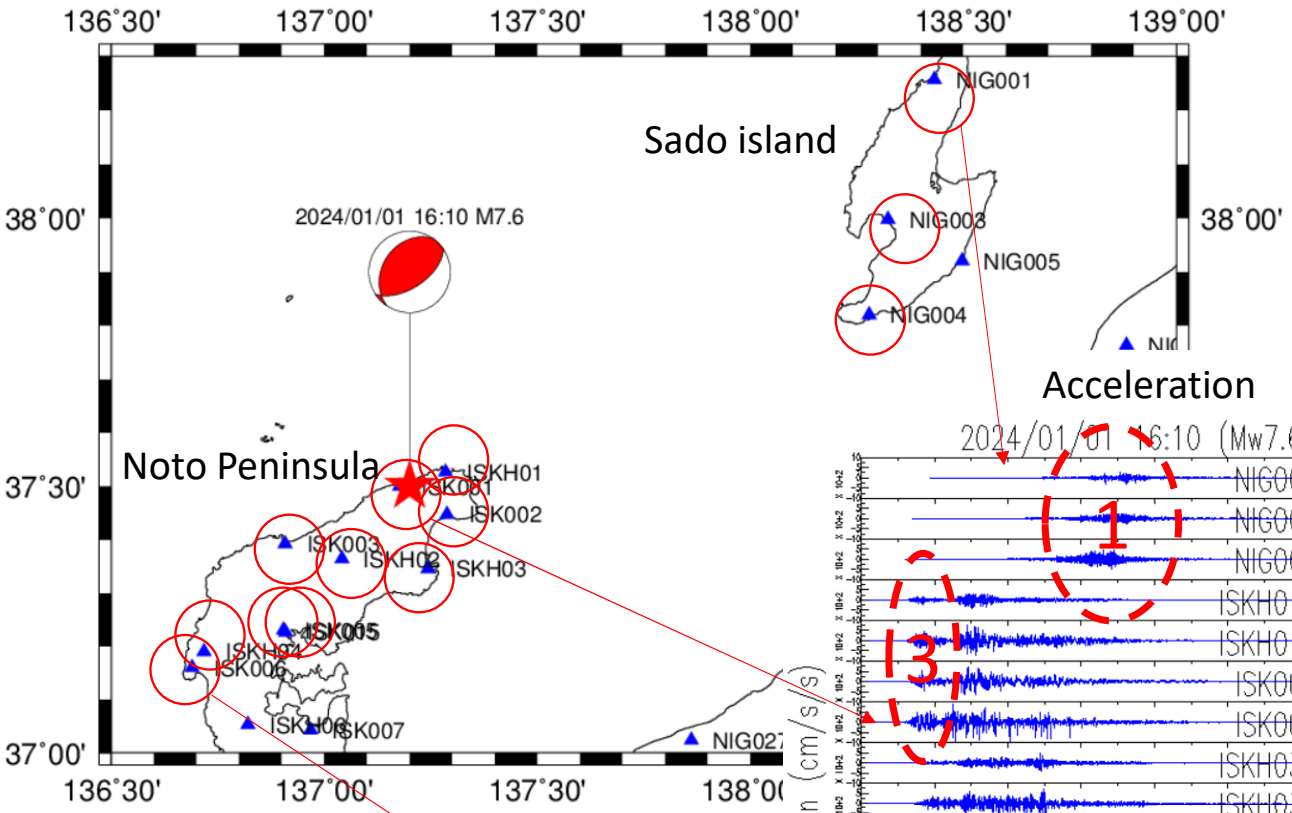
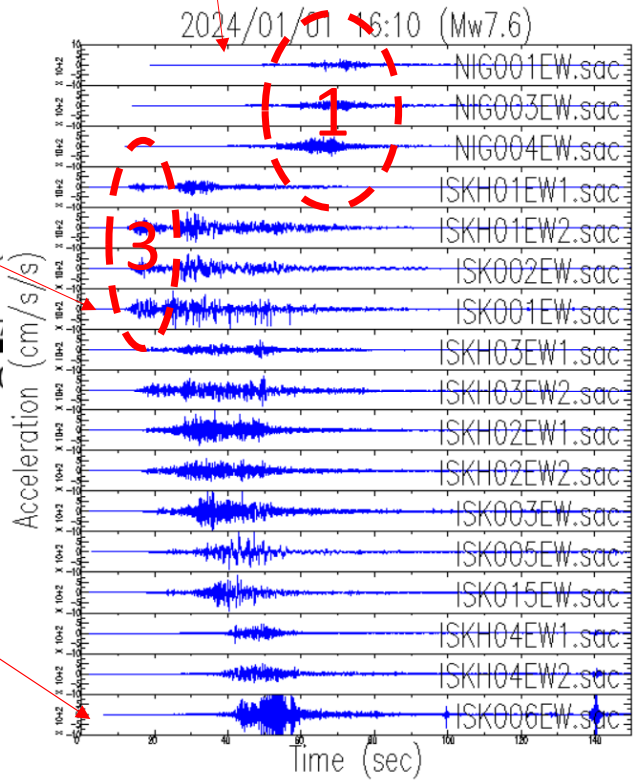
Mw6.0 pre-event of 2024 Noto Penisula earthquake

