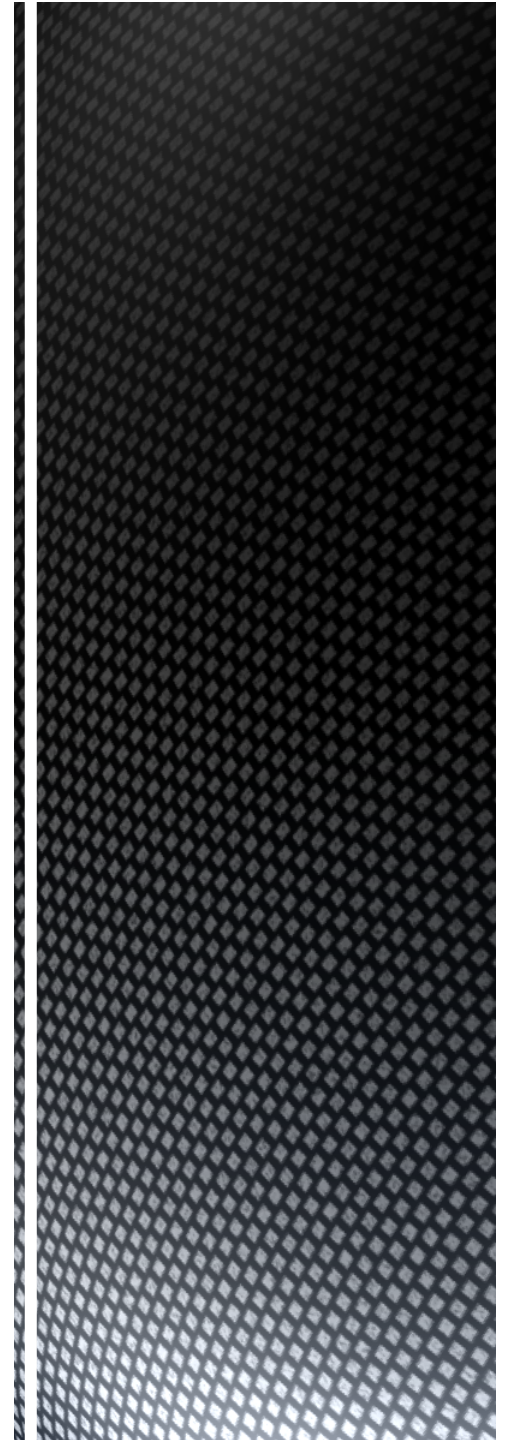


Contrasting nature of the megathrust ruptured by the Maule Earthquake afterslip, aftershocks and gravity-derived forearc structure



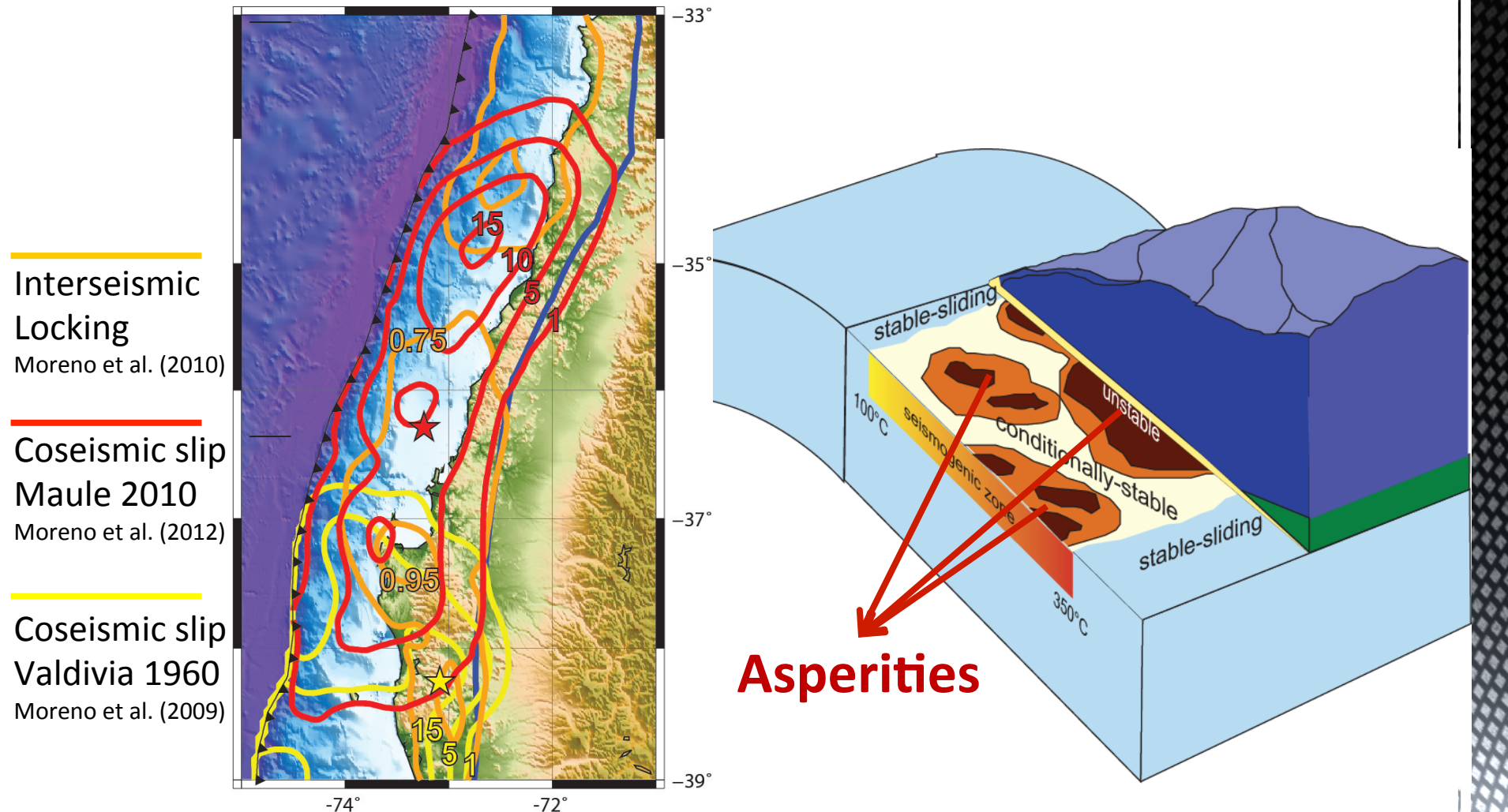
Andrés Tassara (UDEEC)
Hugo Soto (UDEEC)
Jon Bedford (GFZ-Potsdam)
Marcos Moreno (GFZ-Potsdam)
Juan Carlos Baez (UDEEC)



