Dale Alan Cox, Project Manager, USGS Multi-Hazards Demonstration Project

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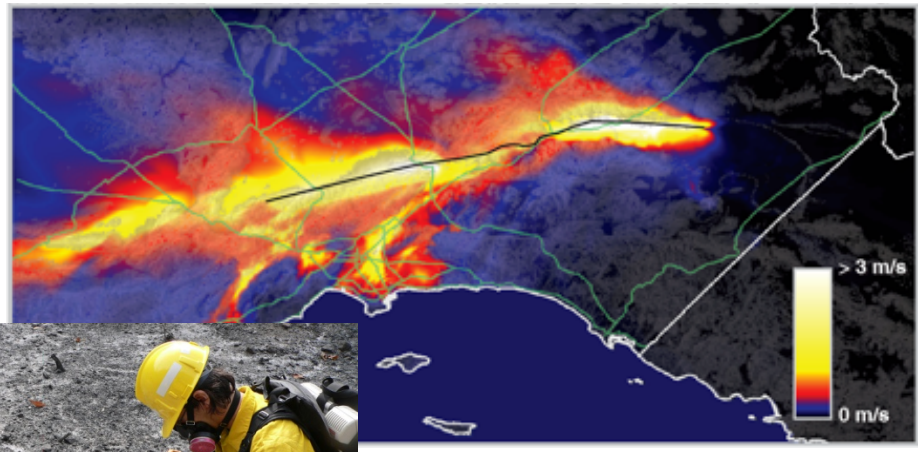
Fire / Debris Flow

