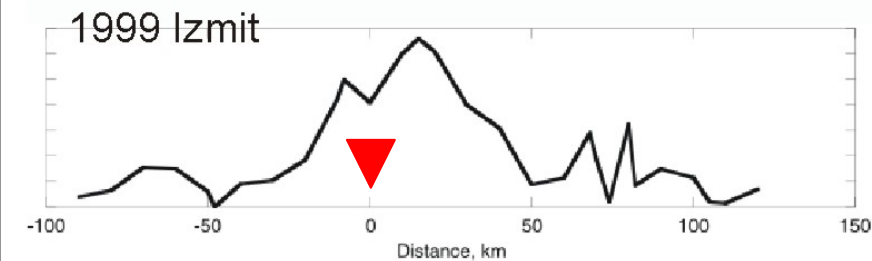
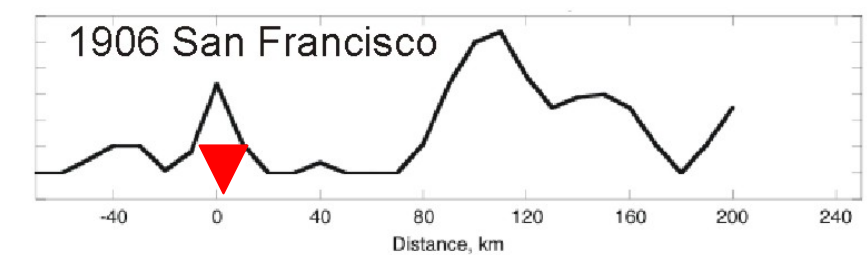
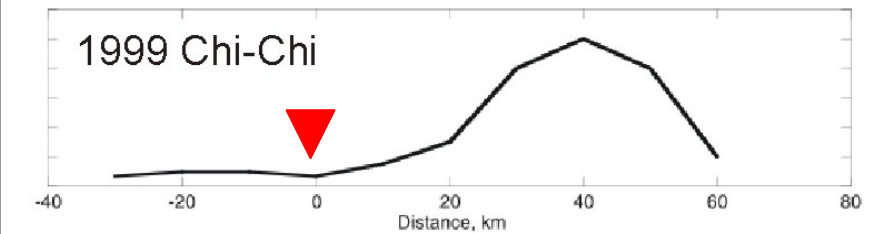
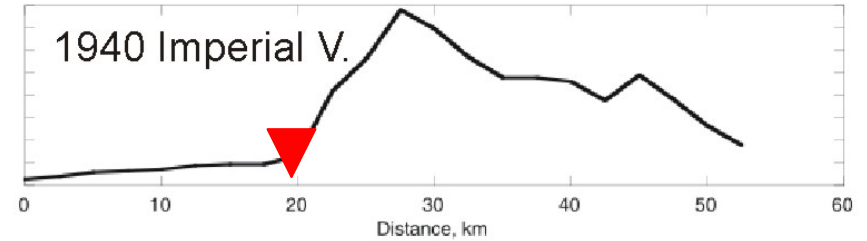
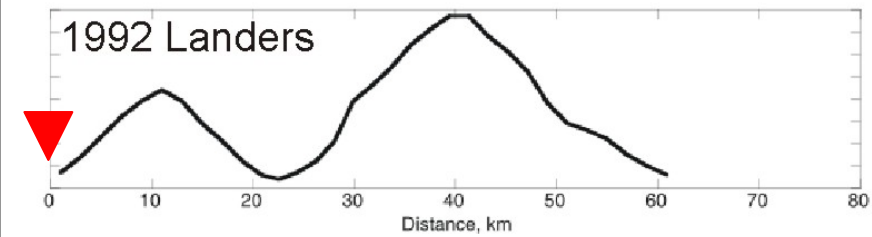
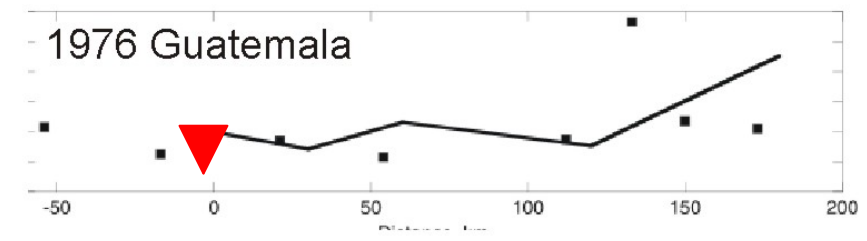
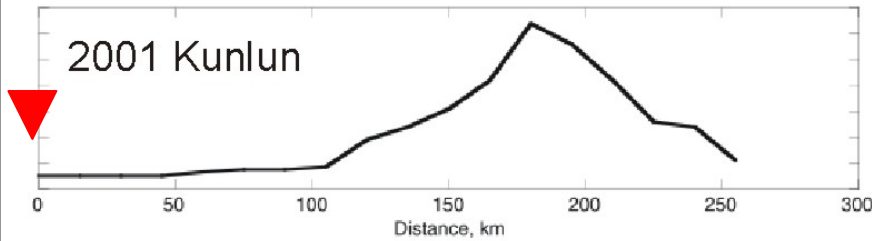
An aerial photograph of a vast, flat, light-colored landscape, likely a salt flat or a dry lake bed. The terrain is uneven with various shades of white, grey, and brown, suggesting different mineral compositions or moisture levels. A semi-transparent grey rectangular box is overlaid in the center of the image, containing the text "Rheological heterogeneities, crack arrest and healing phenomena" in a bold, red, sans-serif font.