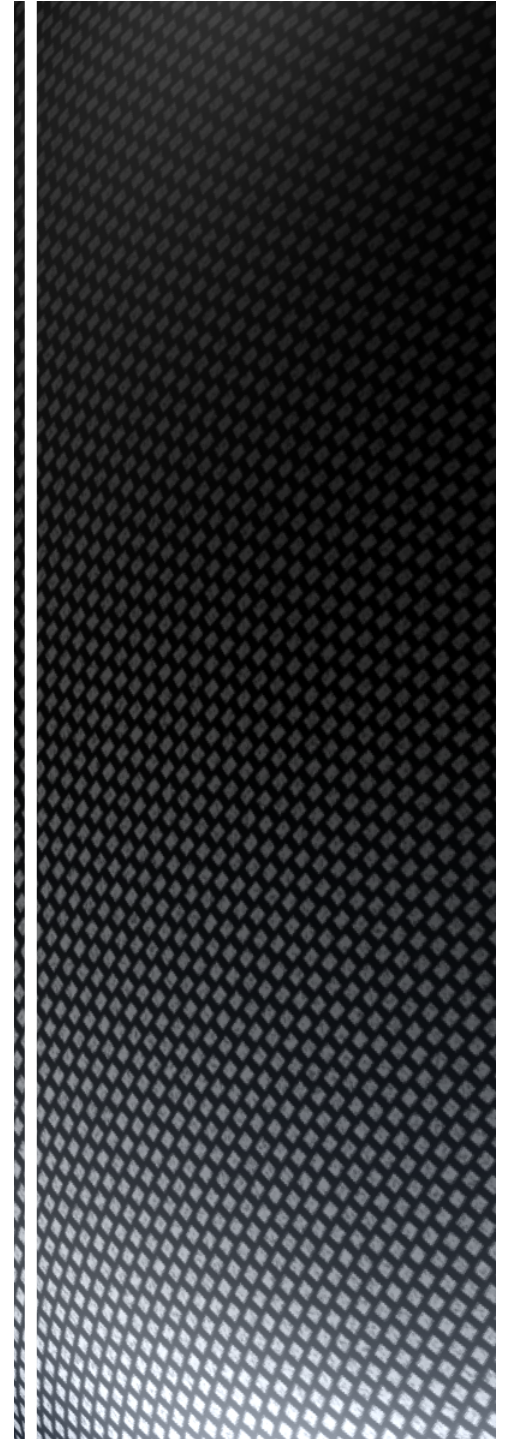
MOTIVATION

Megathrust asperities

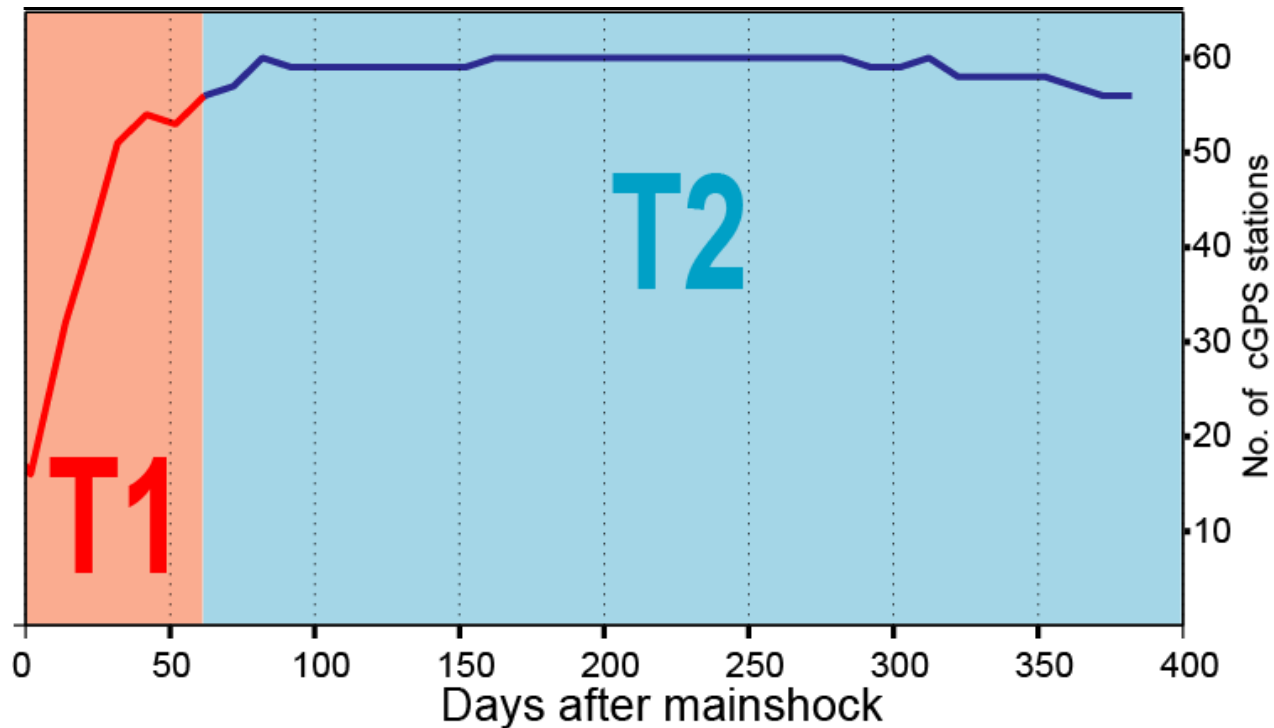
- Are they stable features during the seismic cycle?
- Are they controlled by long-term geological structure (predictable)?
- What can we learn about them studying the post-seismic phase (healing)?



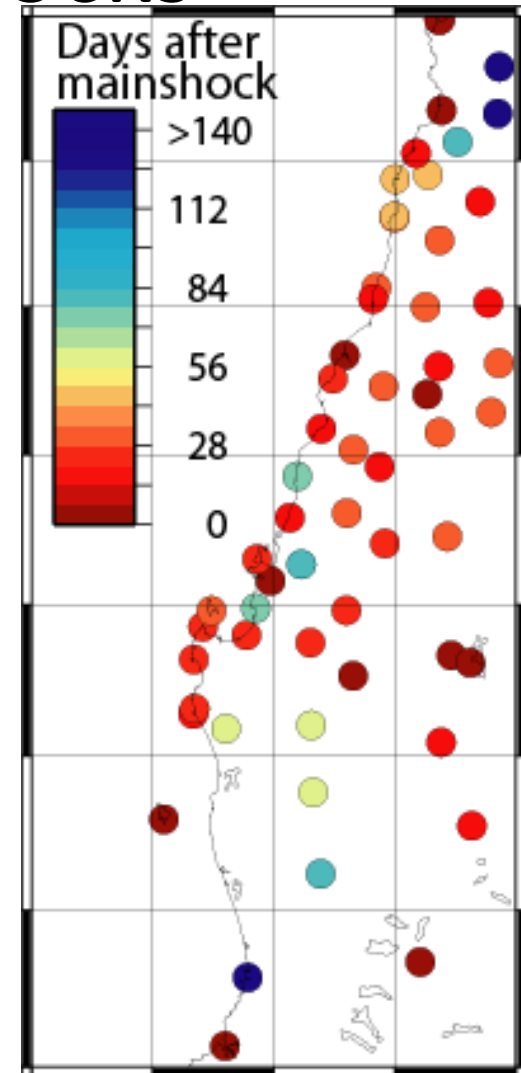
METHOD



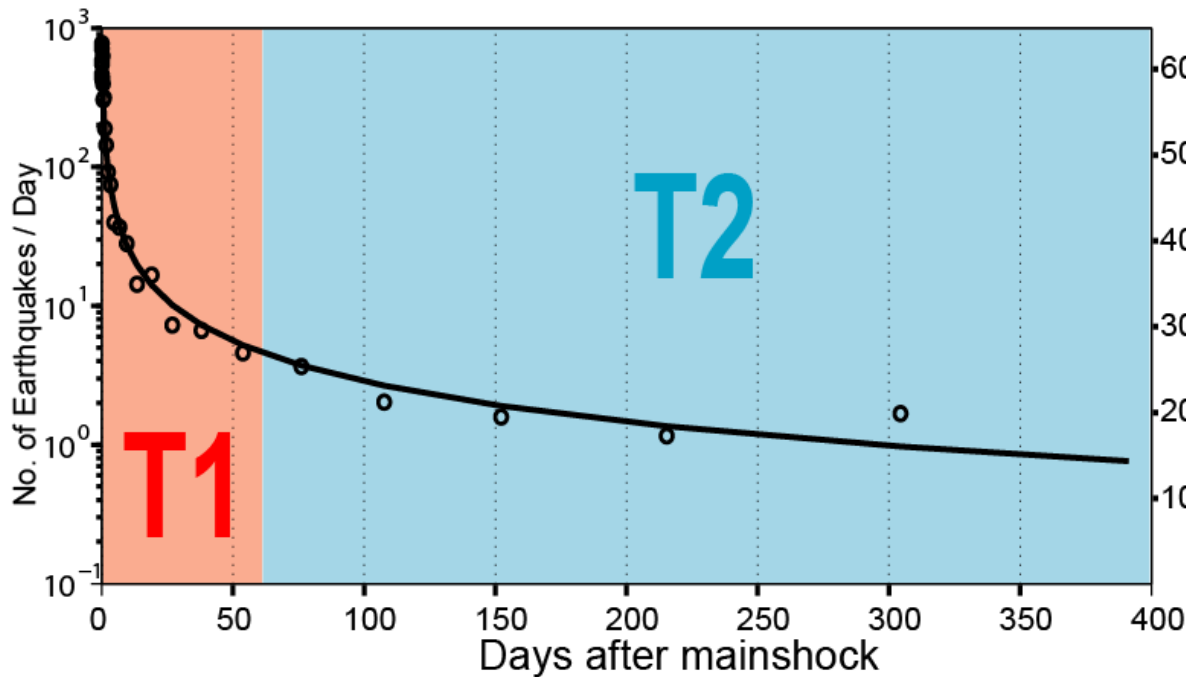
Combined spatio-temporal analysis of afterslip and aftershocks



Bedford et al., submitted



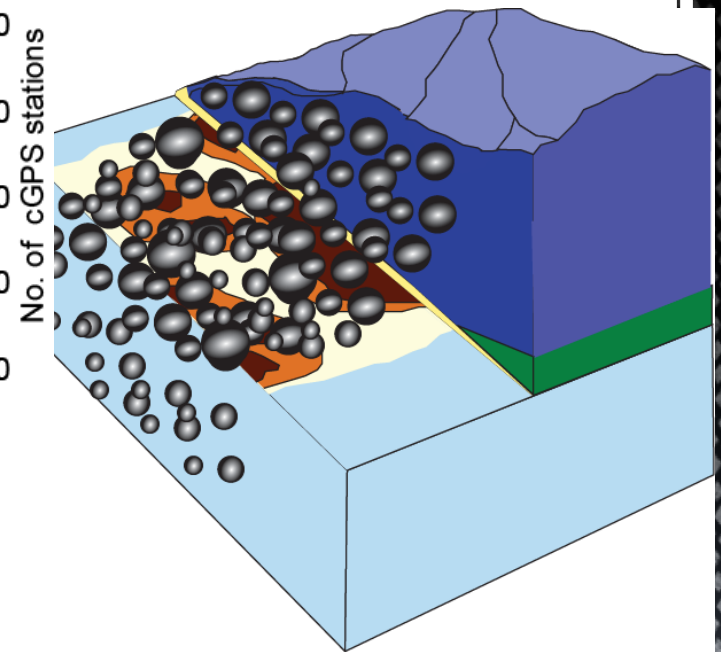
Combined spatio-temporal analysis of afterslip and aftershocks