2007 Post Fire Coordination



- Earthquake / Tsunami

  Earthquake Scenario

Winter Storm

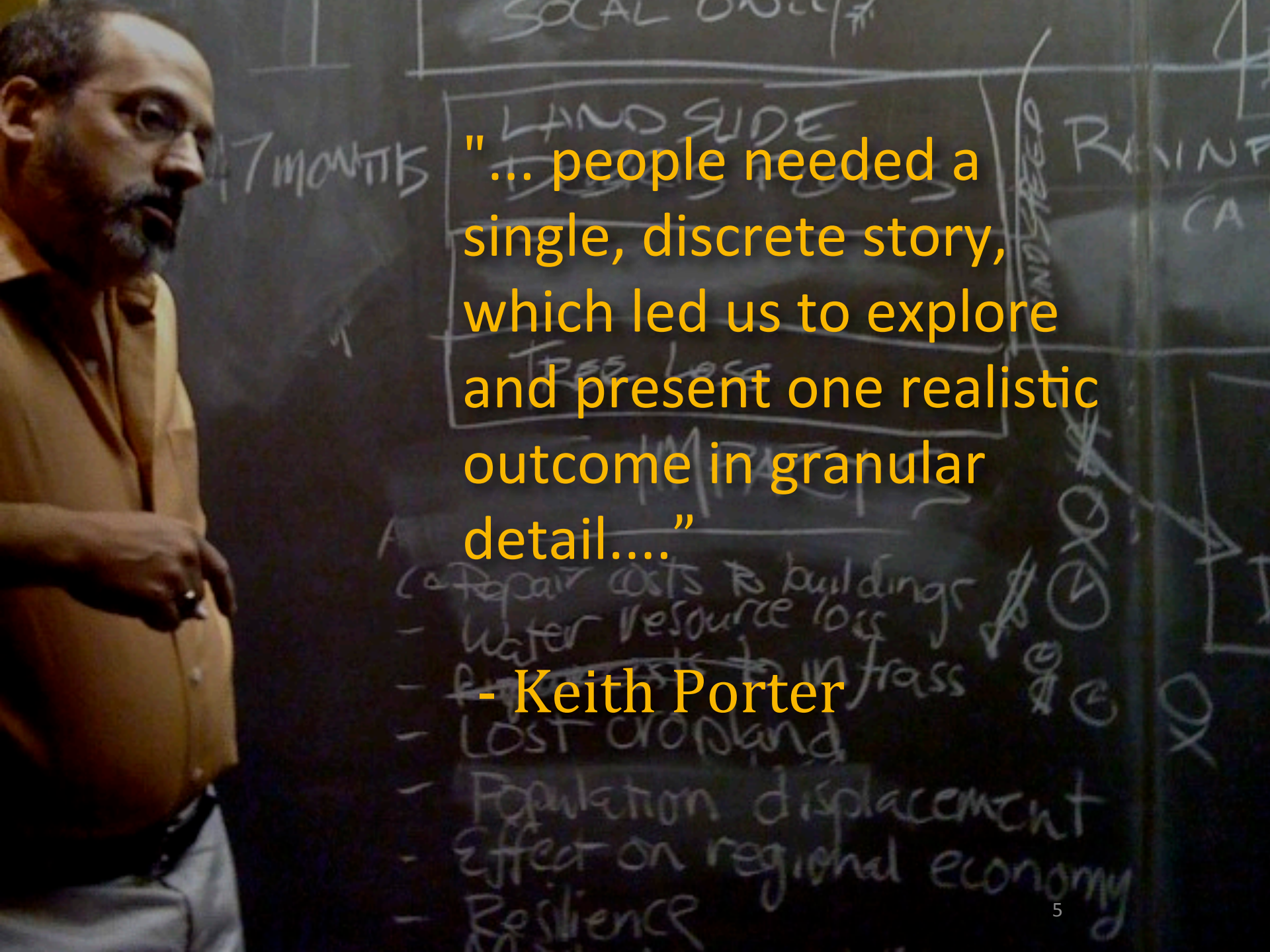
Winter Storm Scenario

Information Interface

Community Interface, Implementation, Tools and Training

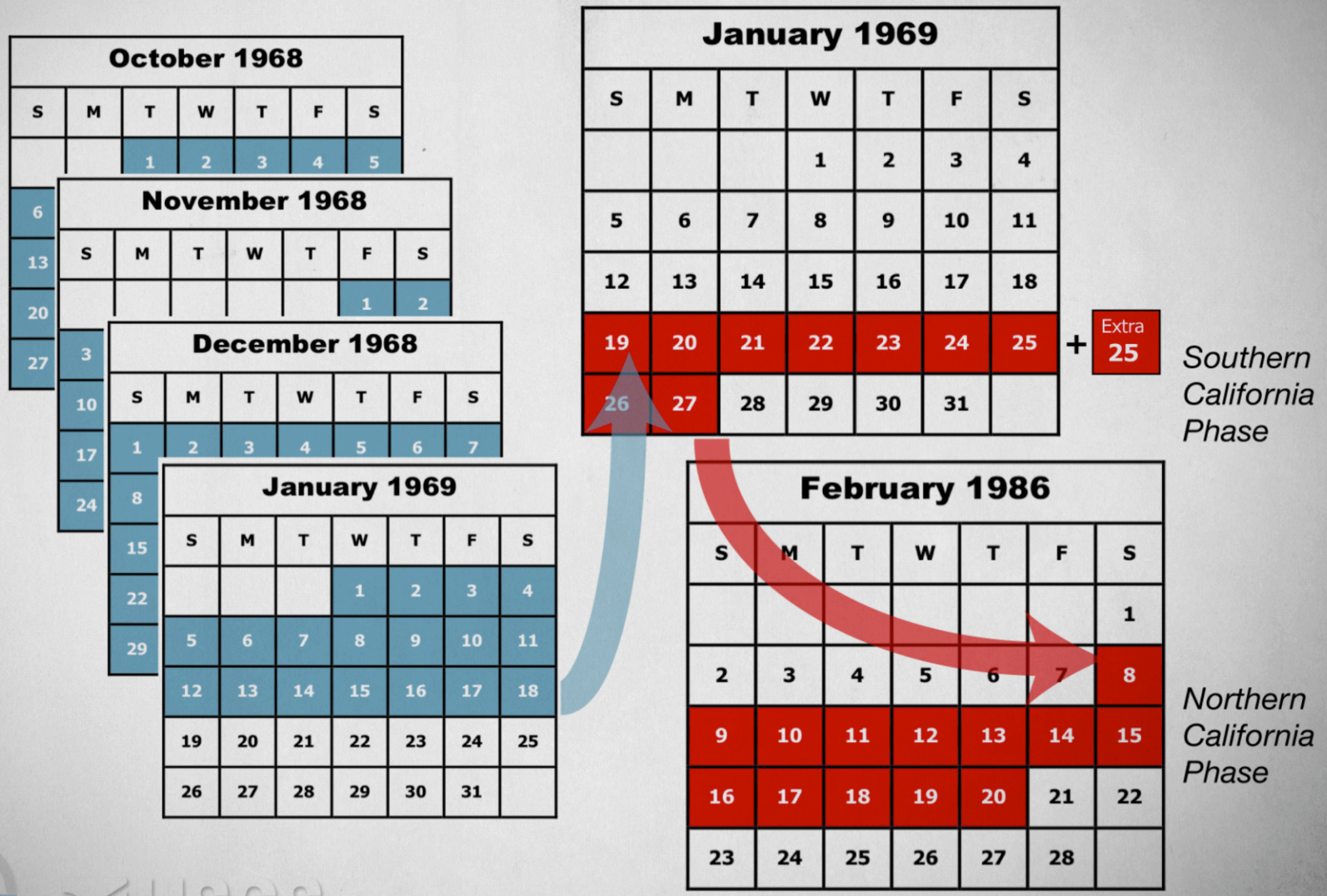
- A week-long series of events to inspire southern Californians to improve their earthquake resiliency; >6 million participants

- Based on a scenario of a major southern San Andreas earthquake designed by the USGS for California Office of Homeland Security's Golden Guardian exercise, Nov 2008, Oct 2009, Oct 2010, …


"... people needed a single, discrete story, which led us to explore and present one realistic outcome in granular detail....”
- Keith Porter