Near-field ground motions

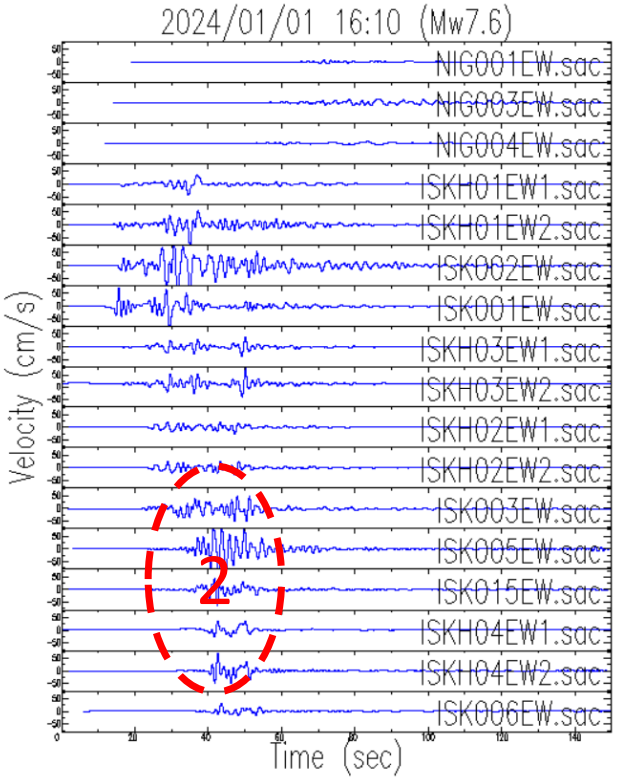


Acceleration

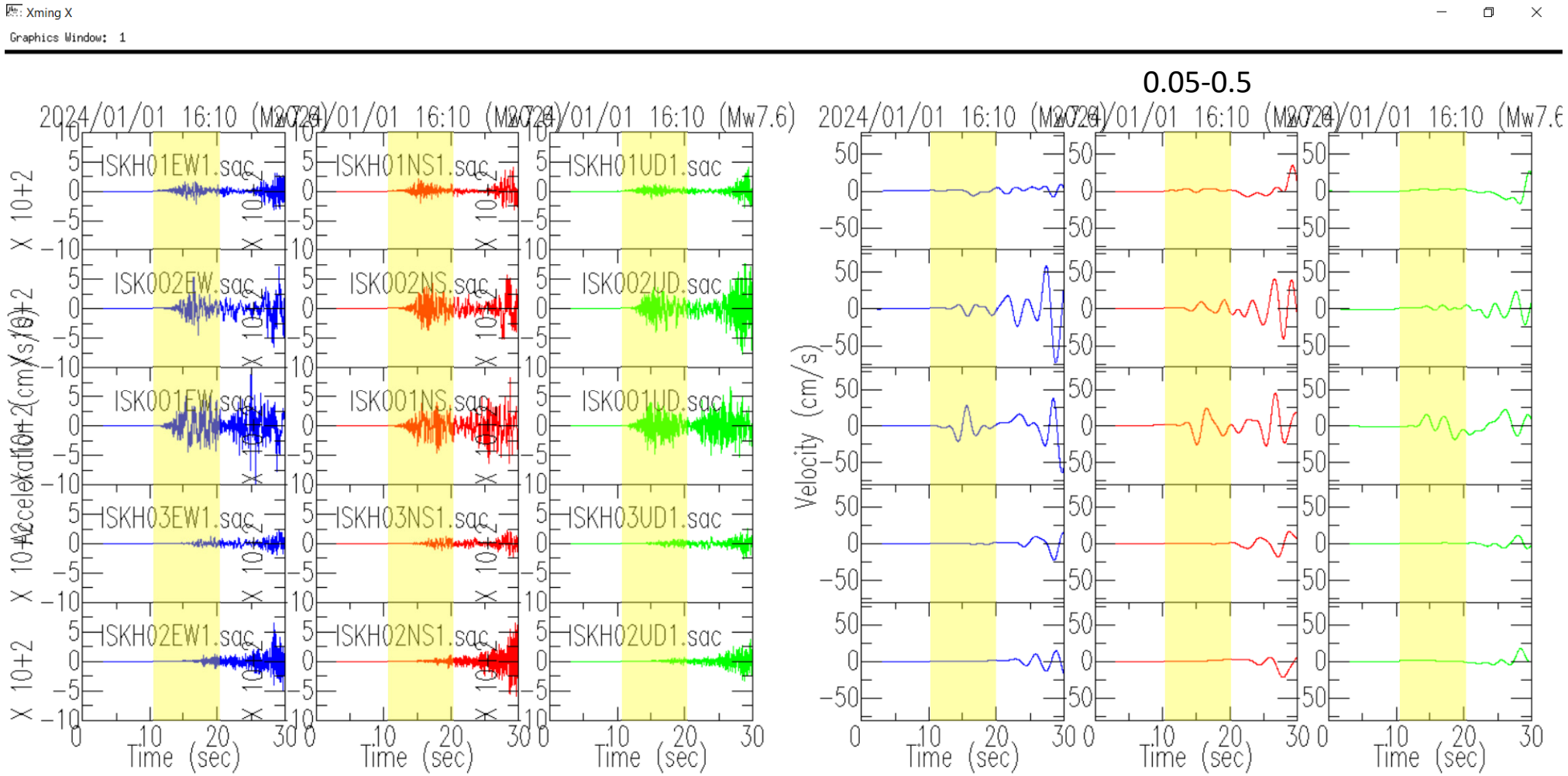


Y-axis max +-1000 cm/s^2

Velocity filtered
between 0.03 and 30 Hz



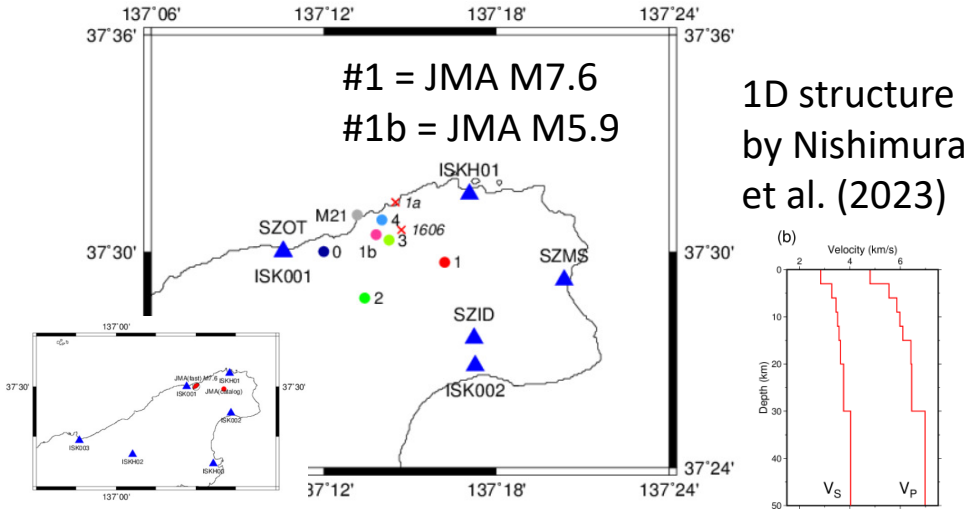
Y-axis max +-80 cm/s



JMA catalog

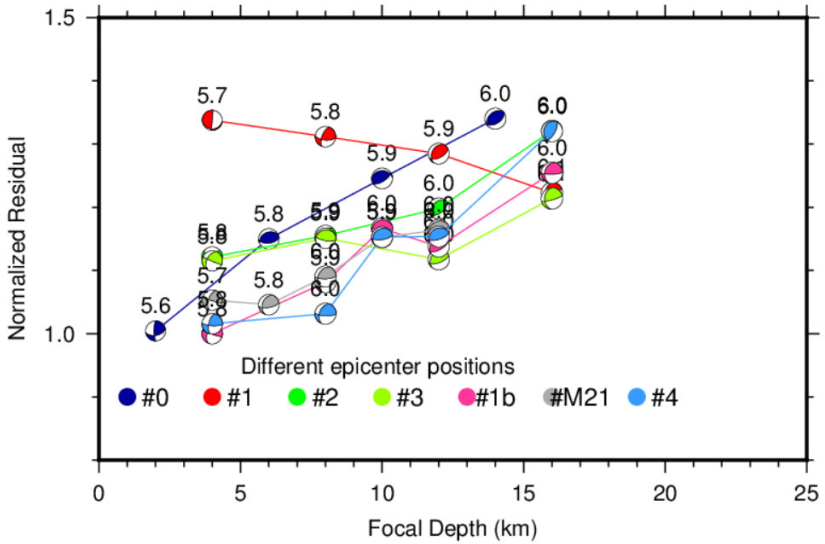
2024 1 1 16:10 8.3 37°31.0'N 137°14.4'E 10 - 能登半島沖
2024 1 1 16:10 9.5 37°30.4'N 137°13.8'E 10 5.9 石川県能登地方
2024 1 1 16:10 22.5 37°29.7'N 137°16.2'E 16 7.6 石川県能登地方