Satisfies Omori's Law

$$N(t) = k/(t+c)^p$$

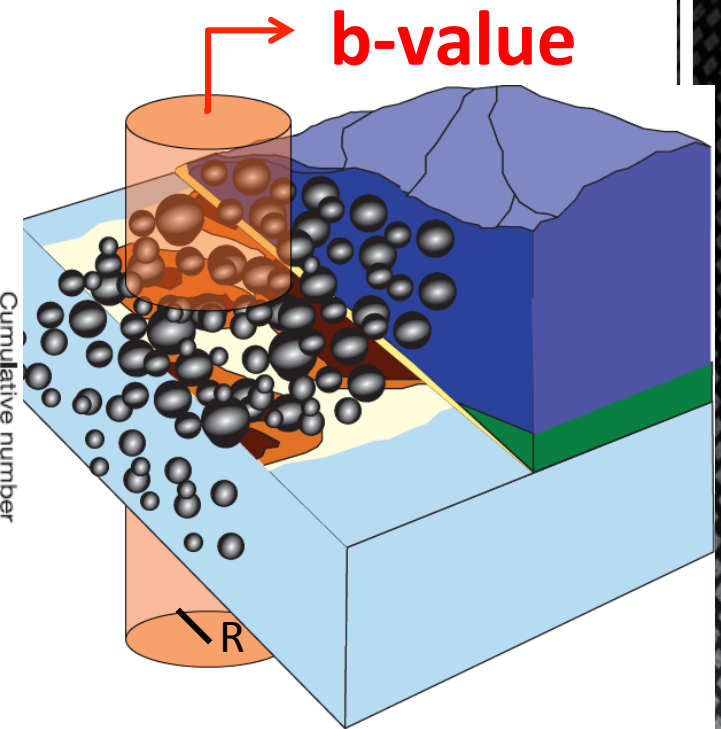
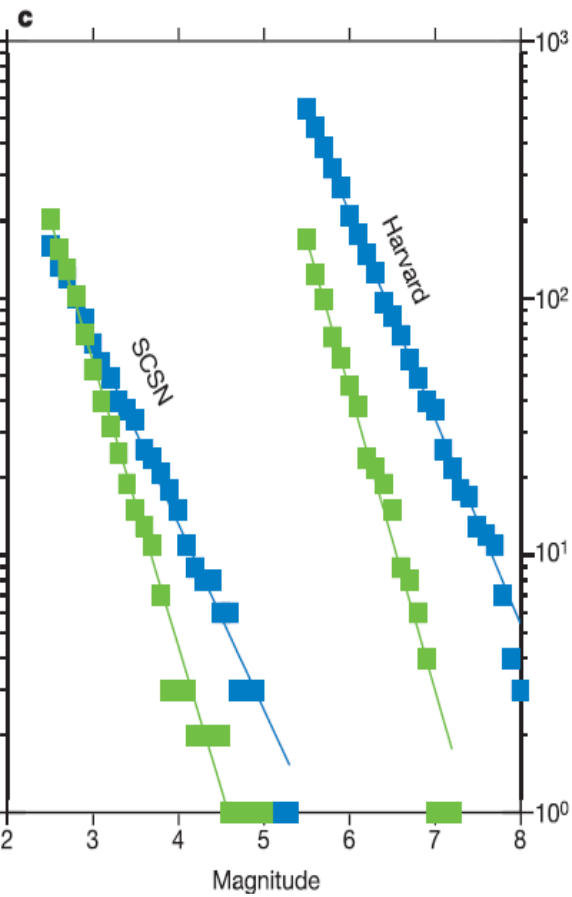
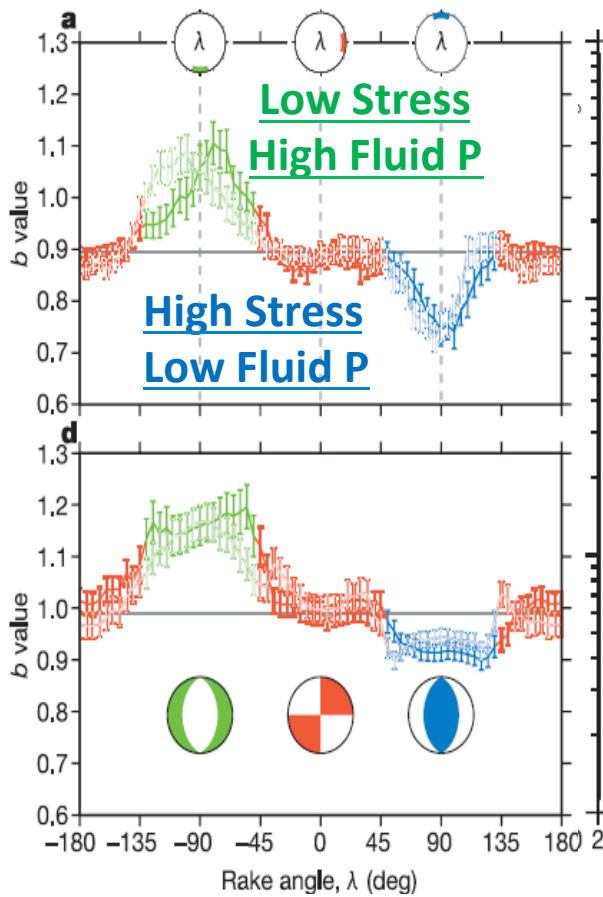
$$k = 242.8, c = 0.26, p = 0.96$$



USGS – NEIC catalogue
27-2-2010 – 10-4-2011

M>4, Mc=4.3

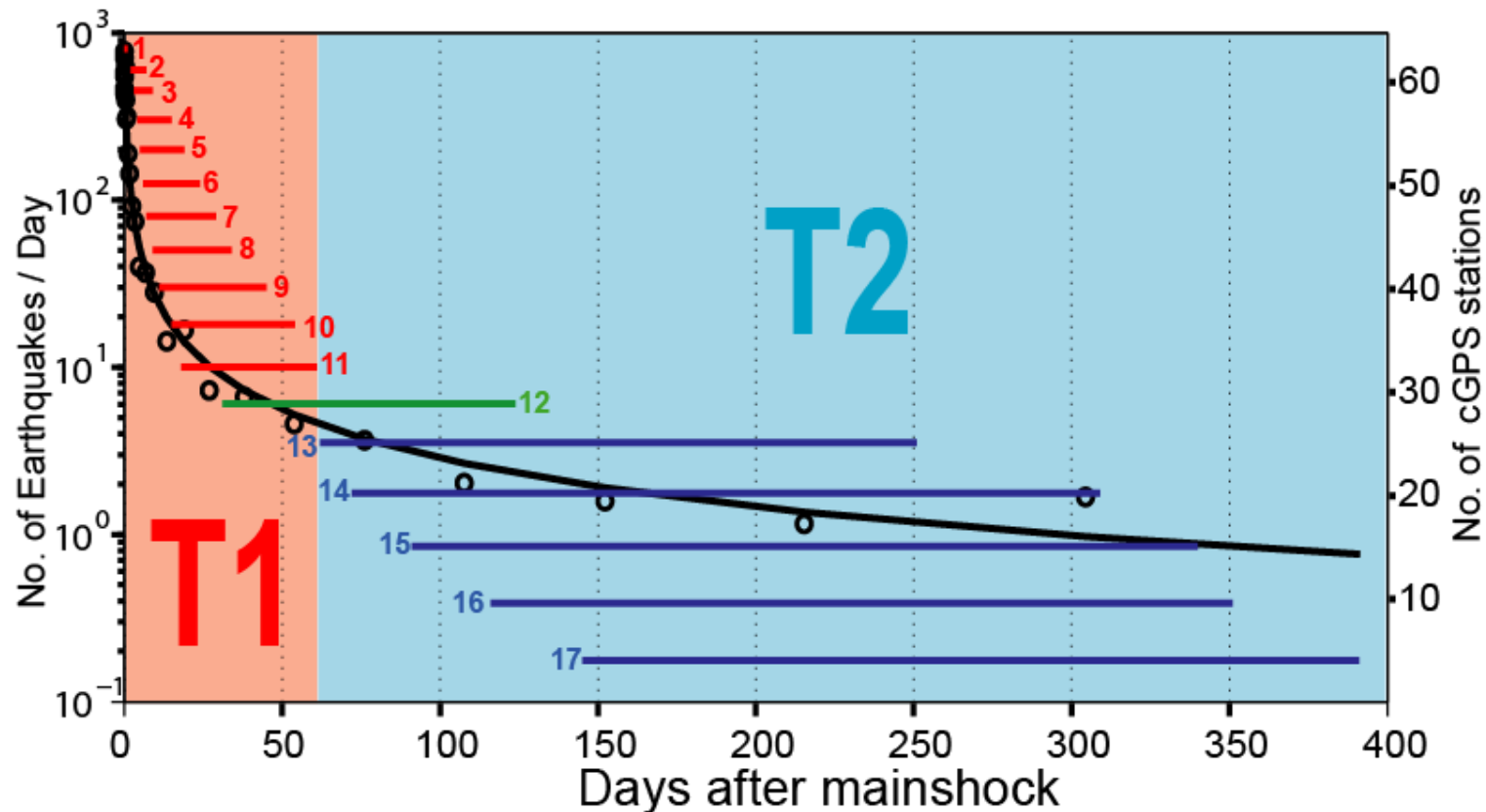
Combined spatio-temporal analysis of afterslip and aftershocks



Schoerlemer et al (Nature 2005)

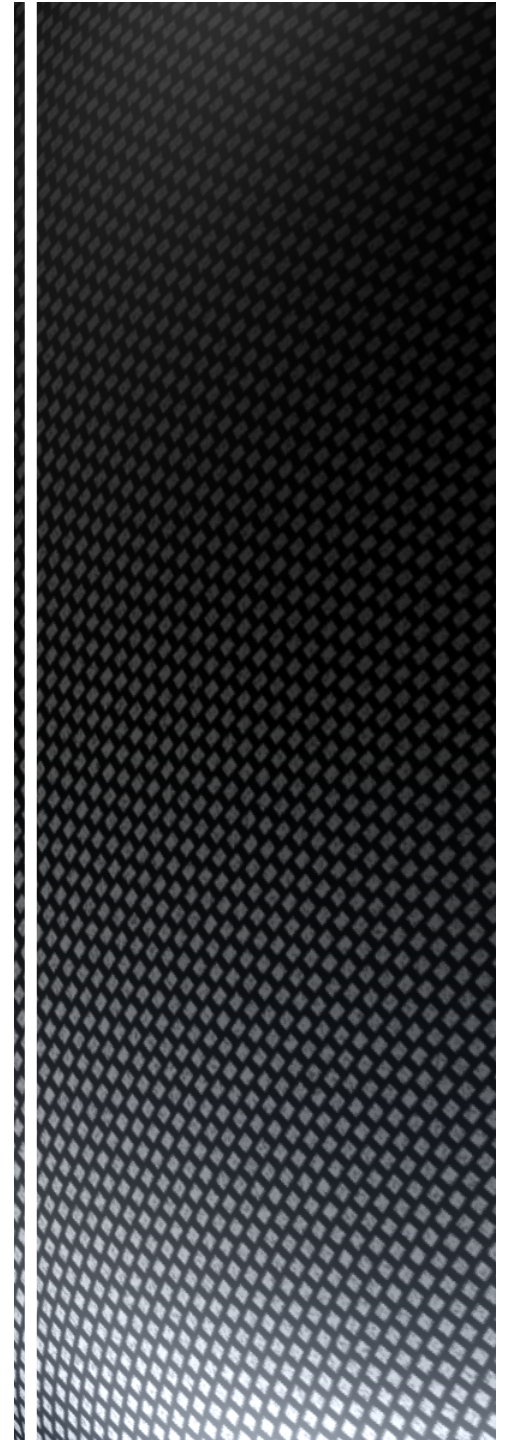
USGS – NEIC catalogue
27-2-2010 – 10-4-2011
M>4, $M_c=4.3$