PRECONDITIONING PERIOD

ARkStorm PERIOD



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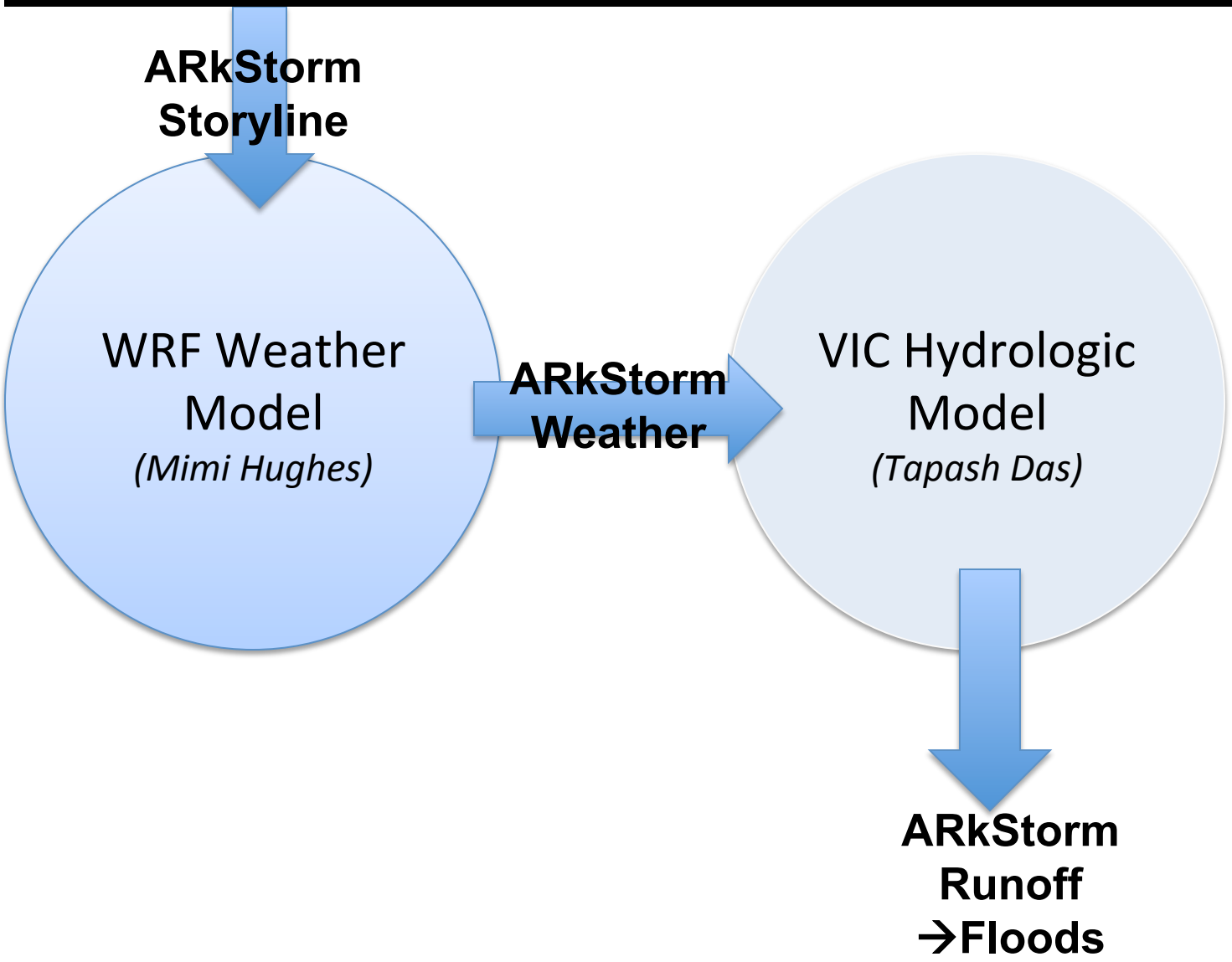
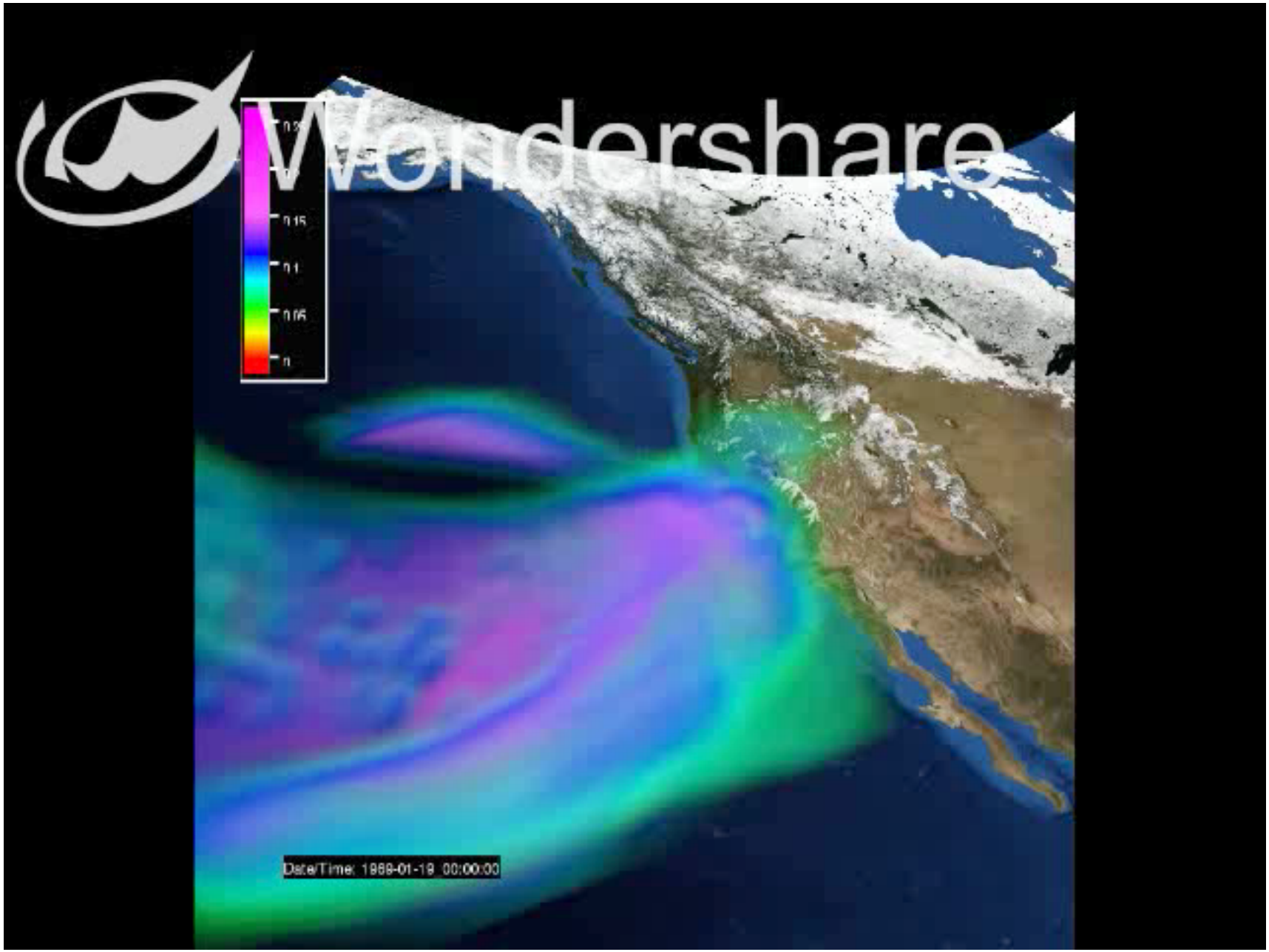
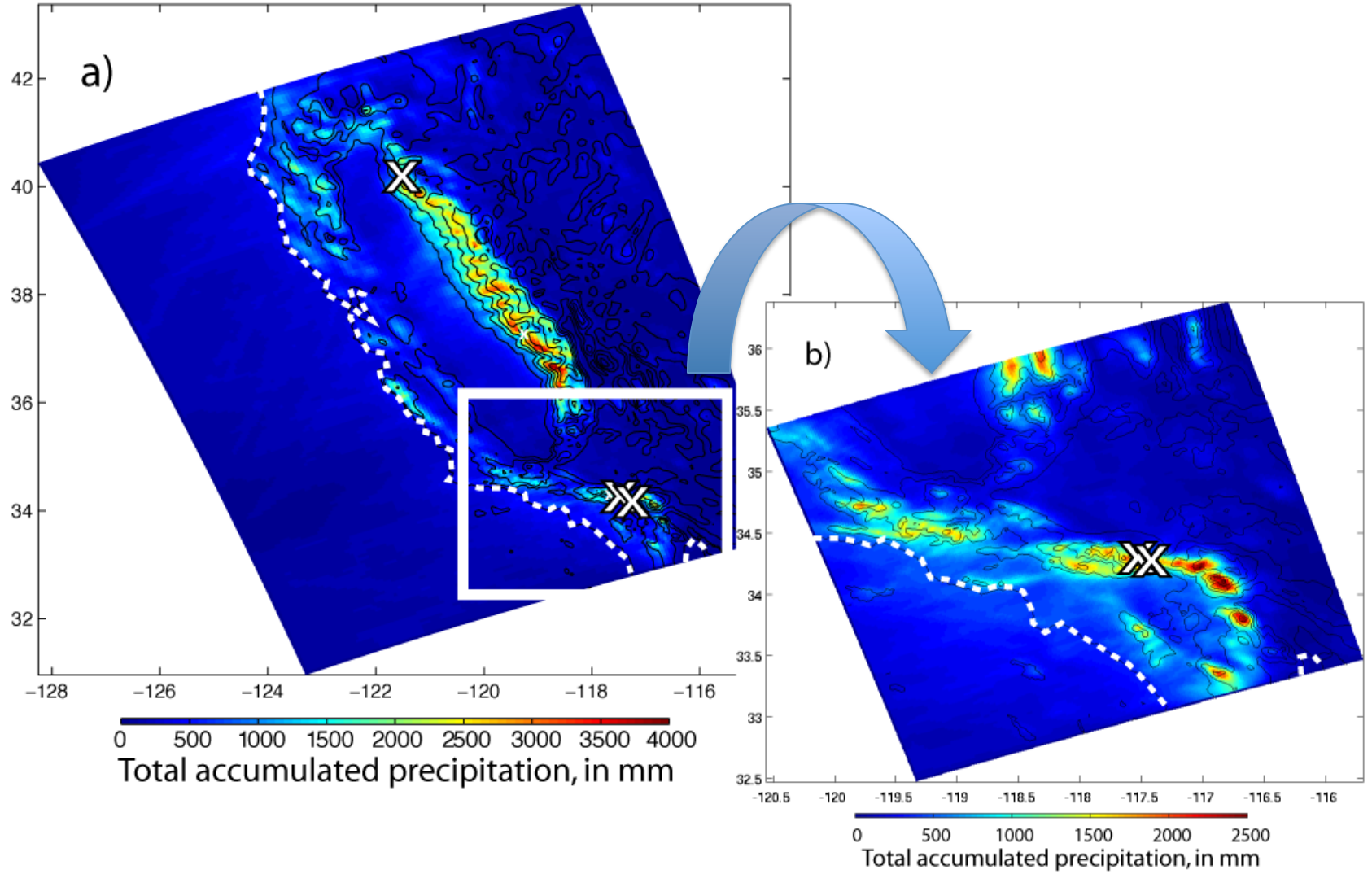
ARkStorm MODELING STRATEGY