Focal mechanism by full waveforms

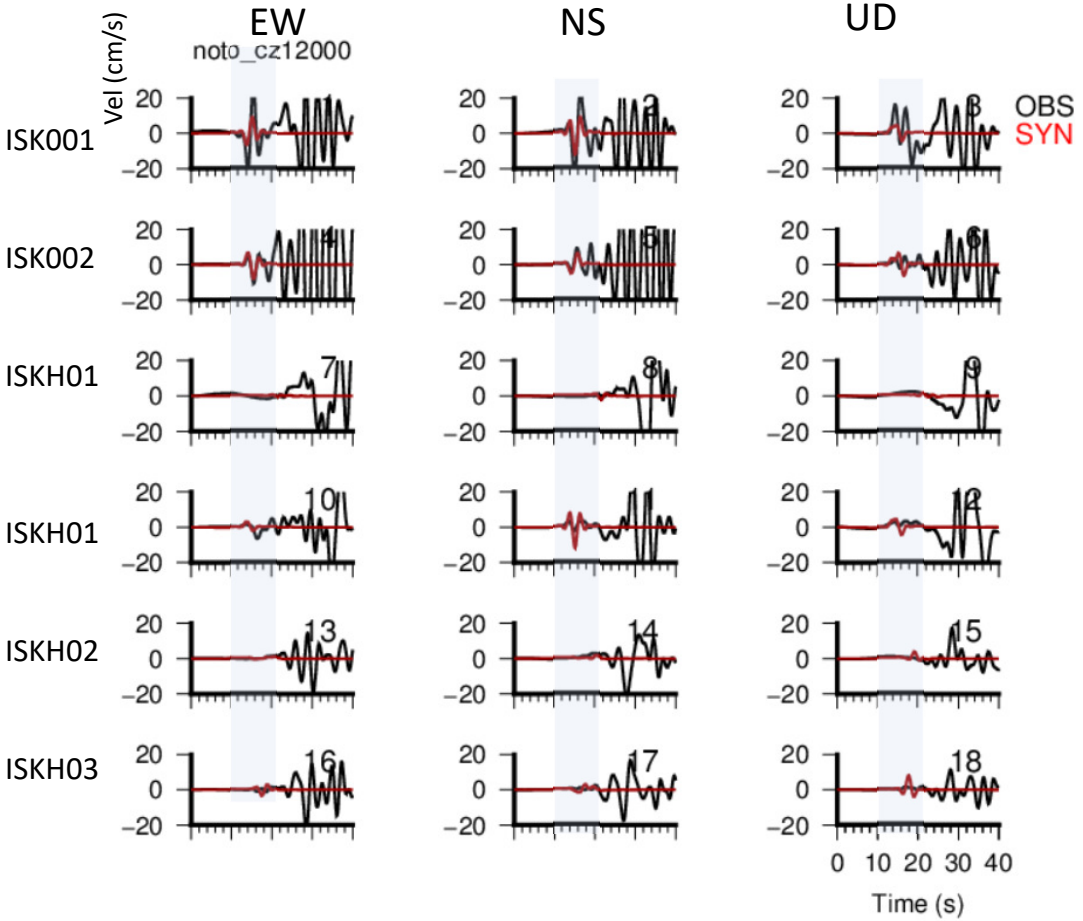


1D structure by Nishimura et al. (2023)

2024/01/01 2024 Mw6.0 NOTO EARTHQUAKE



Position #3, depth =12 km



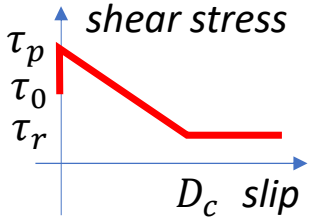
Waveforms filtered between 0.05 – 0.5 Hz
Fitting only between 10-20 seconds

Focal mechanism inversion (strike, dip, rake, t0, Mw)

Dynamic rupture inversion by patch

Nucleation patch (self-similar)