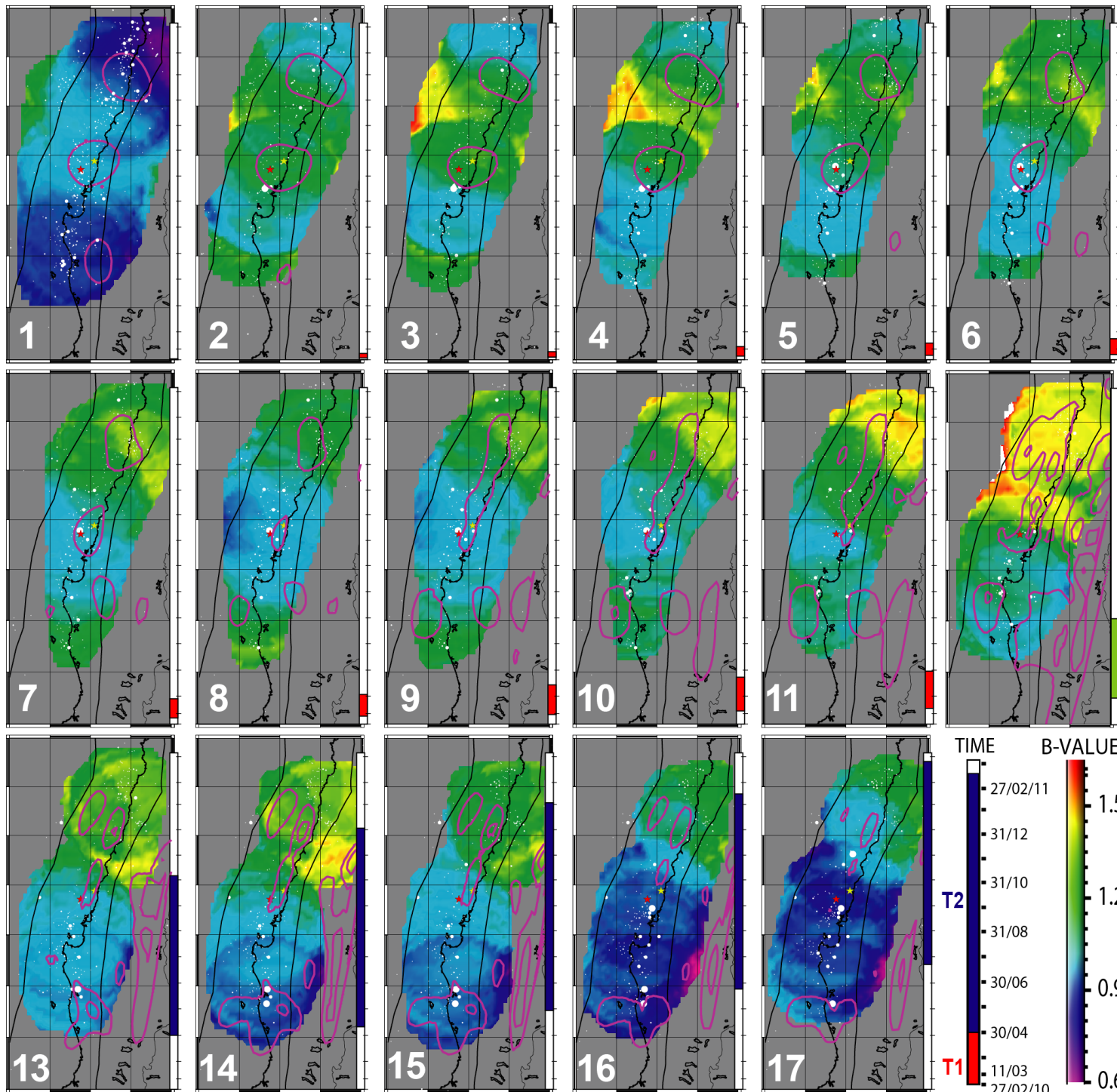
Combined spatio-temporal analysis of afterslip and aftershocks

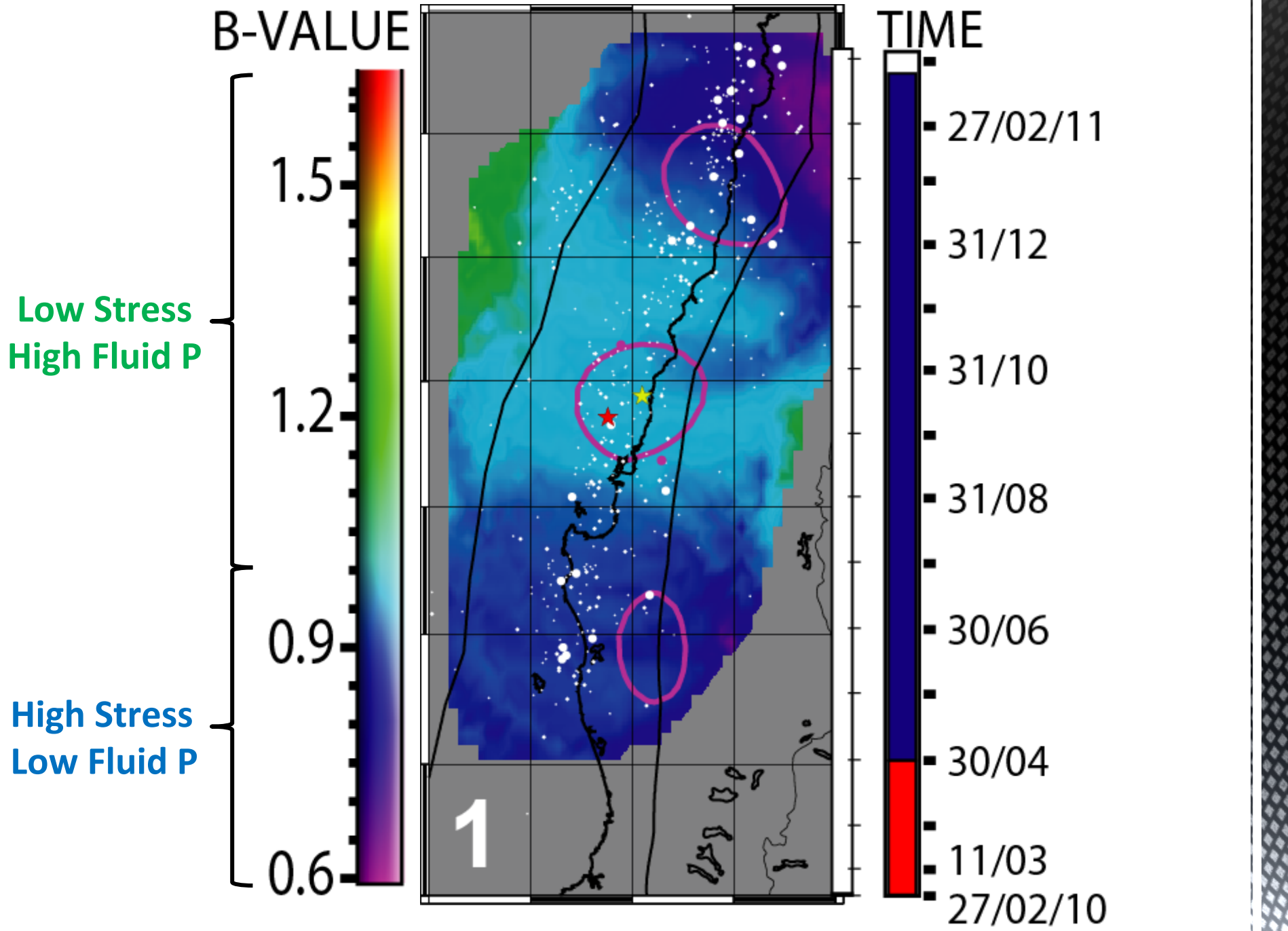


- 17 time windows: **1-11 for T1**, **13-17 for T2** and **one transitional 12**
- Each window has 450 quakes and are overlapped by 85% of them
- For each window we compare the cumulated afterslip with the b-value map

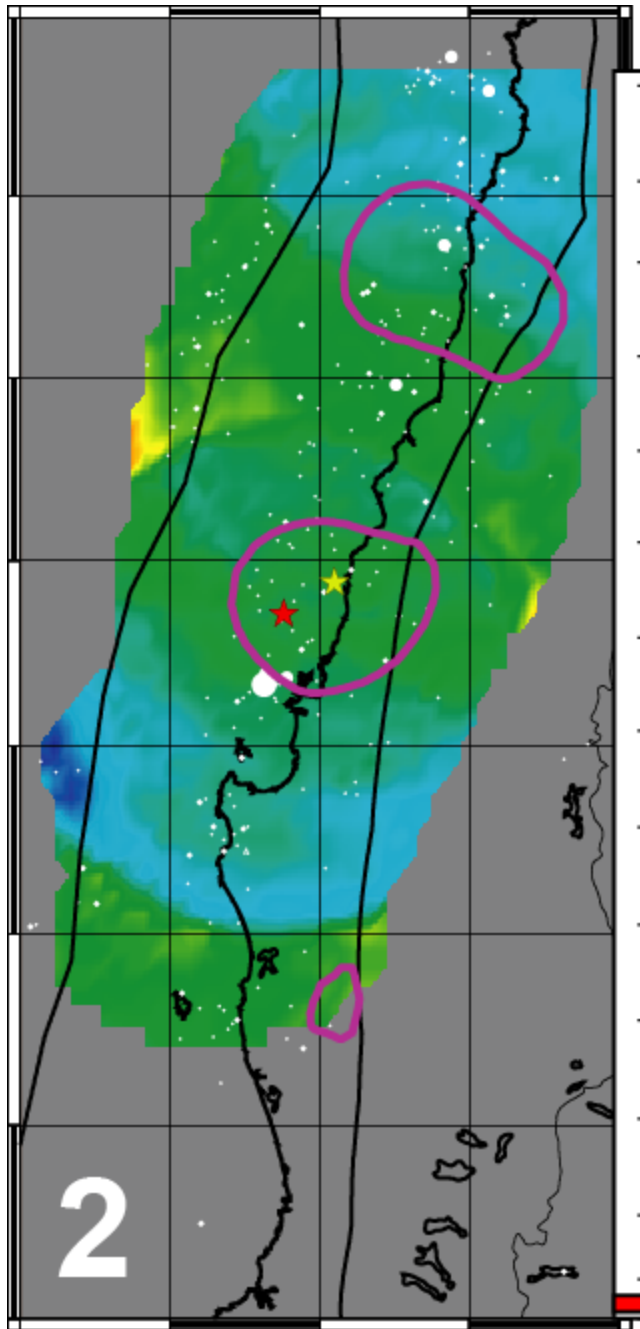
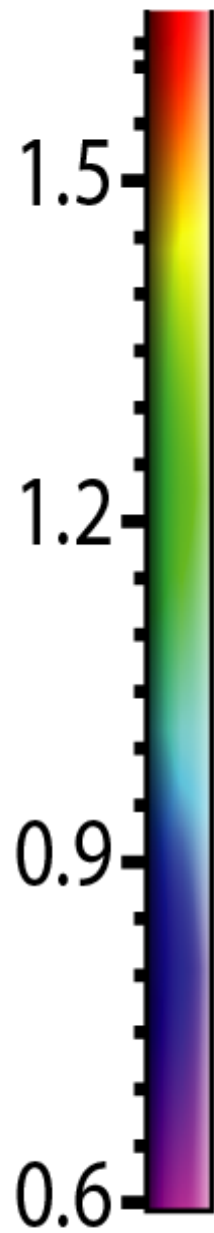
RESULTS