**Rheological heterogeneities,
crack arrest and healing
phenomena**

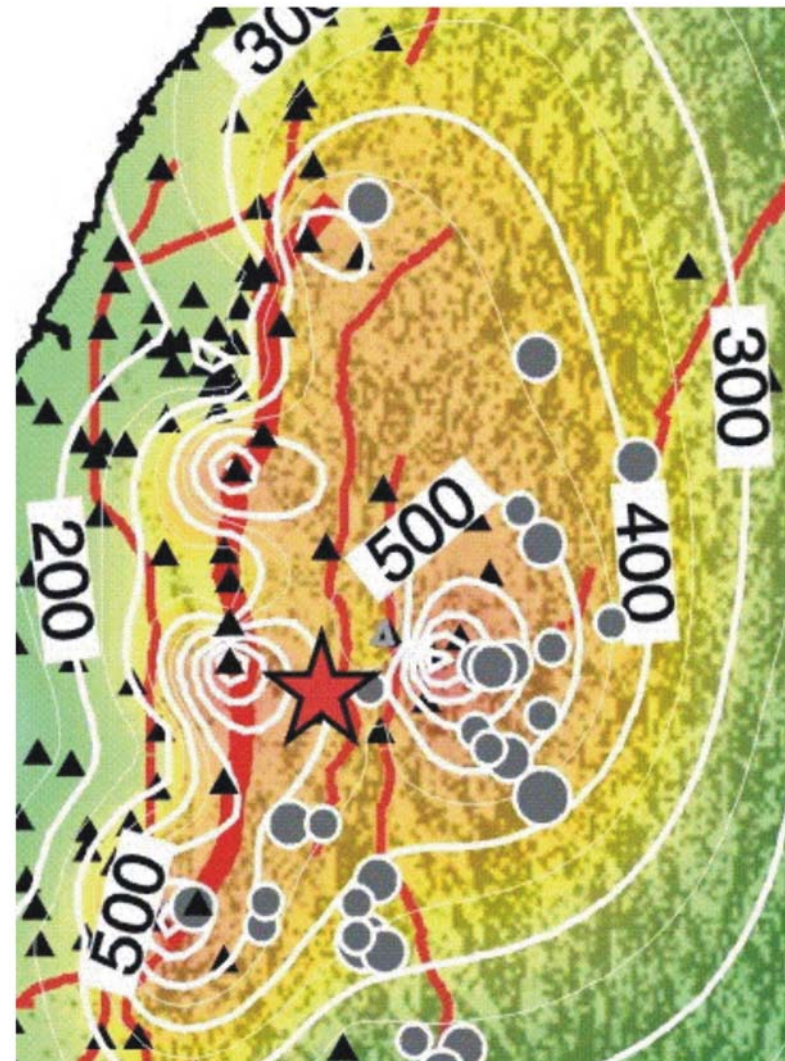
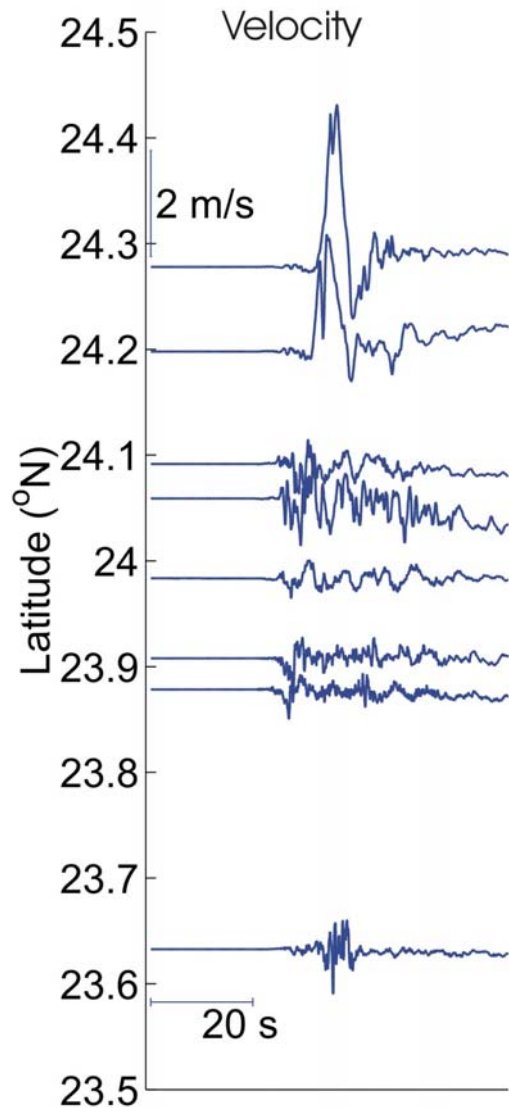
Slip distribution of large earthquakes