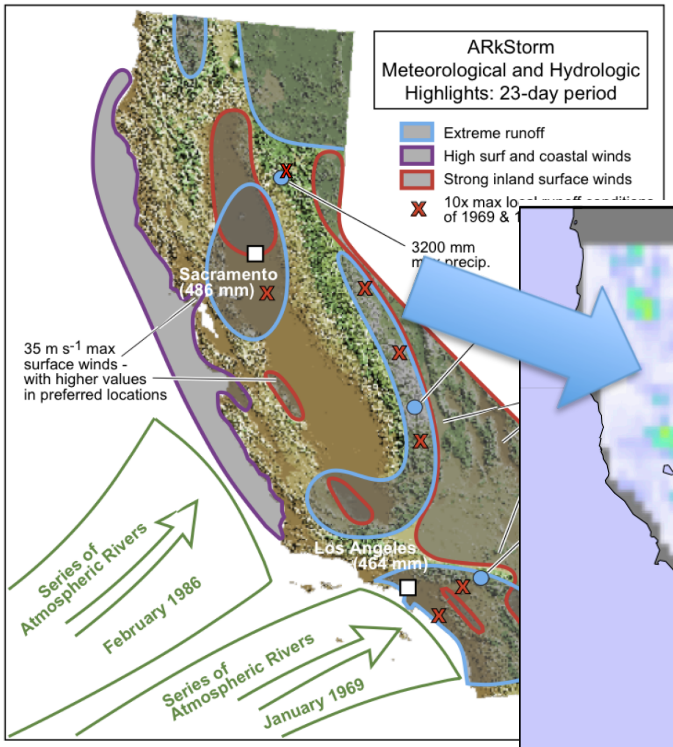


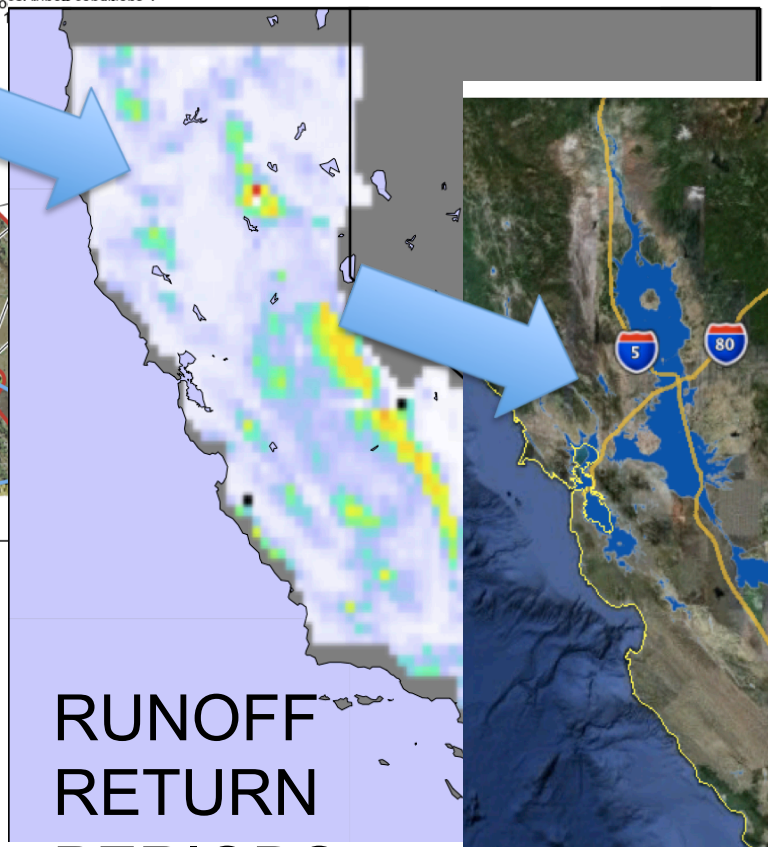


From
James Done,

ARkStorm PRECIPITATION TOTALS







RUNOFF RETURN PERIODS

Rough estimates of Flooding

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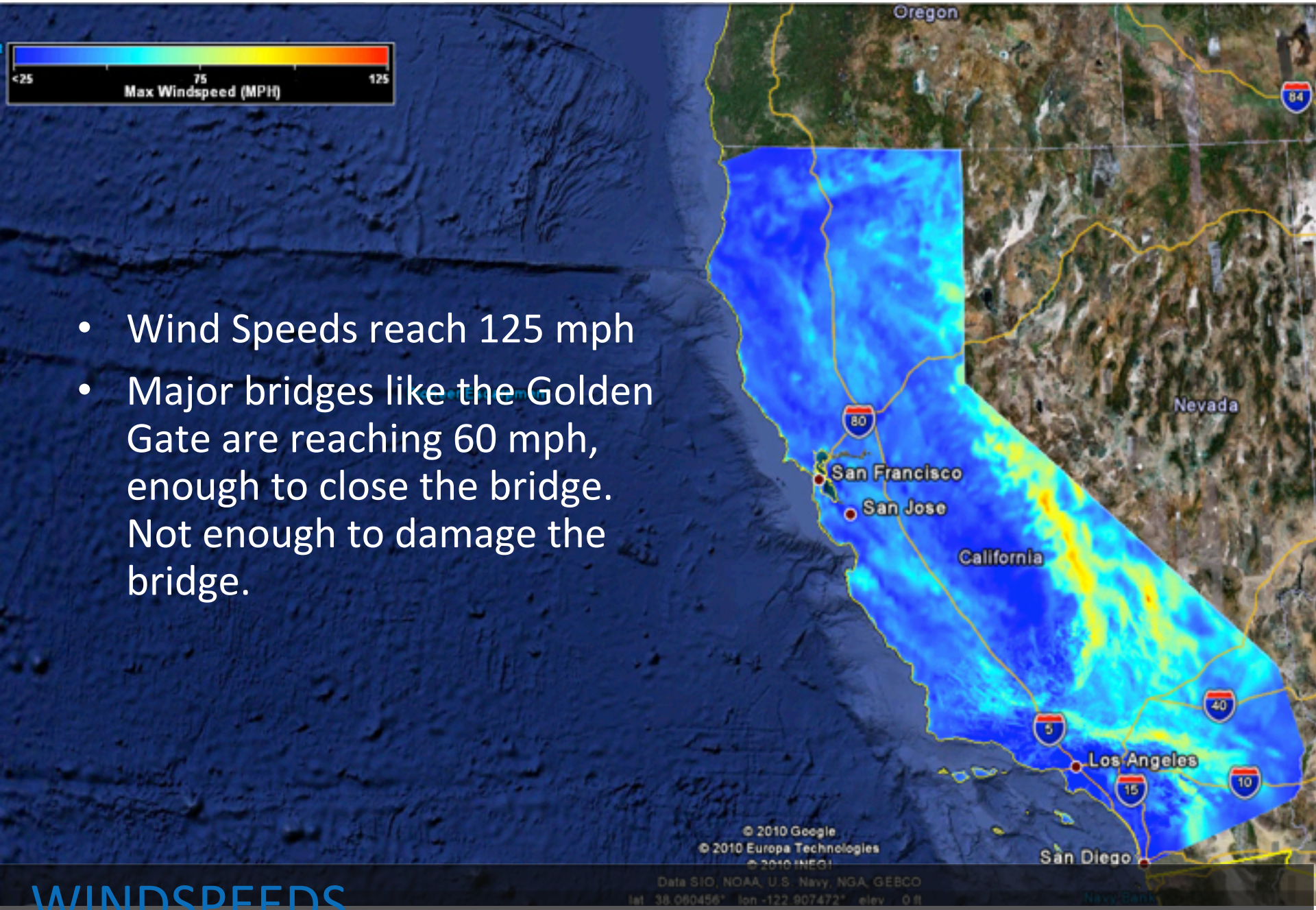

- Wind Speeds reach 125 mph
- Major bridges like the Golden Gate are reaching 60 mph, enough to close the bridge. Not enough to damage the bridge.

WINDSPEEDS