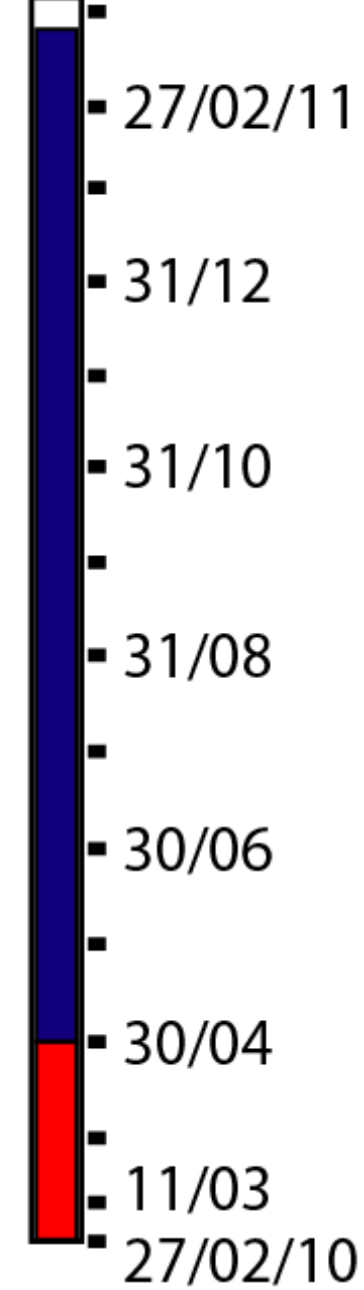




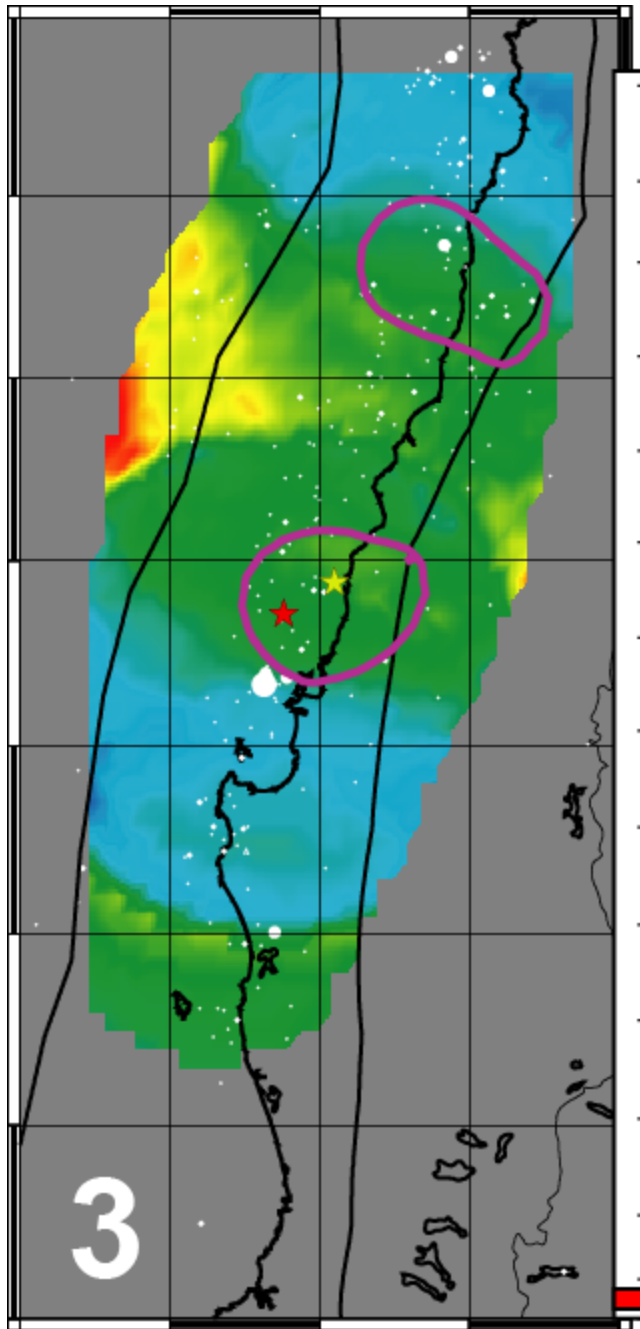
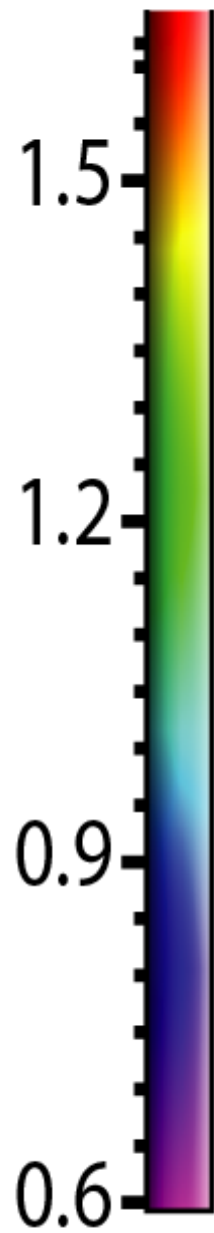
B-VALUE



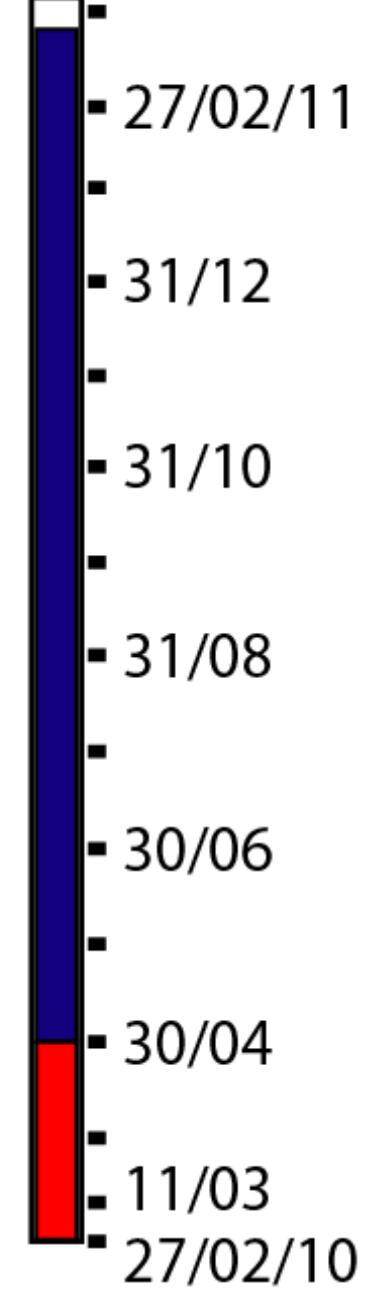
TIME



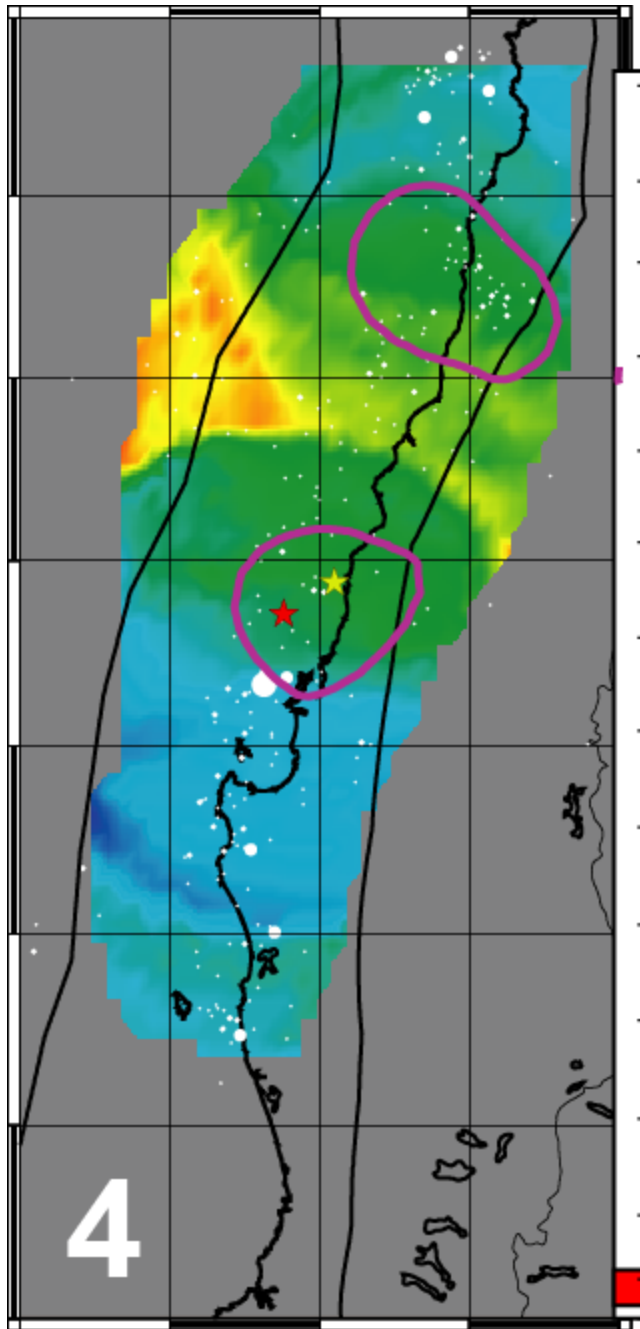
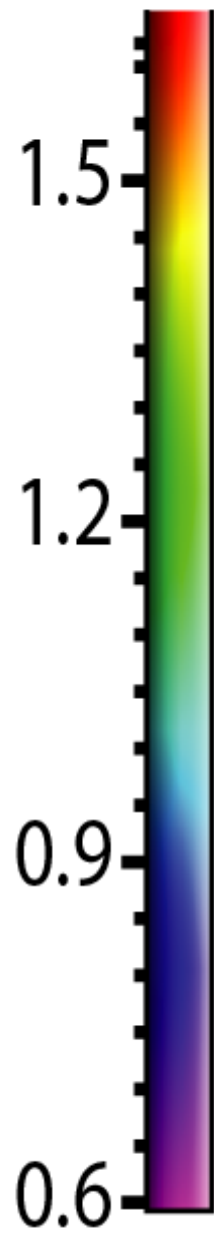
B-VALUE