Ground motion from Chi – Chi, Taiwan, EQ

Brodsky and Kanamori (2001)

Ma et al. (1993)



Healing types

1. CLASSICAL ENLARGING CRACK

- The dynamic problem is solved for homogeneous configurations
- No healing occurs: the fracture propagates without limit
- Non realistic; only reference case

2. ARTIFICIOUS ANALYTICAL MODIFICATION TO FRICTION LAW TO INCORPORATE HEALING

- *Perrin et al. (1995); Zheng and Rice (1998), ...*
- *Self – healing or short slip duration*

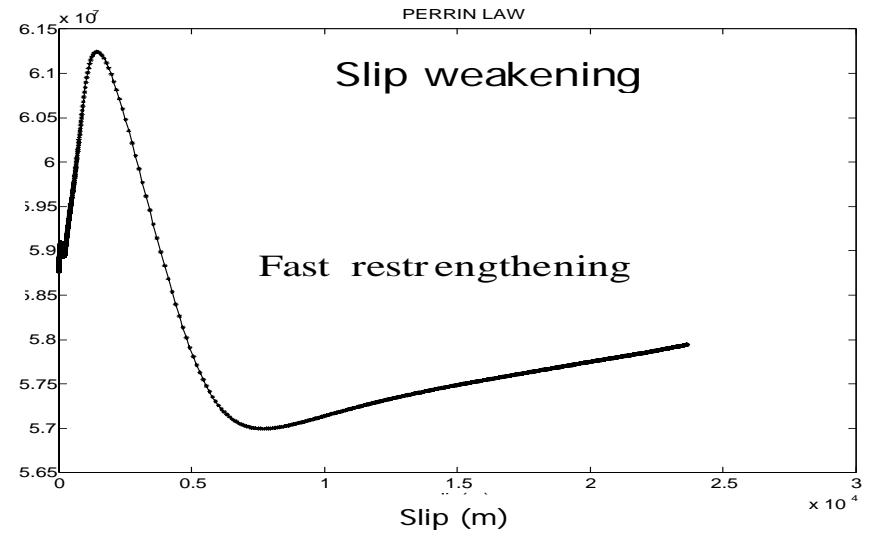
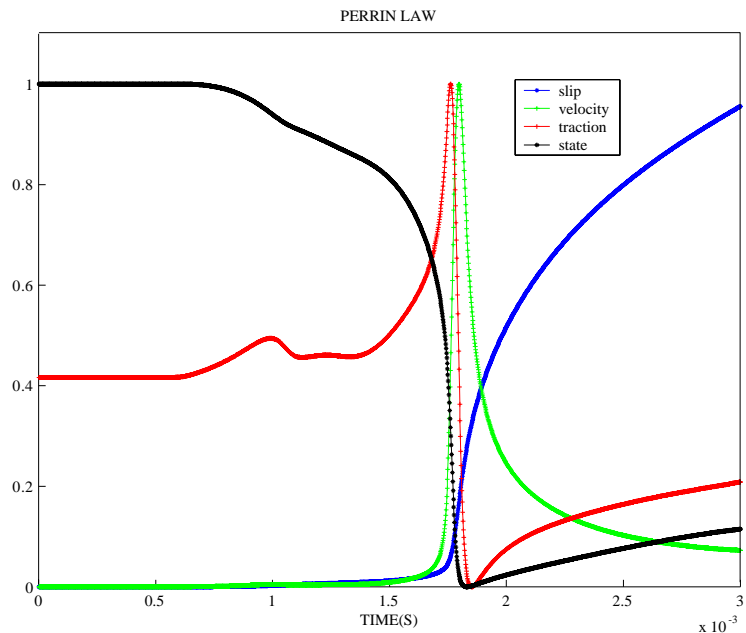
3. HETEROGENEOUS CONFIGURATIONs

- *Heterogeneities in the spatial distributon of frictional parameters*
- *Realistic configurations*
- *Barrier – healing vs. self – healing*