COASTAL IMPACT OF SEVERE STORMS

HAZARDS

- Beach erosion
- Flooding and inundation
- Property damage
- Cliff failure
- Threats to public safety

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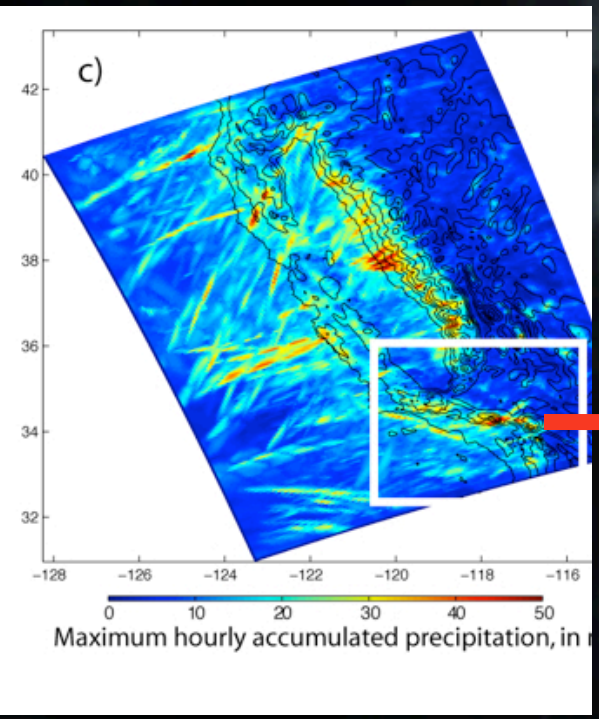
LANDSLIDE AND DEBRIS FLOW TASK



WET WEATHER

Mudflows arrive

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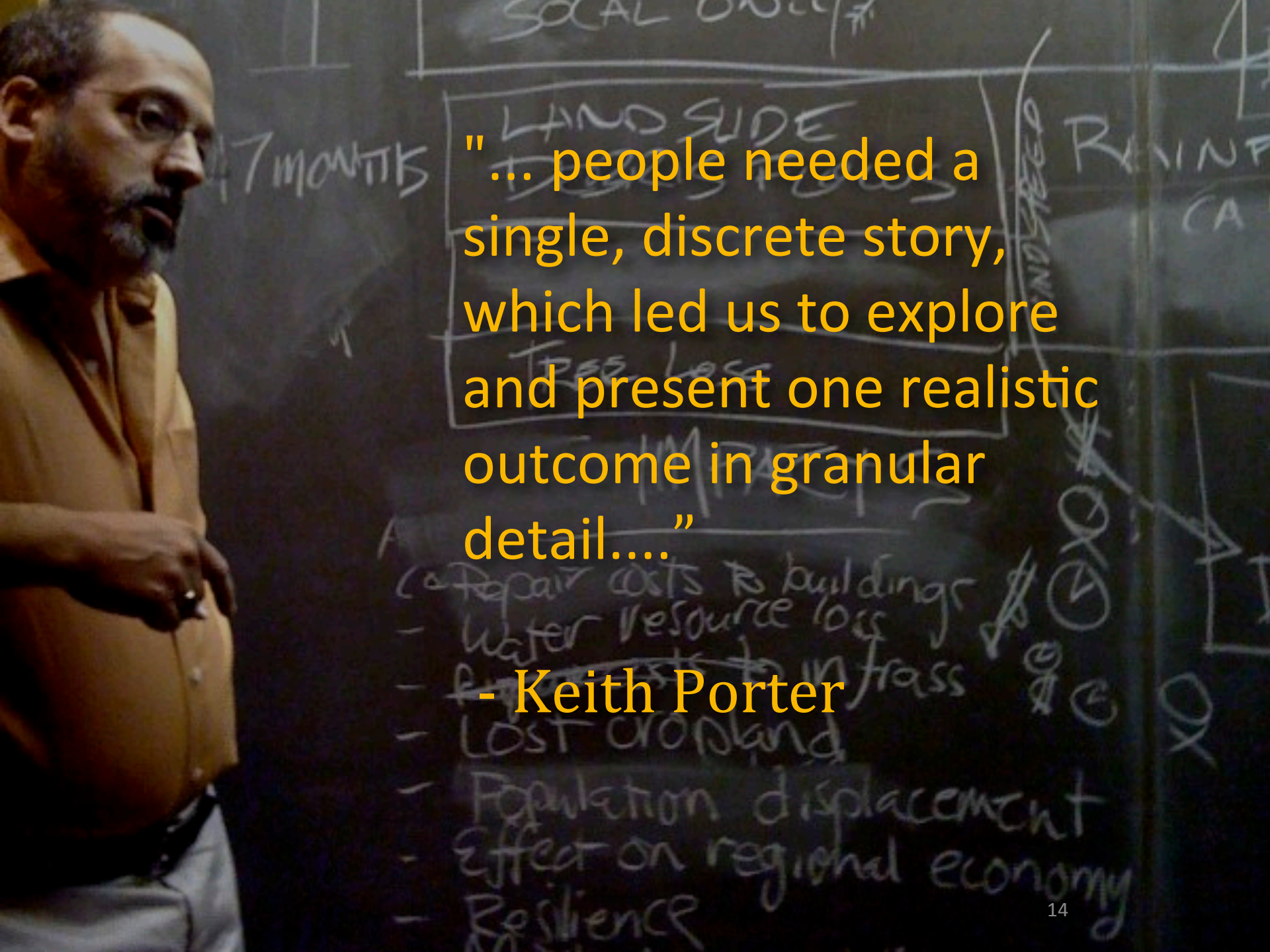
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- Keith Porter