r_0 $\quad D_c \propto R$



Target patch

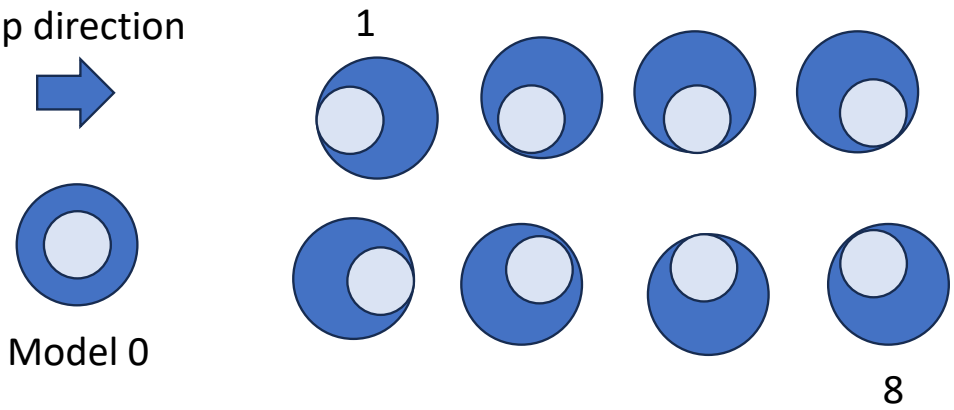
r_1 $\quad r_1 = 2\,r_0$

$D_c = 2D_c(R = r_0)$ ~ 0.15 m

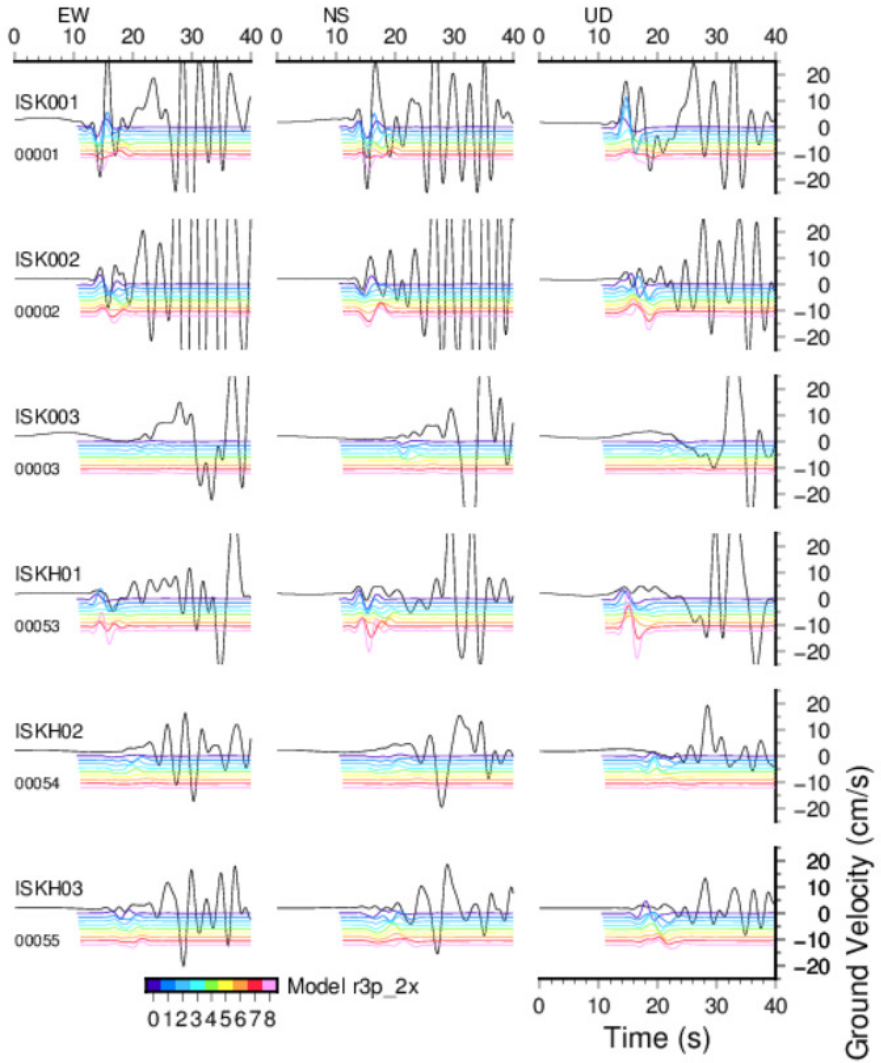
$(\tau_p, \tau_0) = (20, 12), (10, 6), (5, 3)$ MPa

Rupture directivity

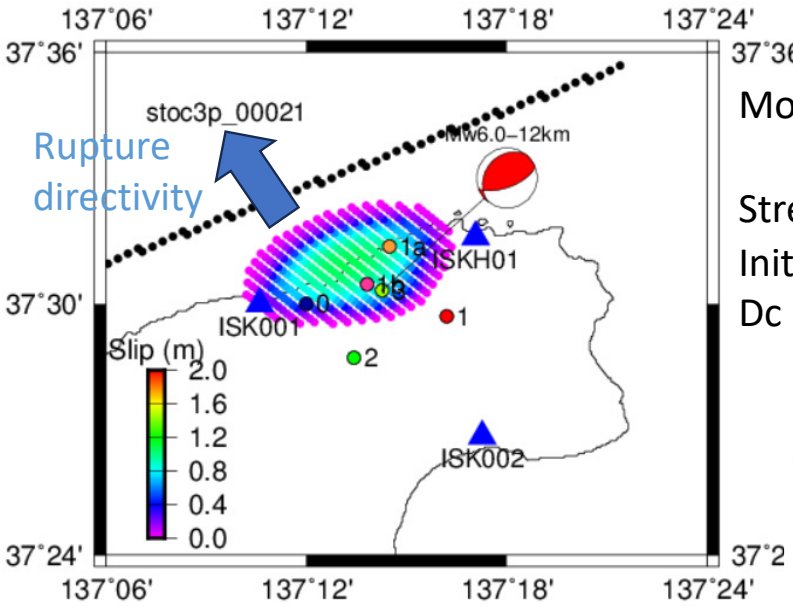
Slip direction



0.05-0.5 Hz
10-20 sec



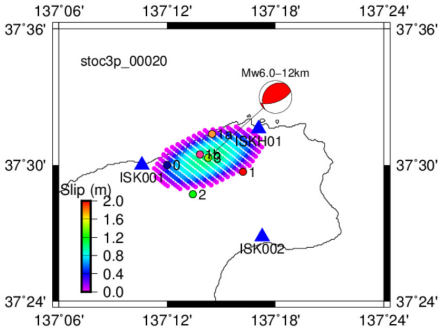
Test 1

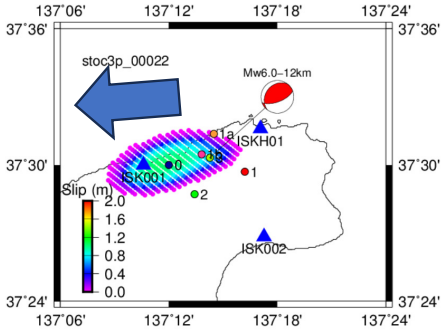


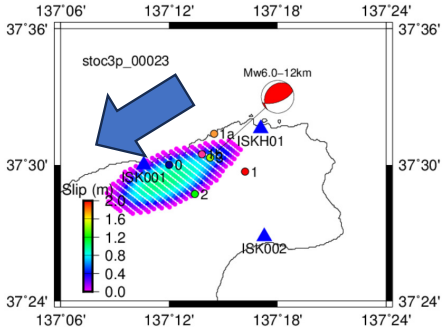
Rupture directivity

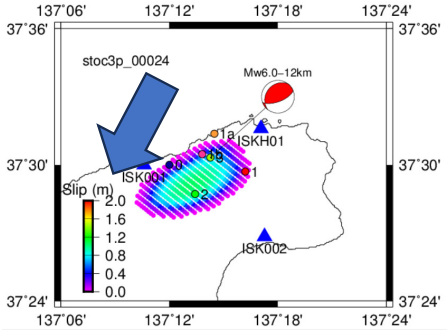
Model 1: (69°, 65°, 104°)

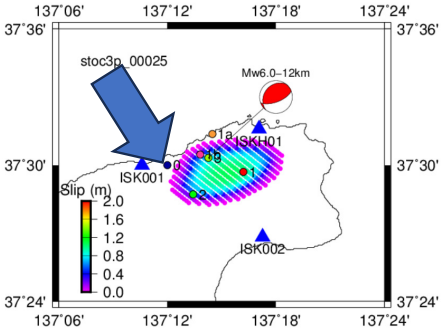
Strength drop τ_p = 10 MPa
Initial stress τ_0= 6 MPa
Dc = 0.15 m