Self – healing with Perrin law

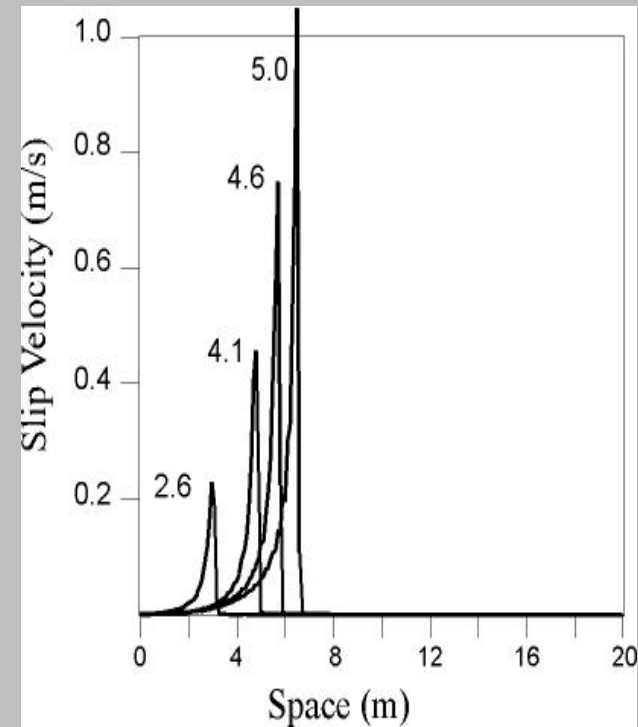
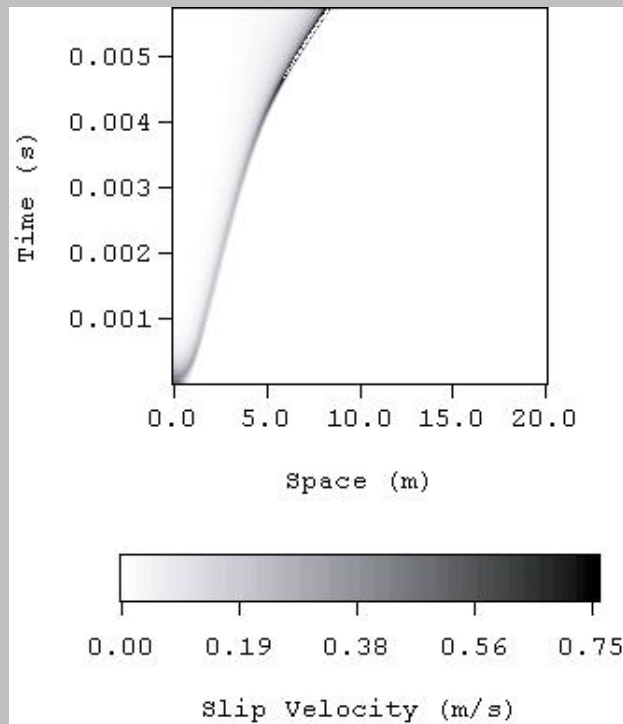
$$\left\{ \begin{array}{l} \tau = \left[\mu_* - a \ln \left(\frac{v + v_*}{v + v_p} \right) + b \ln \left(\frac{\Psi (v - v_p)}{L} + 1 \right) \right] \sigma_n^{eff} \\ \frac{d}{dt} \Psi = 1 - \frac{\Psi (v + v_p)}{L} \end{array} \right.$$





Self – healing with Carlson law

$$\left\{ \begin{array}{l} \tau = \left[\mu_* - a \ln \left(\frac{v_*}{v} + 1 \right) + b \ln \left(\frac{\Psi v_*}{L} + 1 \right) \right] \sigma_n^{eff} \\ \frac{d}{dt} \Psi = \frac{\gamma - \Psi}{t_{fh}} - \frac{\Psi v}{L} \end{array} \right.$$