PHYSICAL DAMAGES

- **Consultant studies**: roof damage, bridge scour, possibly telecommunications
- 12 panel discussion among 82 operators, engineers, & emergency managers from 47 agencies (Jan-Feb 2010)

> Roads & highways
> Electric power
> Dams & levees
> Water & wastewater

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PHYSICAL DAMAGES PANEL DISCUSSIONS

- Given meteorology, flooding scenario, landslide scenario, and
- Other lifeline panels' damage estimates
- We drew upon panelists' knowledge of their system & historic impacts, to
- Hypothesize one realistic outcome for the lifeline:

  Physical damage
  Restoration activities & challenges
  Restoration timeline (% restored by geographic area)

- Identify "Low hanging fruit" for improving resiliency
- Reducing damage
- Improving response & recovery
- Revisit after reviewing all other panels' 1st draft

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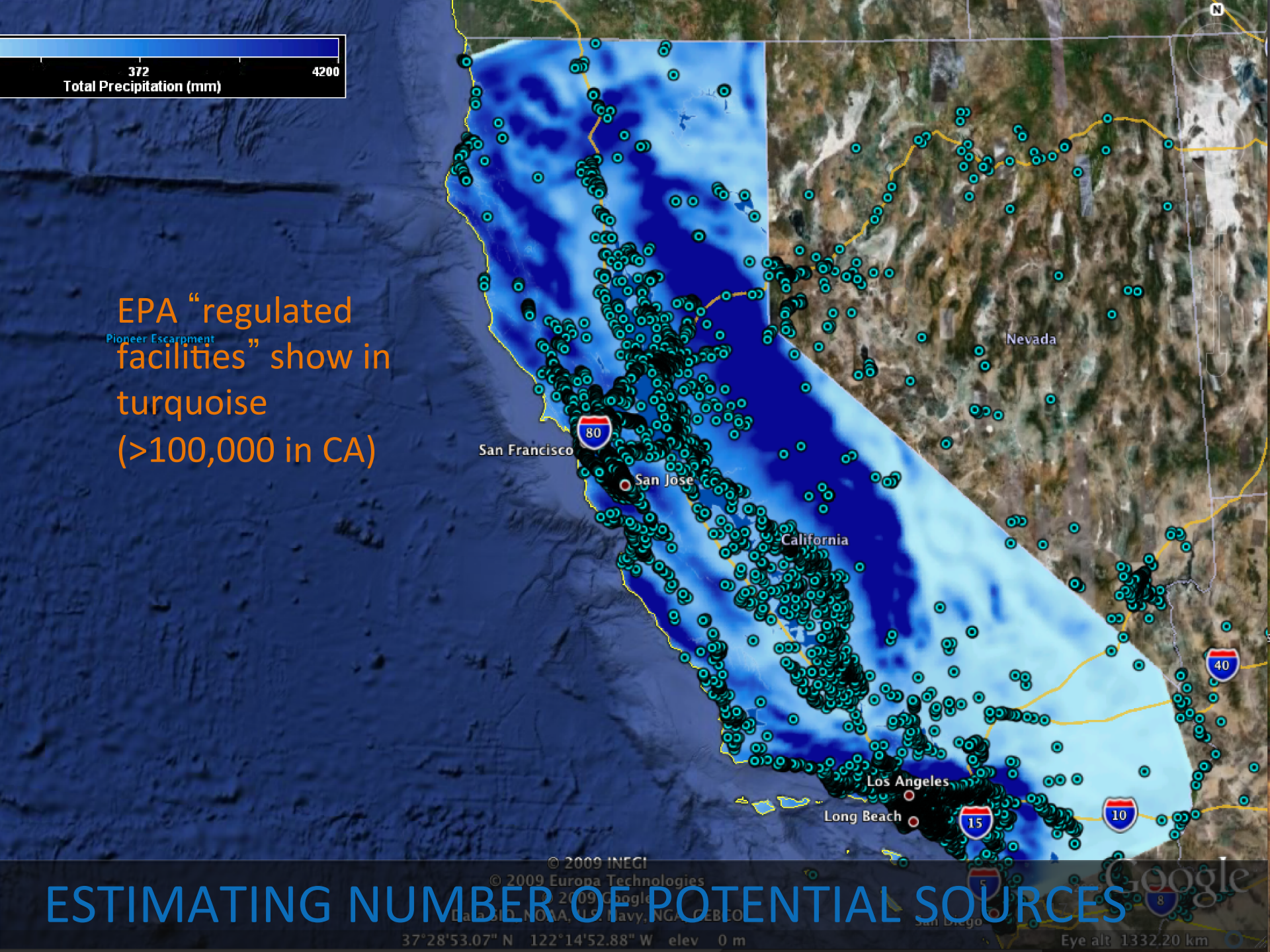

ESTIMATING NUMBER OF POTENTIAL SOURCES

Dettinger, M.D., Ralph, F.M., Hughes, M., Das, T., Neiman, P., Cox, D., Estes, G., Reynolds, D., Hartman, R., Cayan, D., and Jones, L., submitted, *Design and quantification of a severe winter storm scenario for emergency preparedness and planning exercises in California:* Journal of Hydrometeorology, *52 p.*

Porter, K., and 21 co-authors, in review, *An overview of the ARkStorm scenario:* USGS Open-File Report, *72 p.*