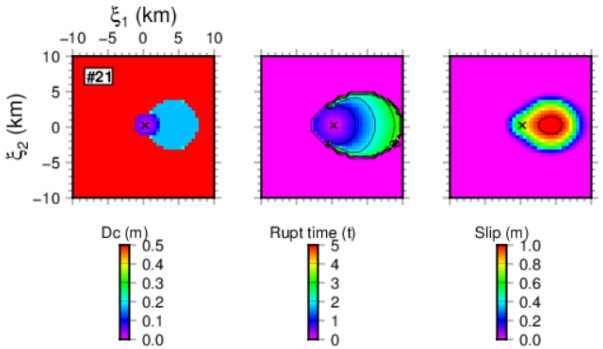


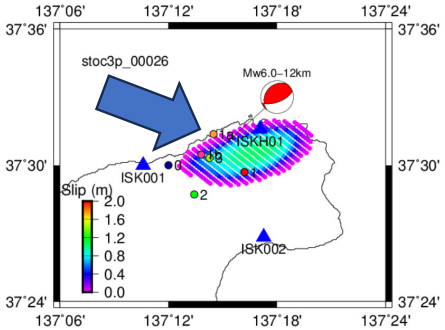


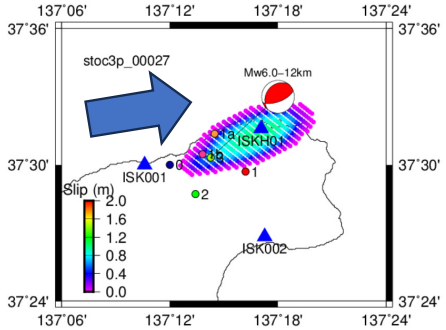


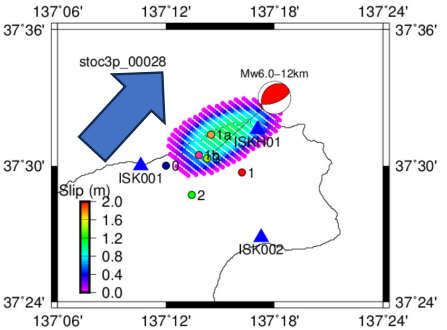


Mw6.03 (not contolled, not optimized)

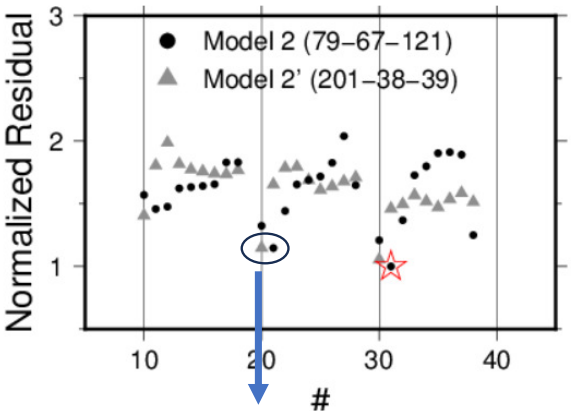


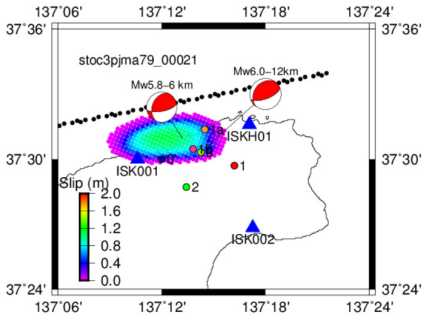


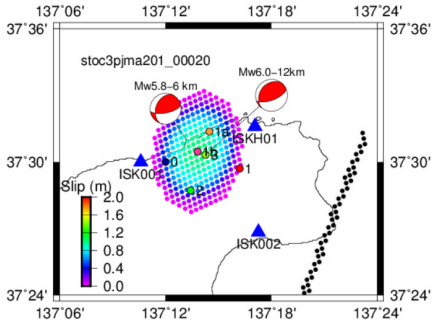




High stress drop



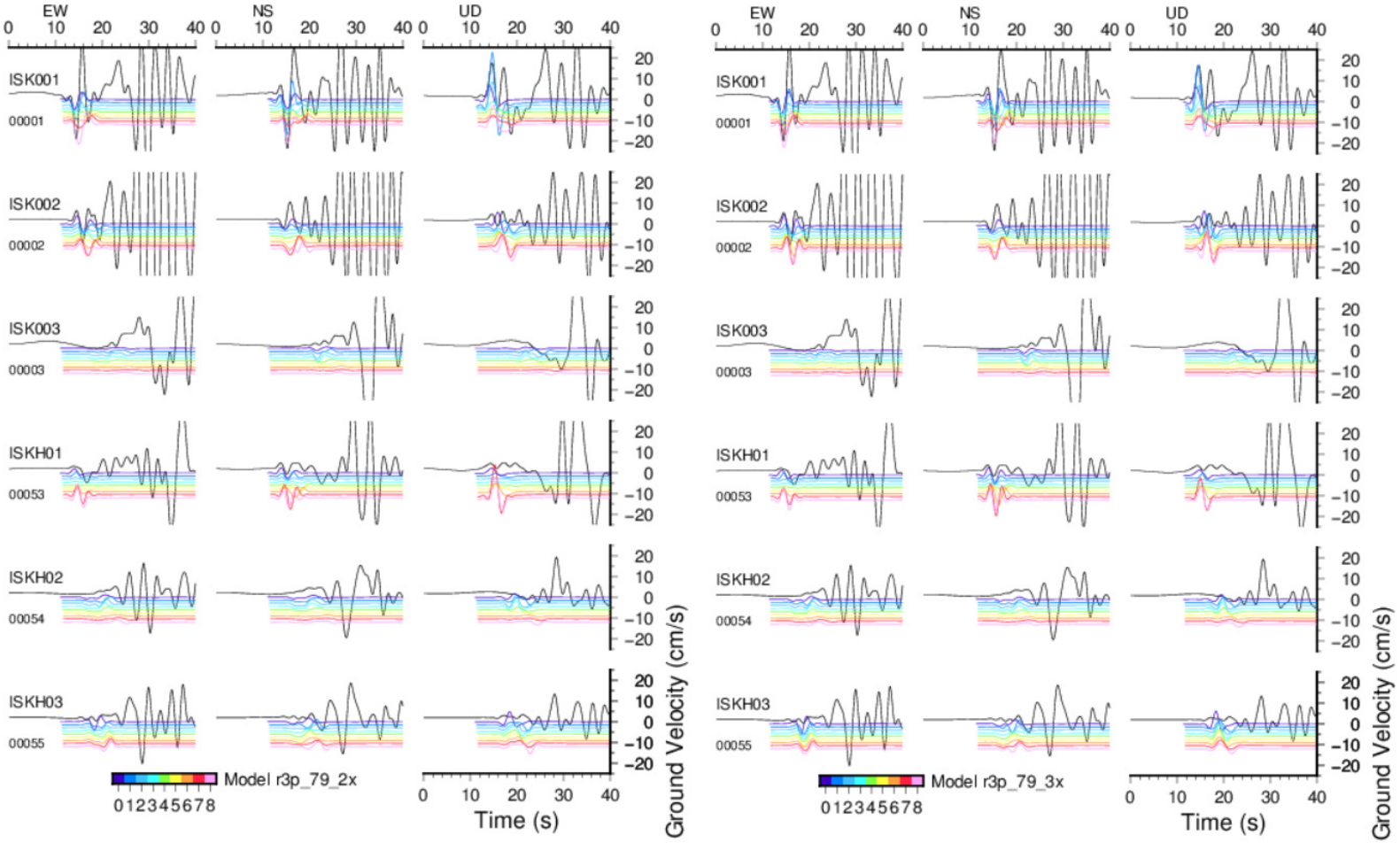




Test 2 (79°, 67°, 121°)

Strike N79°E, Model 2x (τ_0= 6 Mpa)