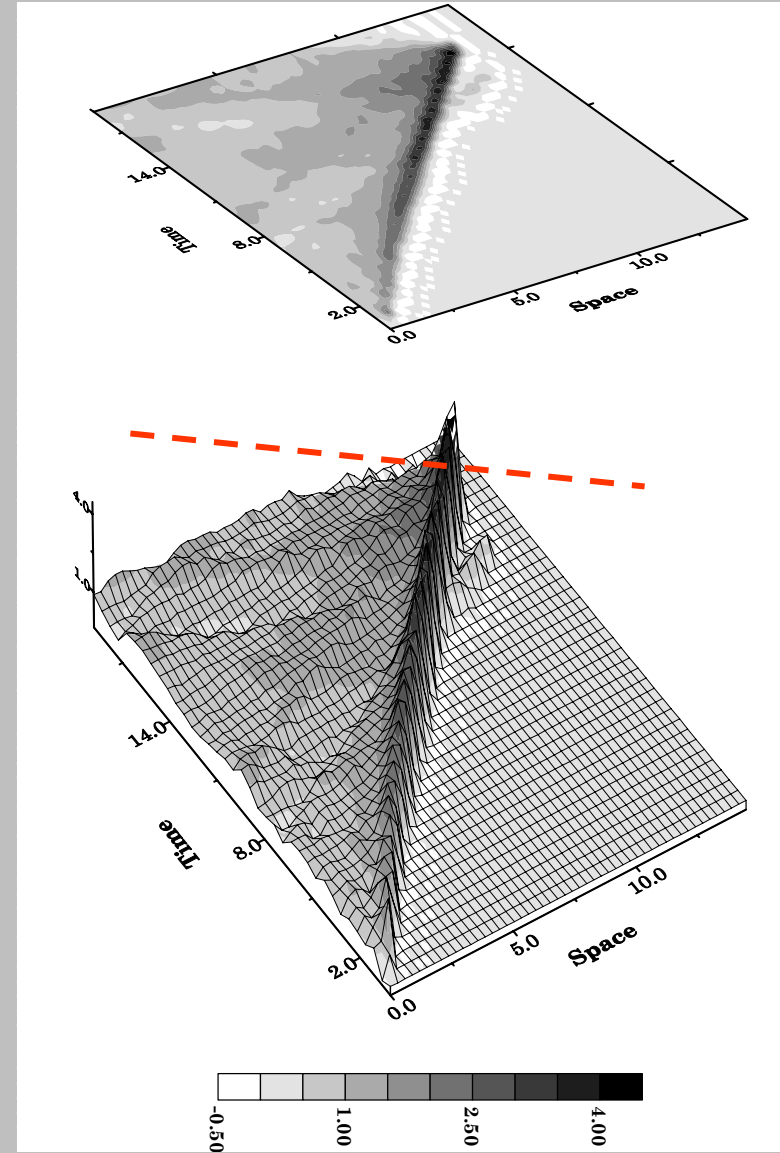
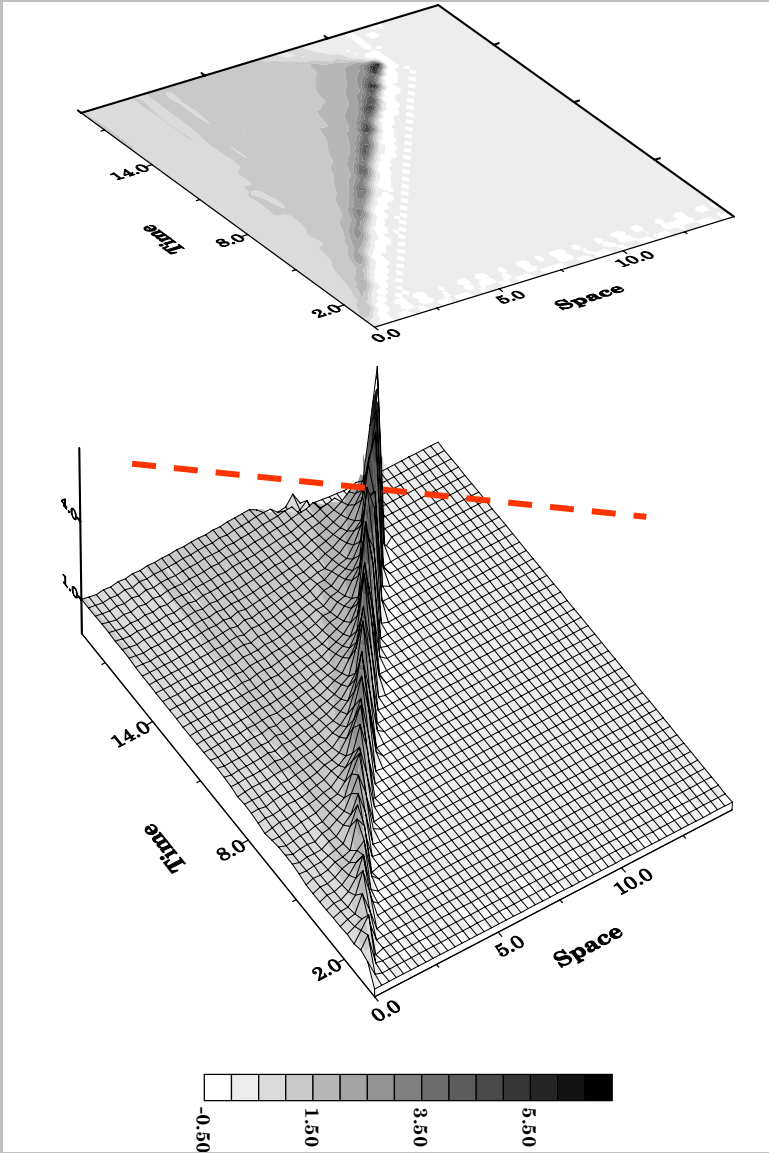




