70% insured

