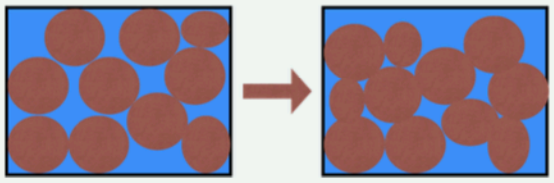
Can we reproduce site response accounting for soil nonlinearity and pore-pressure effects?

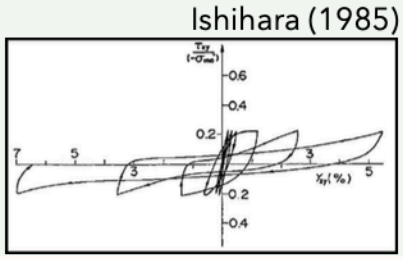
CYCLIC MOBILITY

Before loading After loading



- Instantaneous change in pore pressure (if no water evacuation)
- Excess-pore pressure development due to shear loading

Ishihara (1985)

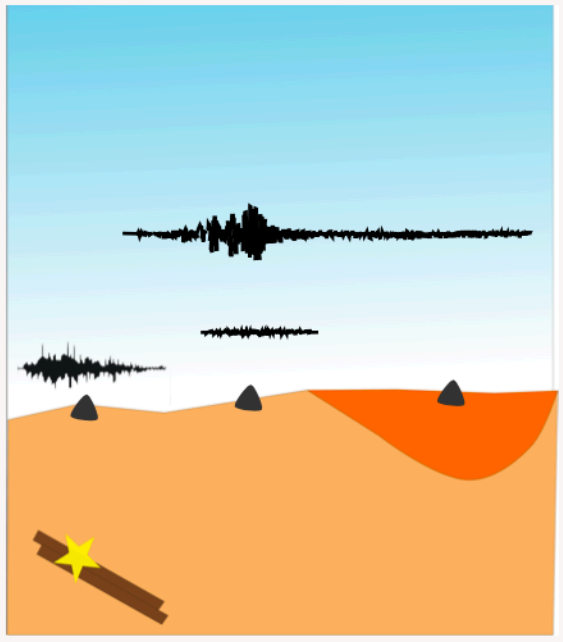


MORE Strength loss &

MORE permanent deformation

SITE EFFECTS

- Significant change of wave energy and duration inside sedimentary basin (ex: The 1985 Mexico earthquake)

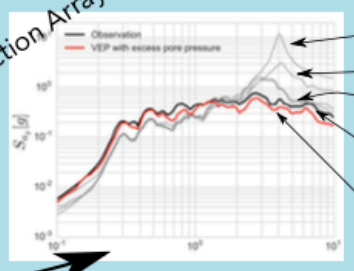


OUR APPROACH

A linear approach is not sufficient to understand the combined effect of these phenomena on wave propagation

- MPII model of Iwan (1967): Modelling hysteresis with use of friction angle & cohesion
- Liquefaction front model of Iai et al. (1990): Modelling pore-pressure rise under shearing

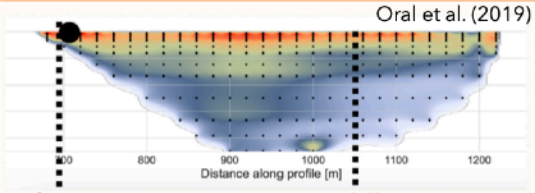
verified in the case of Wildlife Refuge Liquefaction Array (Holzer et al., 1989)



Oral et al. (2017)

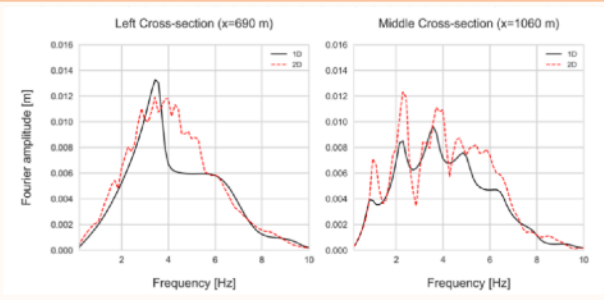
1D APPROACH UNDERESTIMATES NON-LINEAR BASIN RESPONSE

Oral et al. (2019)

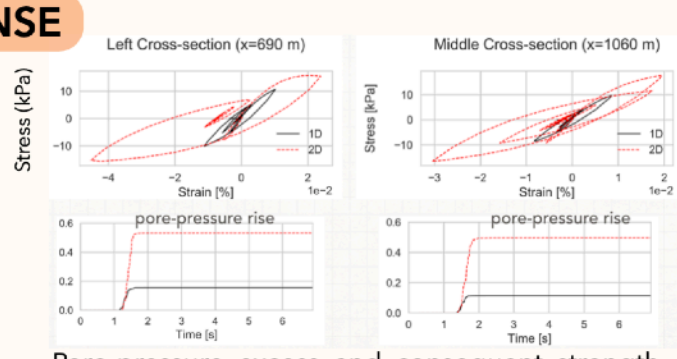


Left section (x=690 m) Middle section (x=1060 m)

We compare the basin response in 1D and 2D approaches



- 2D basin geometry leads to complex wave propagation also when non-linearity occurs



- Pore-pressure excess and consequent strength loss are not predicted in 1D approach

Conclusion: Complex site requires the consideration of the coupled effect of soil and geometrical complexities

Big picture: Can we apply our approach to real sites? See the application on Kathmandu basin (Nepal).

More about codes:
see tutorials linked at homepage

synergistic work with
C. Gélis & L.F. Bonilla