Barrier – healing with SW

BIE

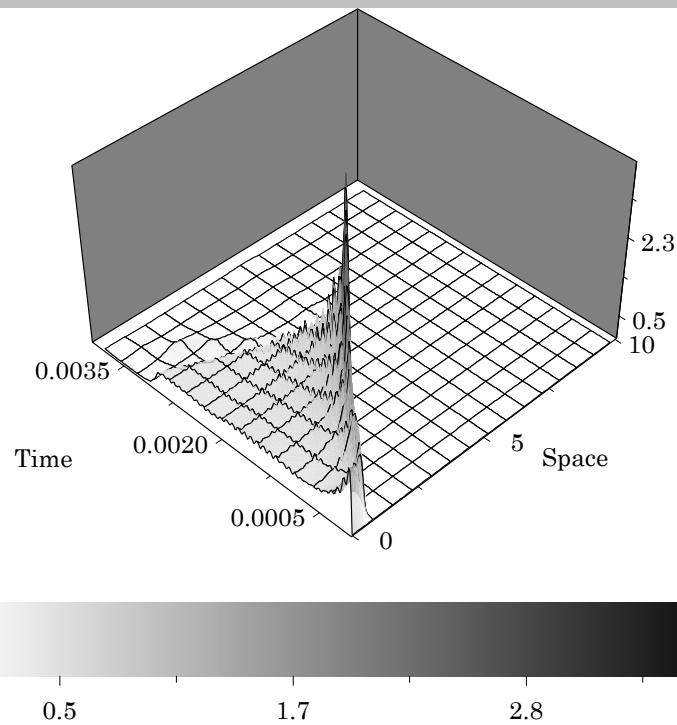
FD



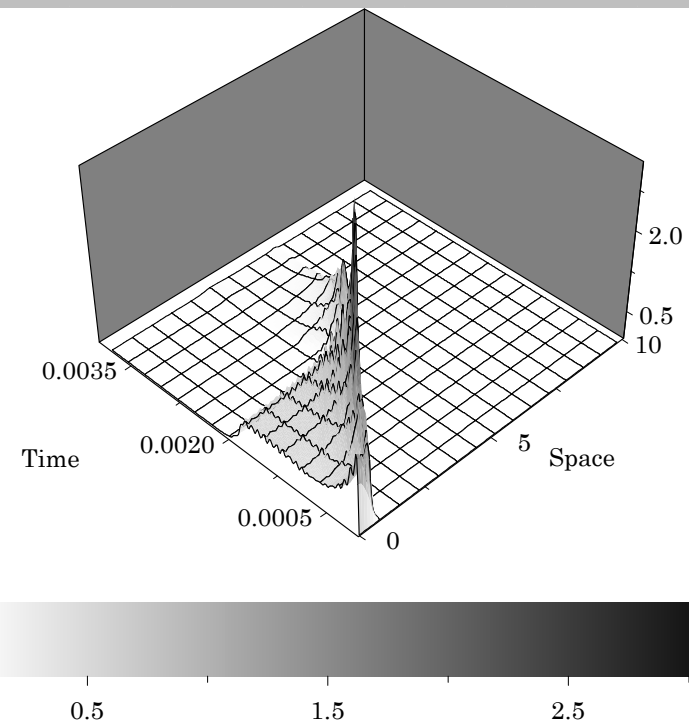


Healing with RS #1

**Barrier – healing:
heterogeneity of L parameter**