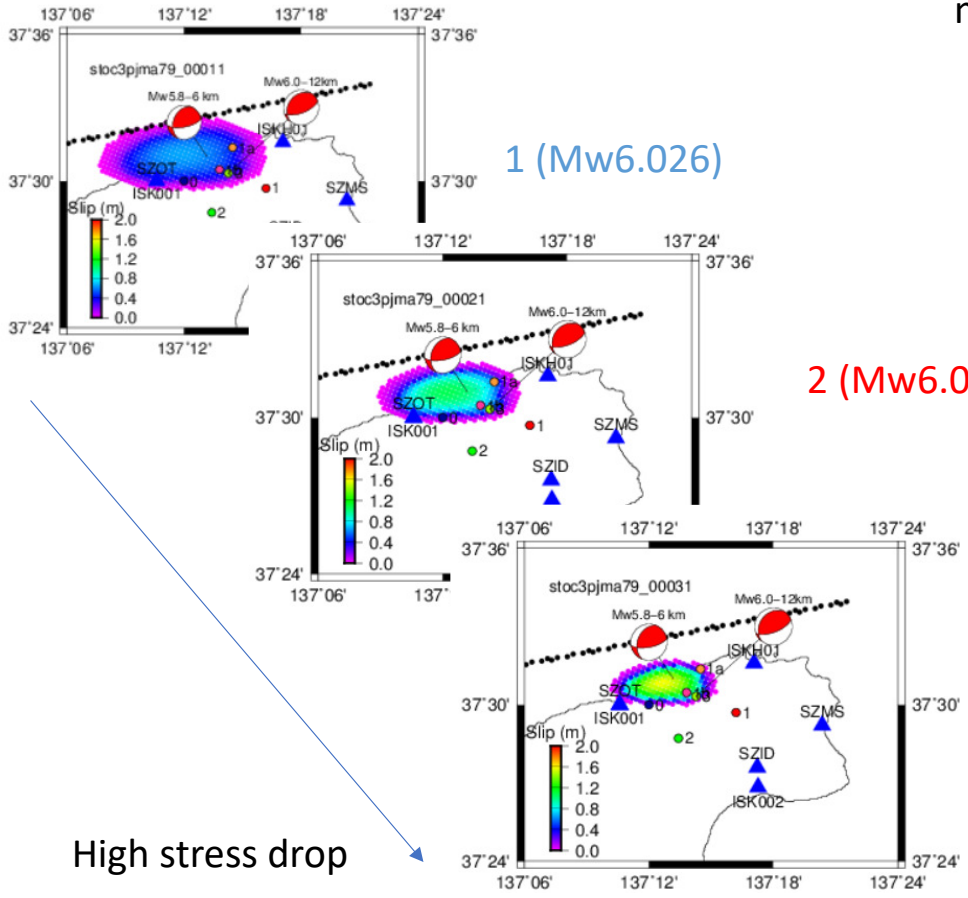
Strike N79°E, Model 3x (τ_0= 12Mpa)



Fitting 0.05-0.5 Hz, 10-20 sec

Vertical Displacement

Test 2 (79°, 67°, 121°) from JMA hypocenter



1 (Mw6.026)

2 (Mw6.034)

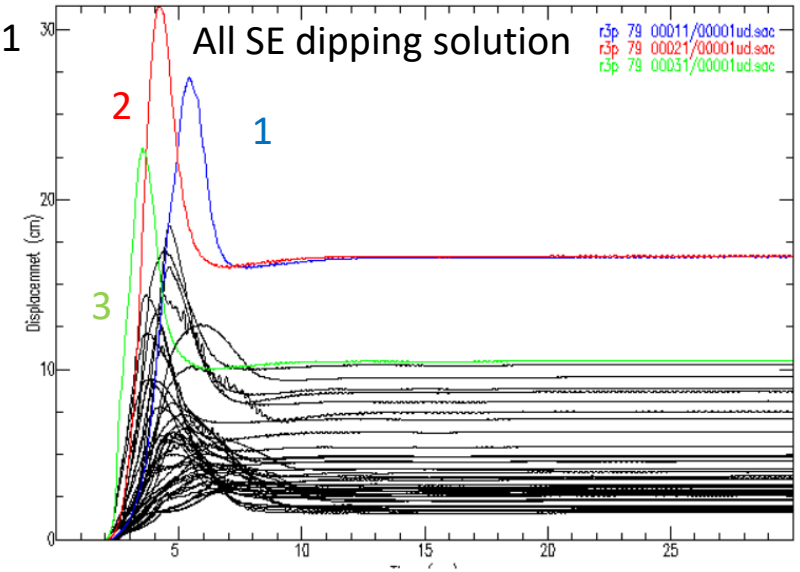
3 (Mw5.978)

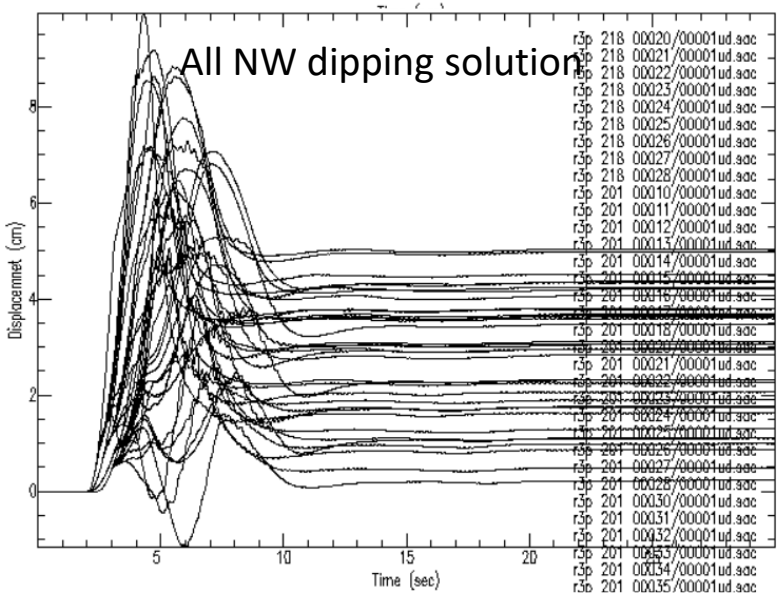
High stress drop

SZOT ≈ ISK001

About 30 cm uplift before the mainshock (DPRI)

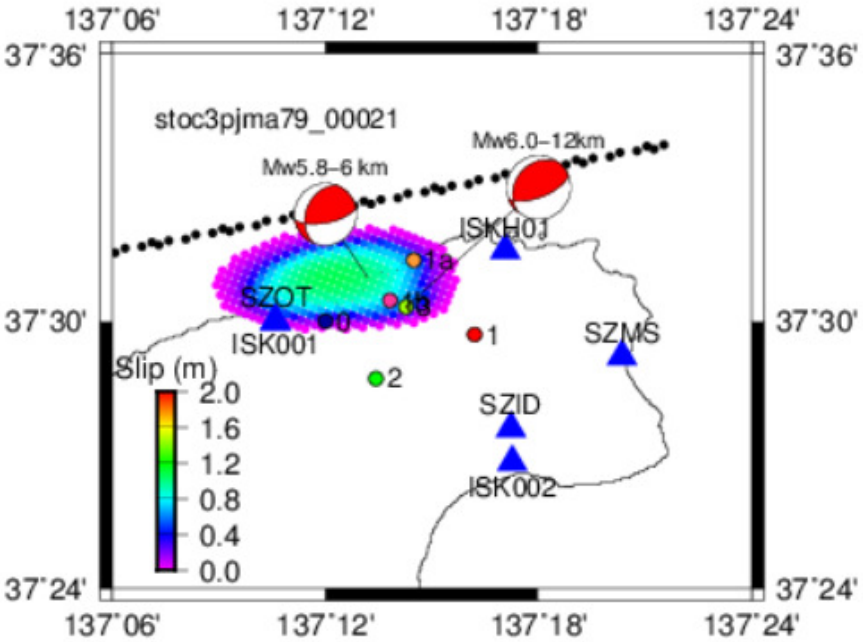
Uz (cm)