- *Public exercise remains uncertain*

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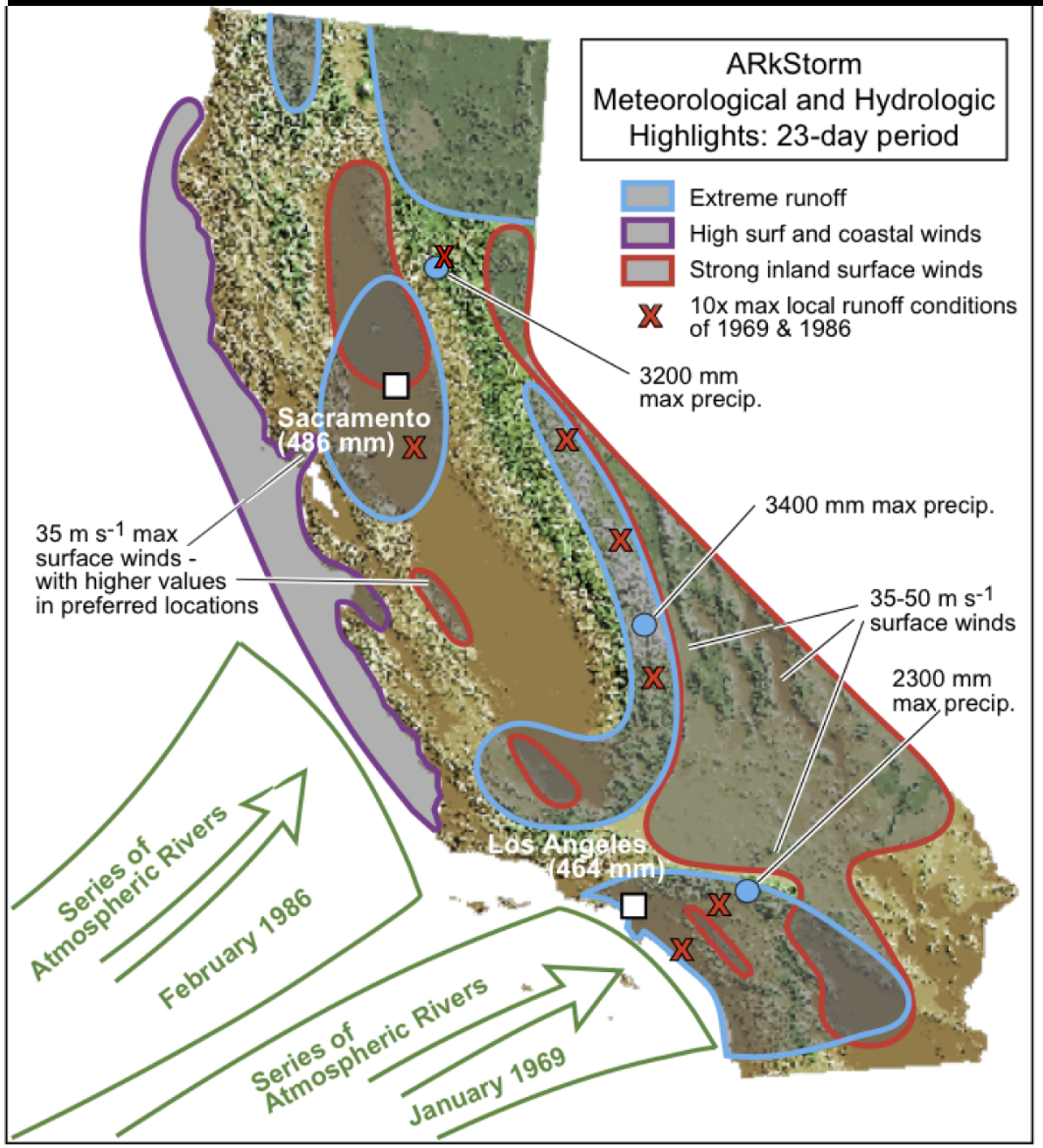
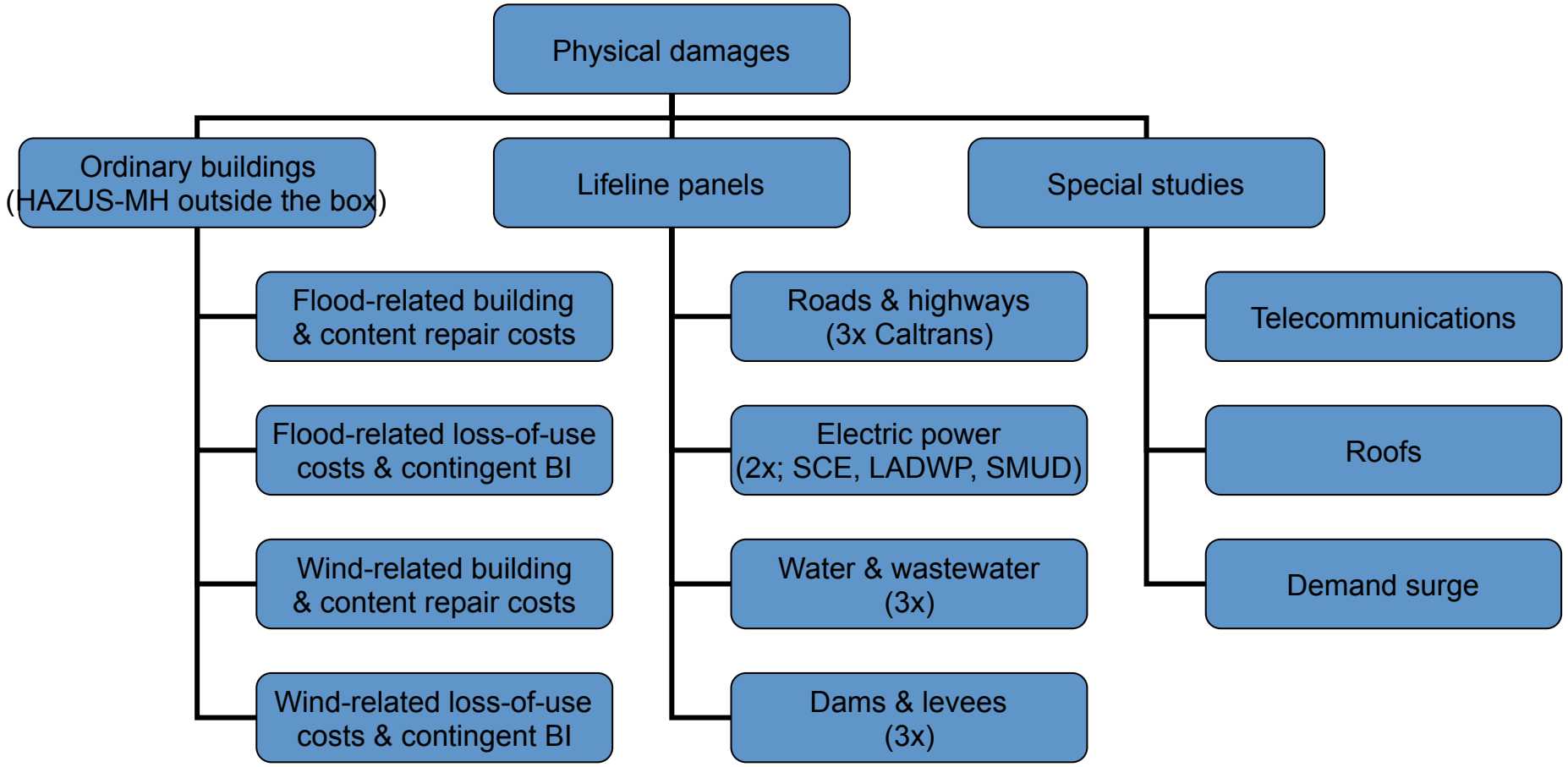
SUMMARY OF ARkStorm METEOROLOGICAL EVENTS