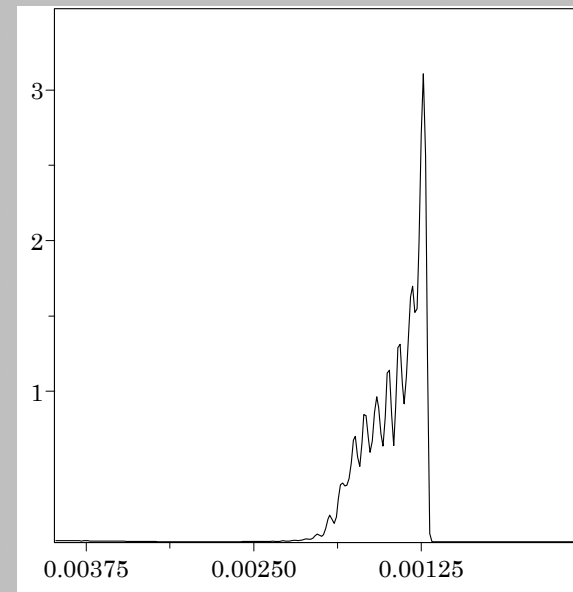
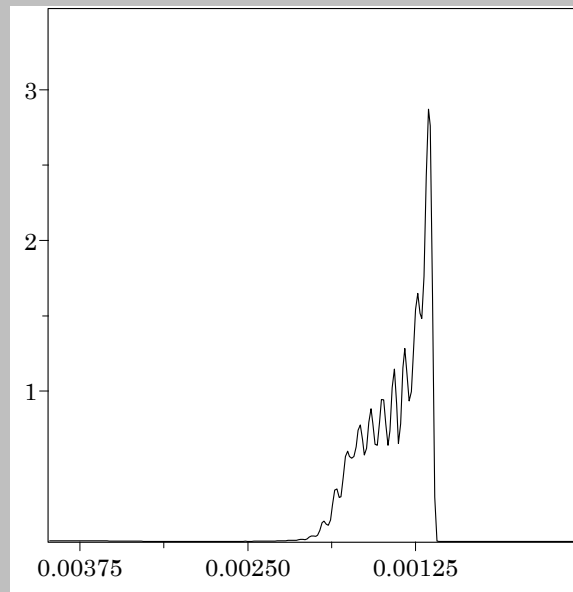
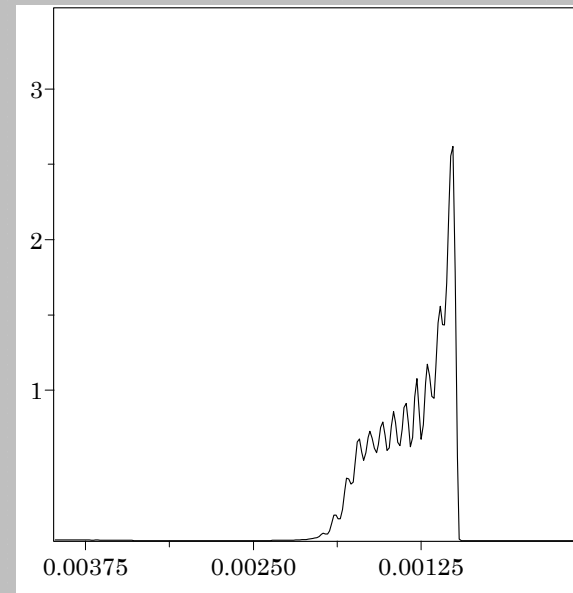
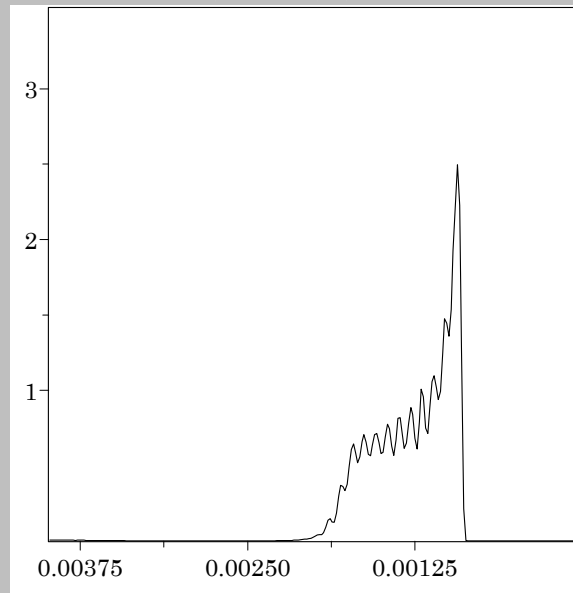