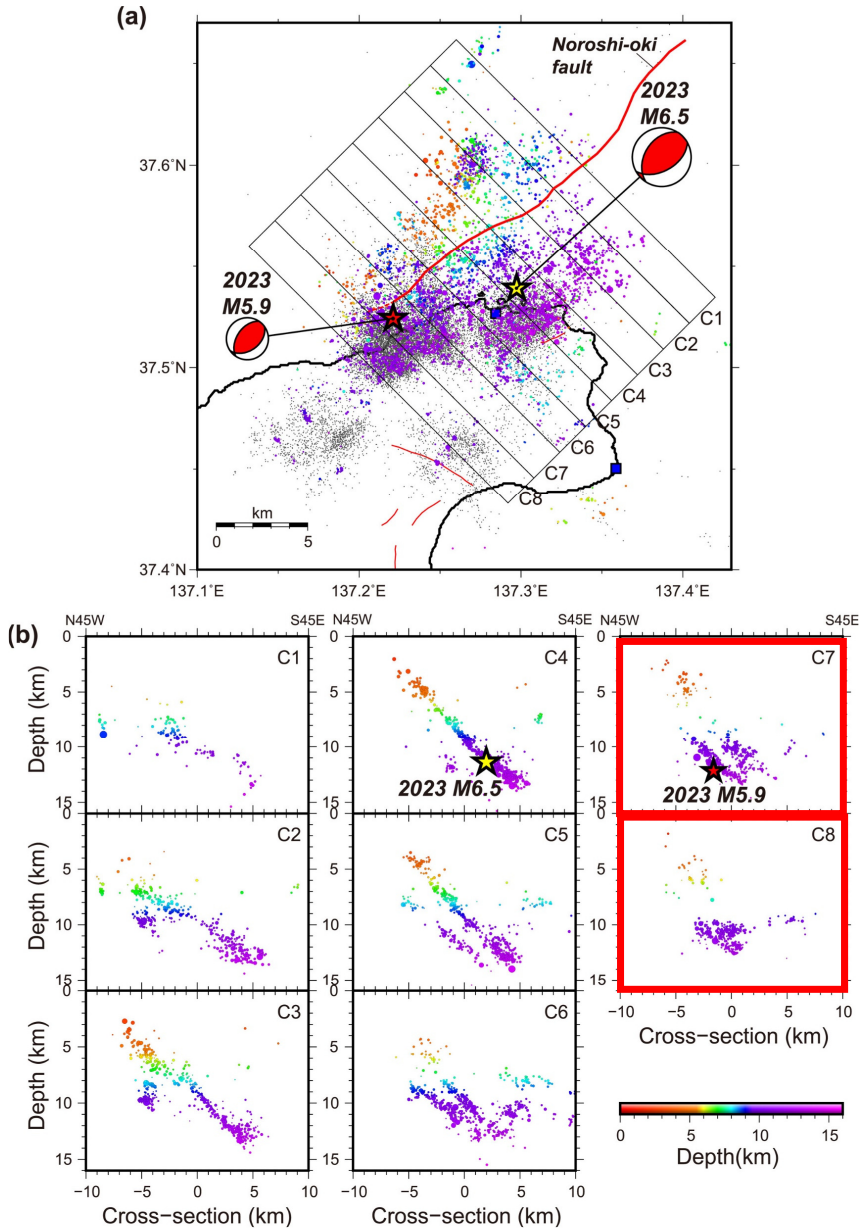




Where is the causal fault?

Test 2 (79°, 67°, 121°) from JMA hypocenter





Kato et al. (2023)

Where is the causal fault?