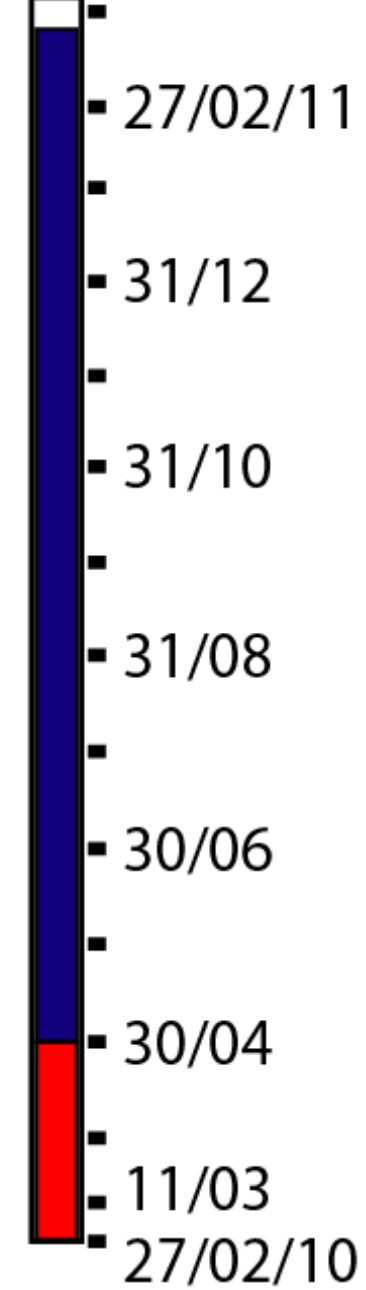
TIME



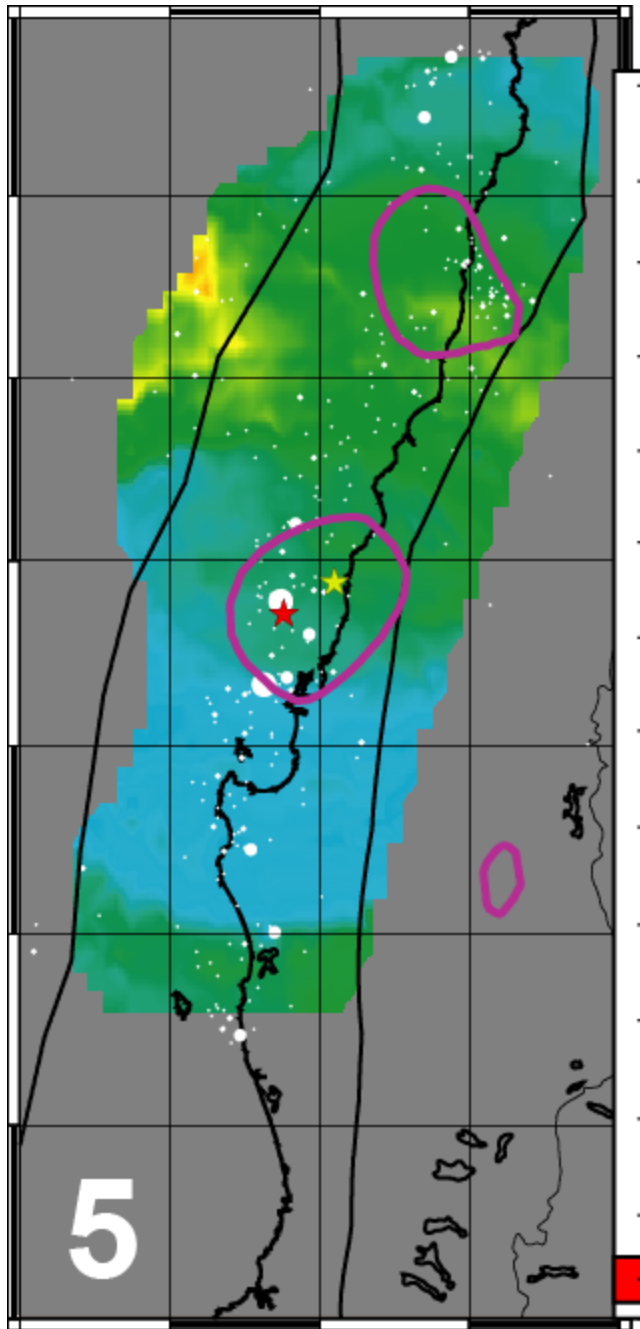
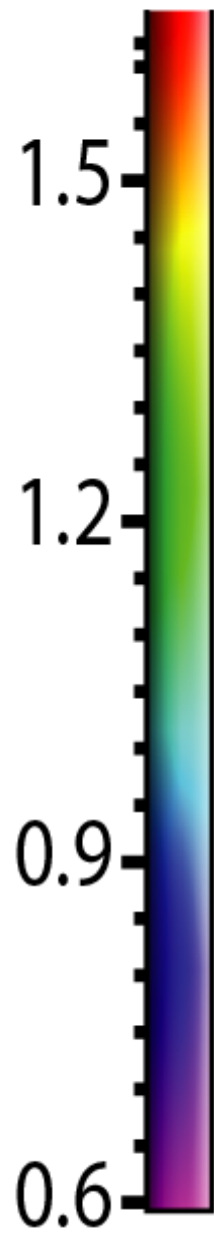
B-VALUE



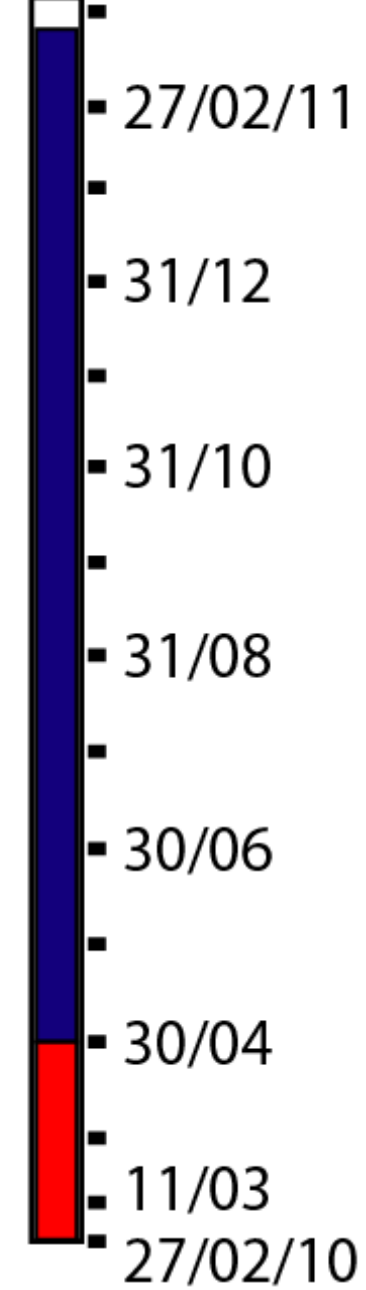
TIME



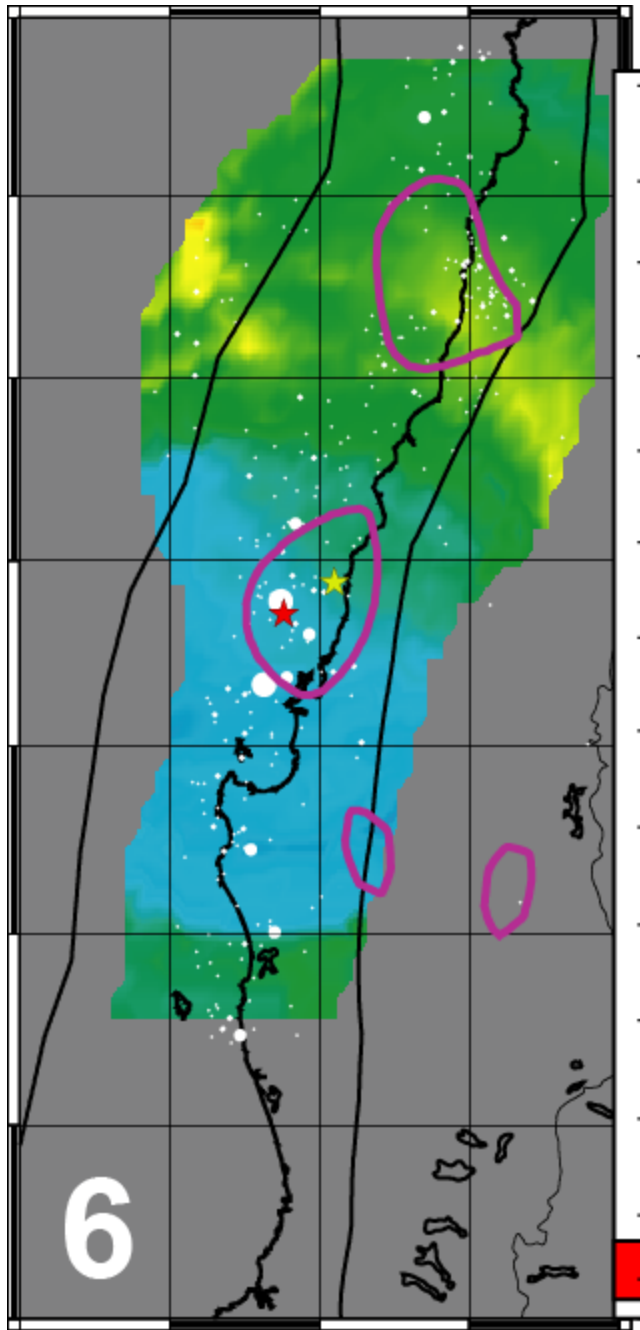
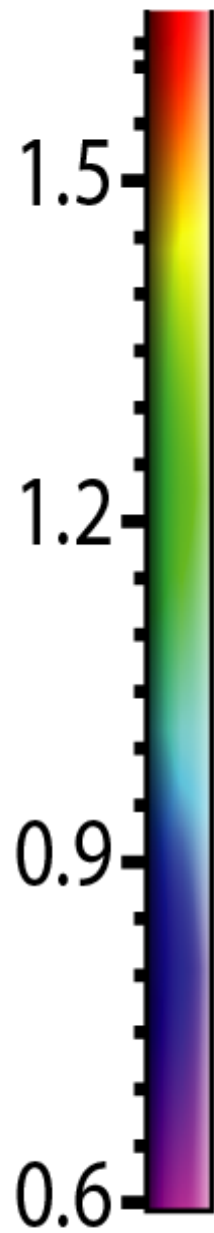
B-VALUE