Dettinger, M.D., Ralph, F.M., Hughes, M., Das, T., Neiman, P., Cox, D., Estes, G., Reynolds, D., Hartman, R., Cayan, D., and Jones, L., submitted, *Design and quantification of a severe winter storm scenario for emergency preparedness and planning exercises in California:* Journal of Hydrometeorology, *52 p.*

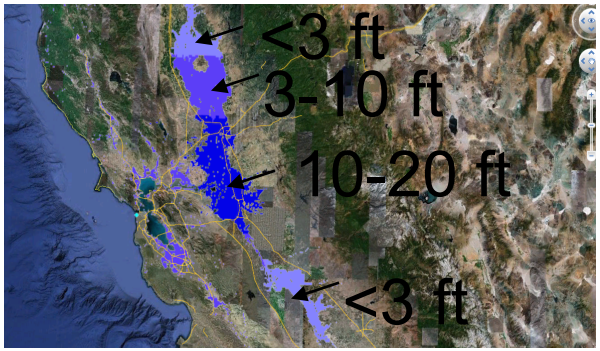
Physical damage estimates



Building & content repair costs

HAZUS-based analysis (outside of HAZUS)

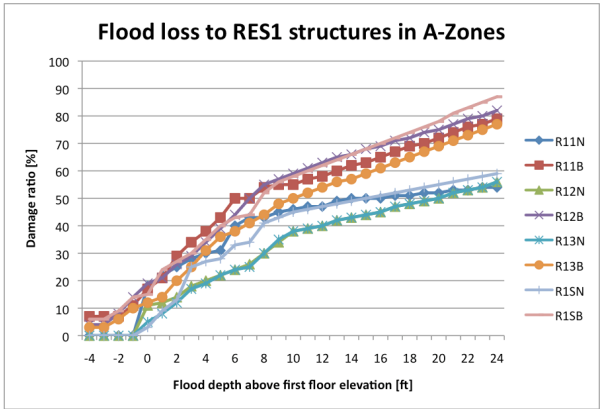
- Loss = ∑V*y(s)
- V = Value exposed
- y = vulnerability function
- s = environmental excitation (e.g., flood depth)



s = flood depth

Flood-related building repair costs ~ $200bn

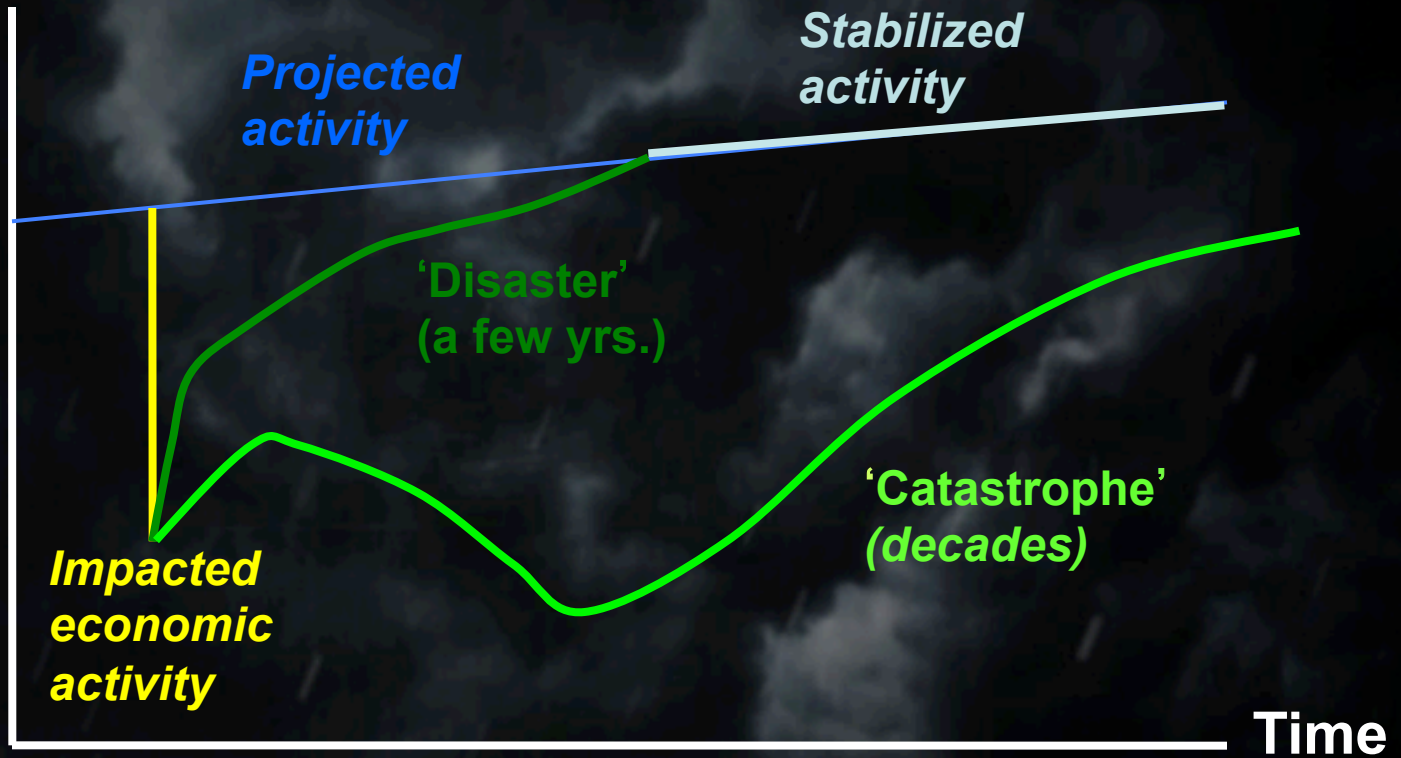
- Equiv. to ~3-5% of replacement costs
- Or 5-10 years of construction at 2007 rates
- 24% of buildings have some flood damage
  - *1% light damage, 22% extensive, 2% complete*
- Flood-related content losses: ~$100bn?



Example vulnerability functi

Wind-related building repair costs ~$6bn

Economics of a Natural Disaster



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