**Self – healing: heterogeneity
of a and b parameters**



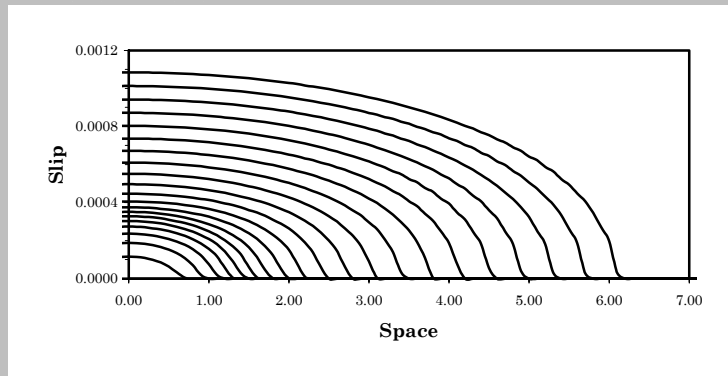


Healing with RS #2



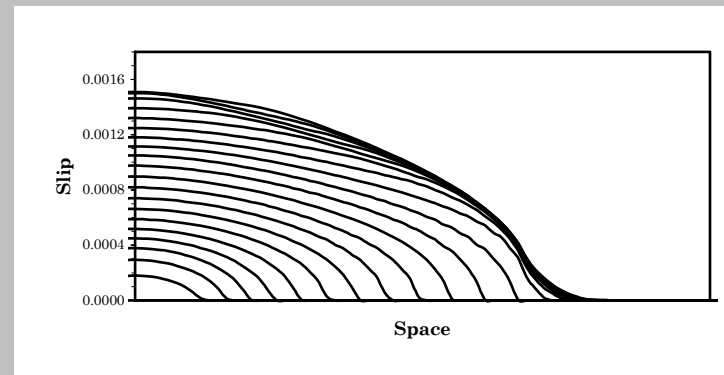


Healing with RS #3: DRF

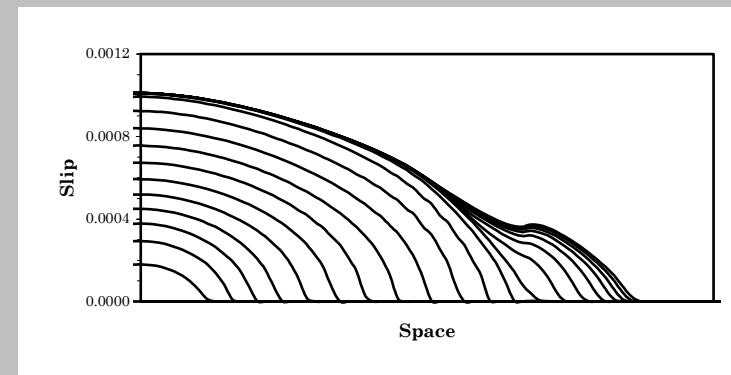


Classical enlarging crack

Barrier - healing



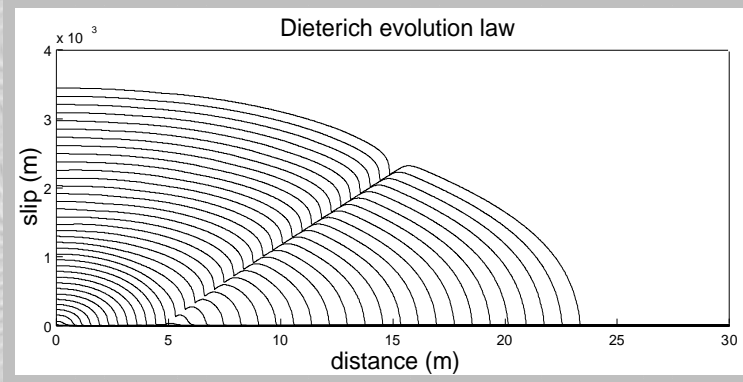
Self - healing



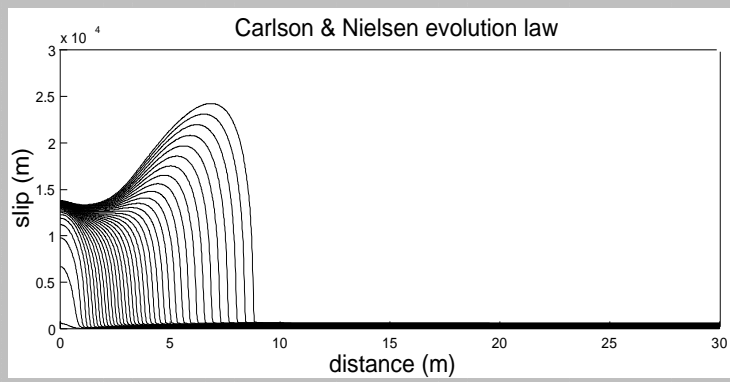


Healing with RS #4

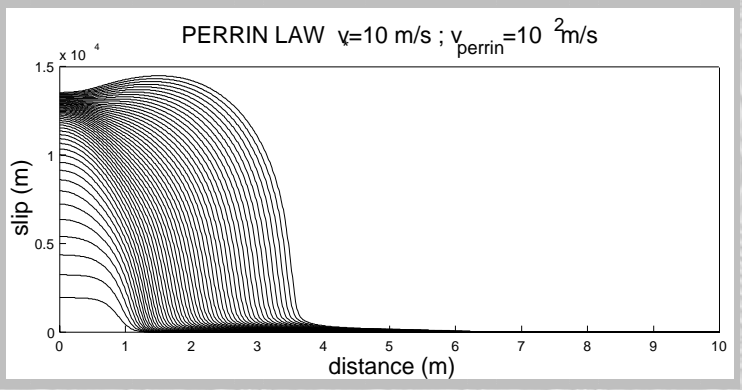
Classical enlarging crack



Self – healing with Carlson’s law



Self – healing with Perrin’s law



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