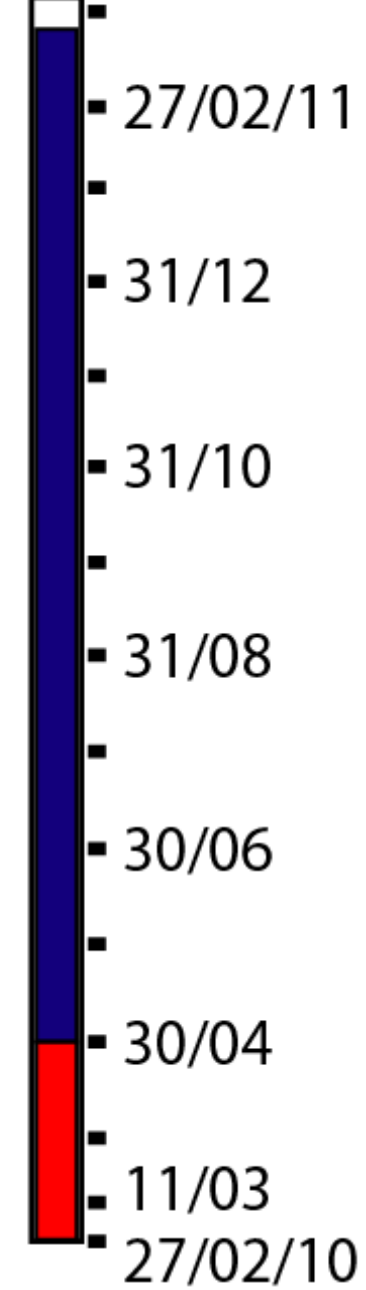
TIME



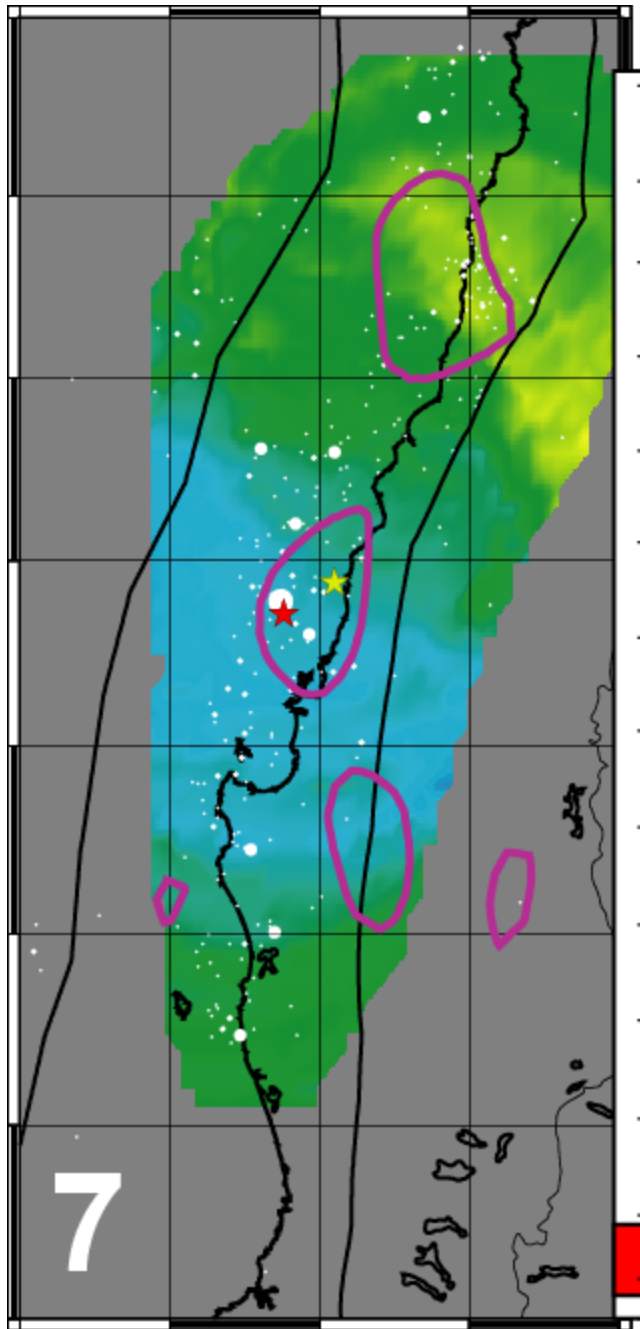
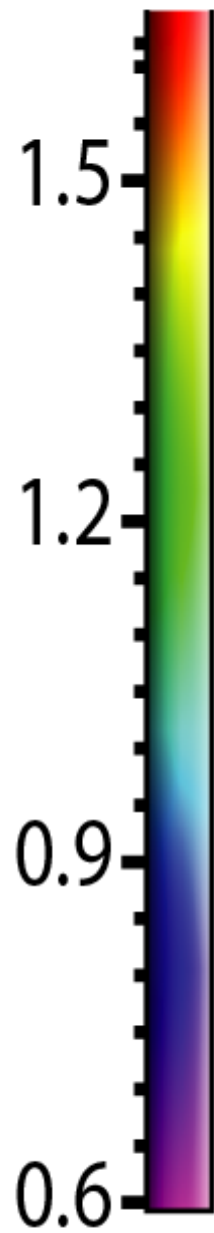
B-VALUE



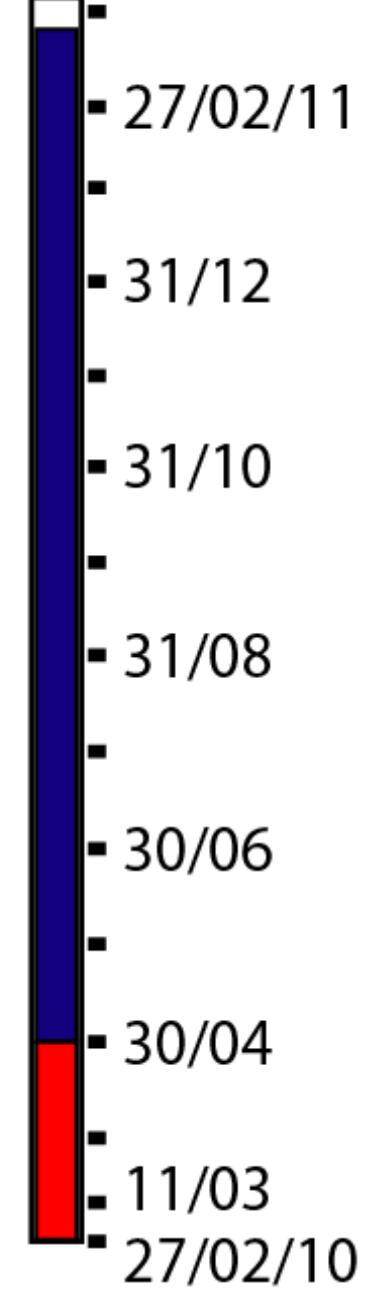
TIME



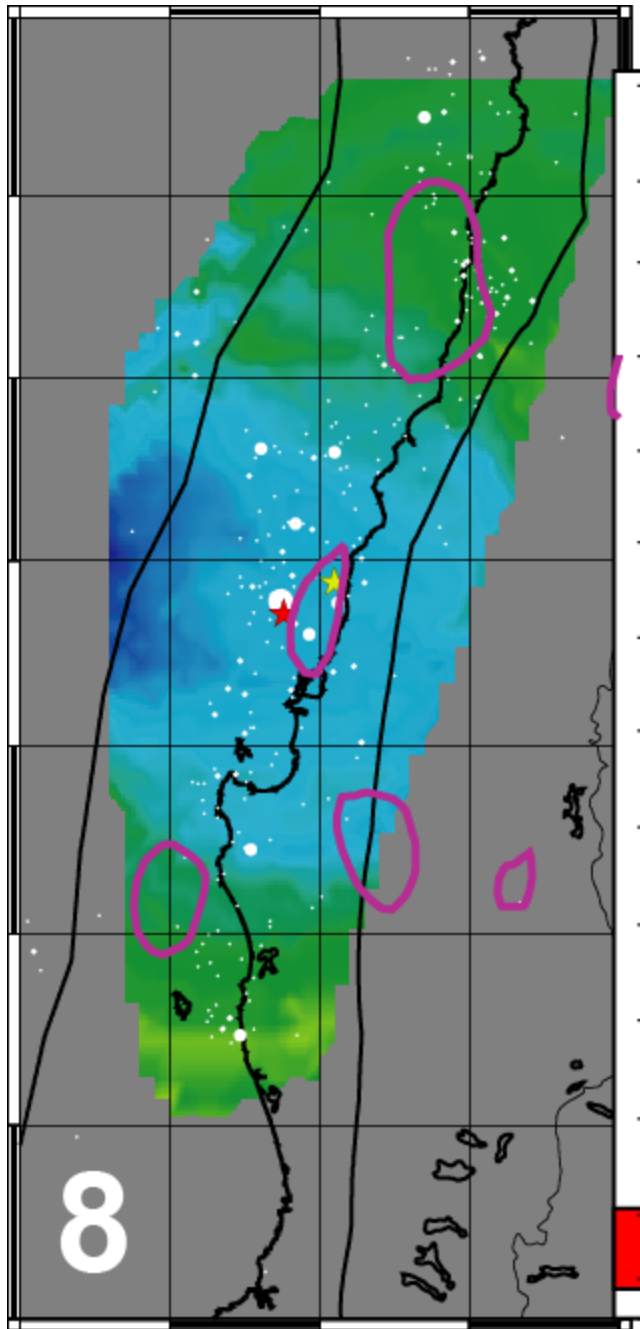
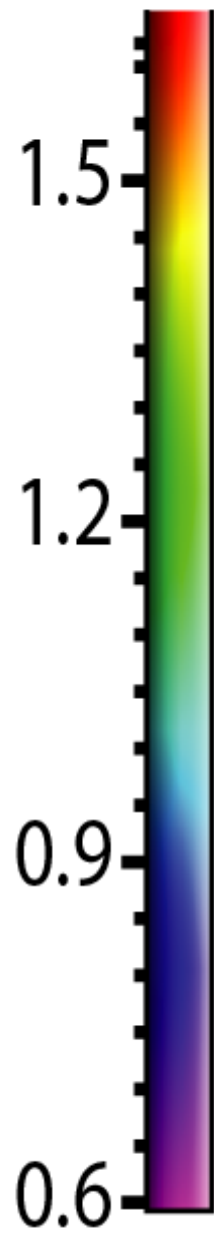
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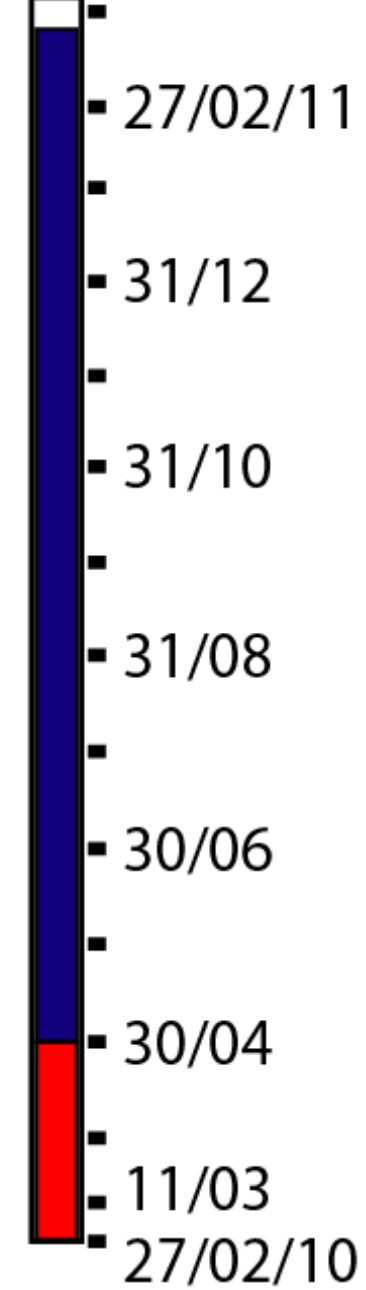
TIME