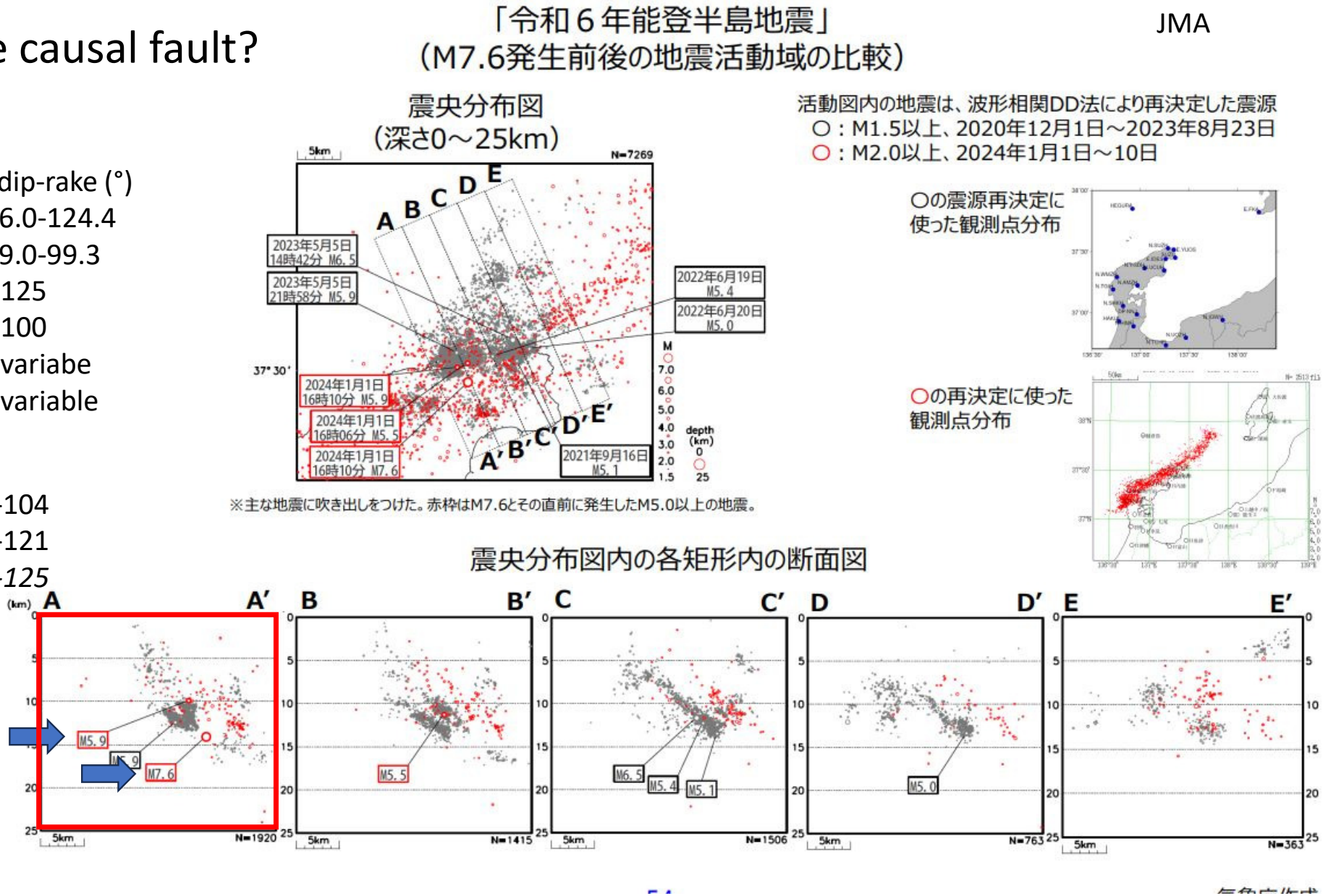
Other models

Model	strike-dip-rake (°)
1_SW	46.9-26.0-124.4
1_NE	56.9-59.0-99.3
2	56-33-125
3	47-37-100
4	52-42-variabe
5	47-46-variable

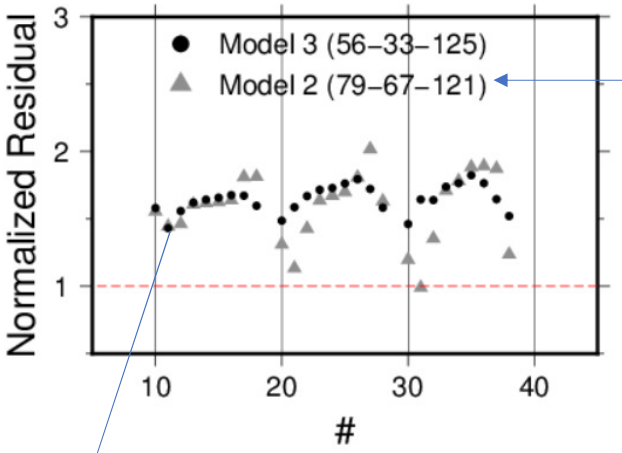
Tested

1	69-65-104
2	79-67-121
3	*56-33-125*

JMA



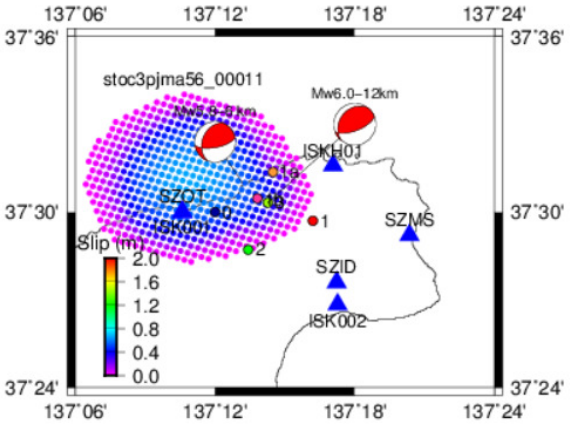
Influence of a smaller dip angle



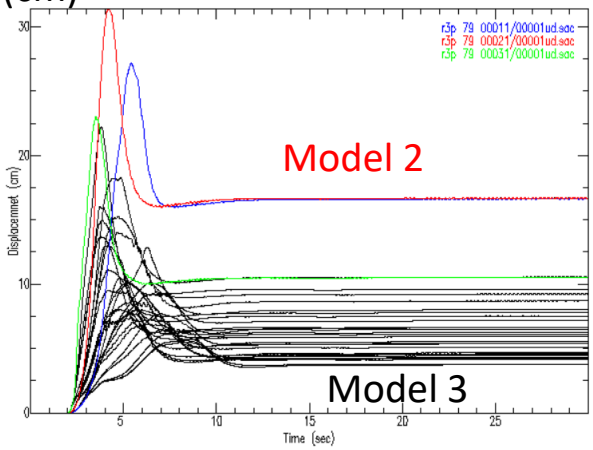
Prevous one

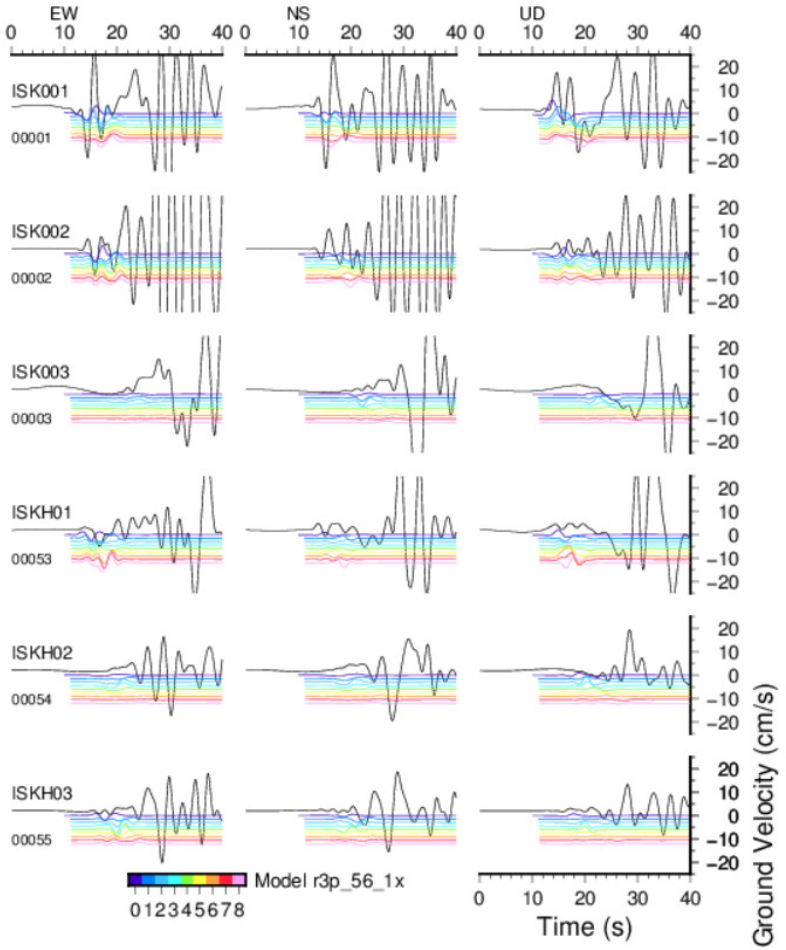
Model 2 is better

JMA hypocenter at 10km



Uz (cm) ISK001~SZOT





Remarks

- SE dipping fault is reasonable from the uplift at ISK001 (~SZOT).
- Rupture directivity is up-dip direction, going away from the hypocenter of M7.6.
- Preferred stress drop is 6 MPa or less so that the rupture extends below station ISK001.