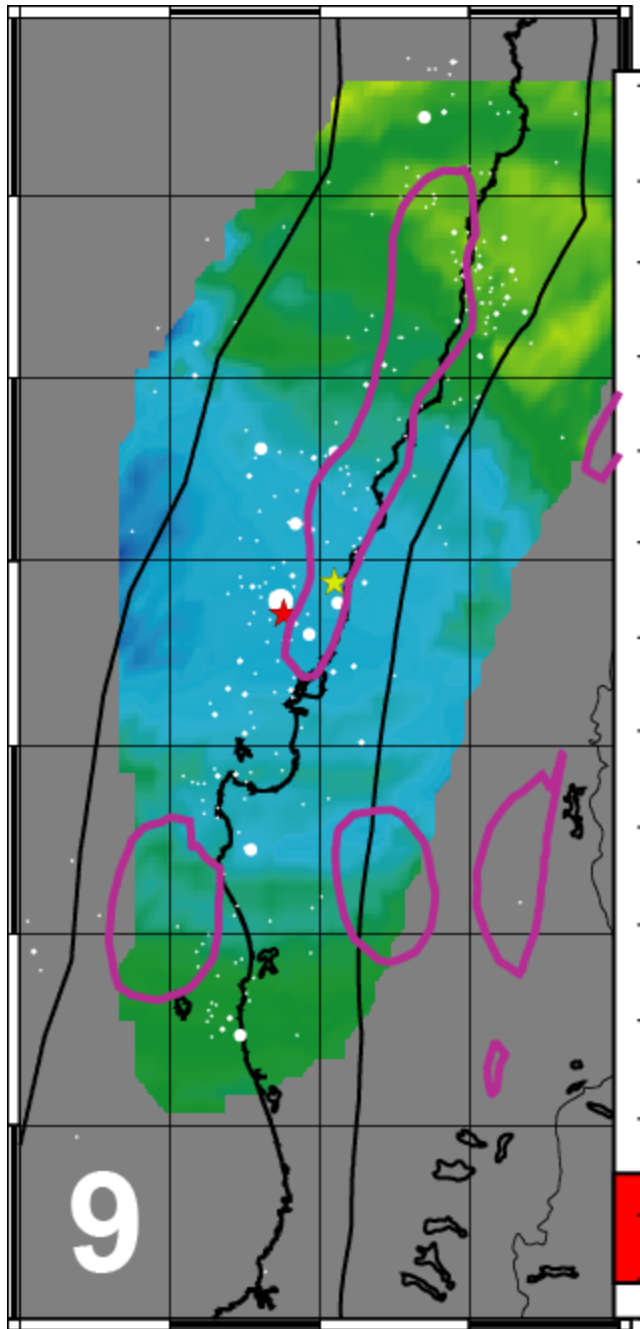
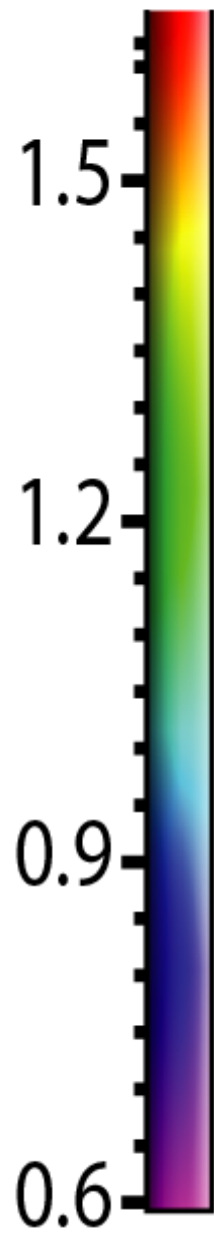
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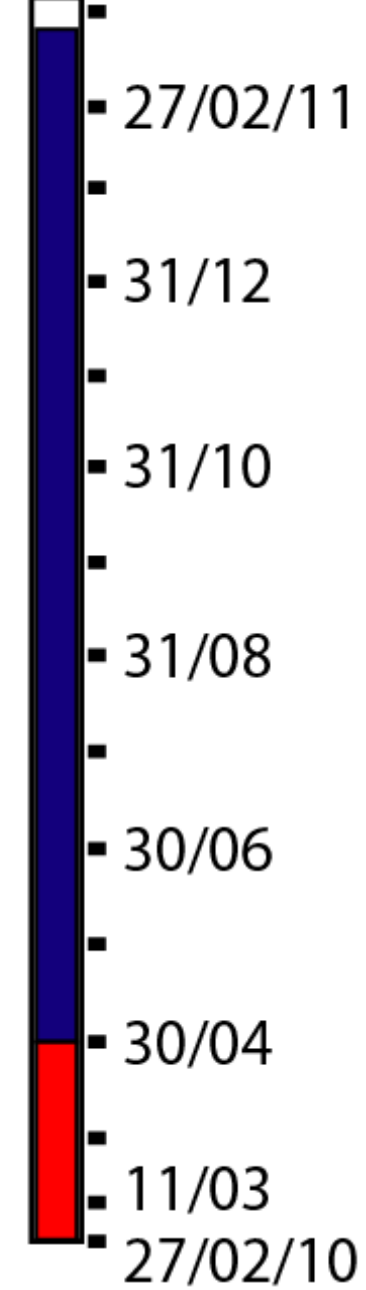
TIME



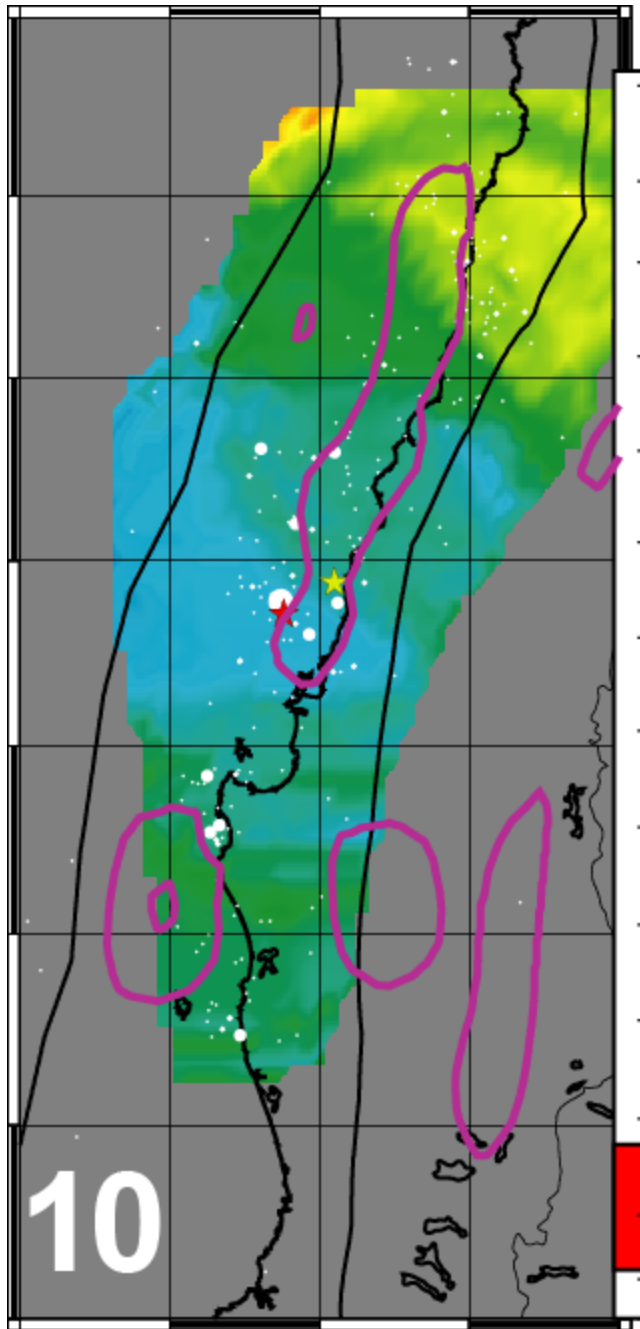
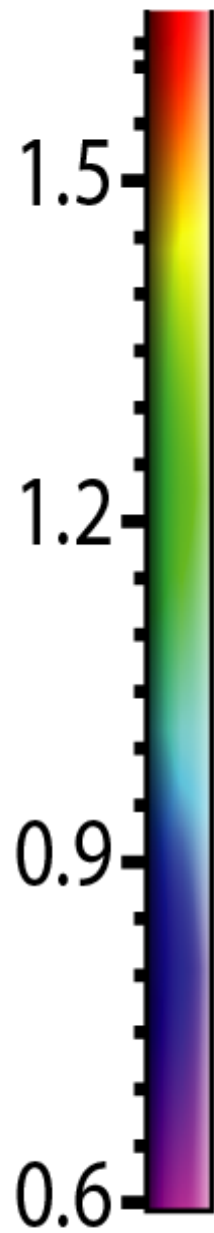
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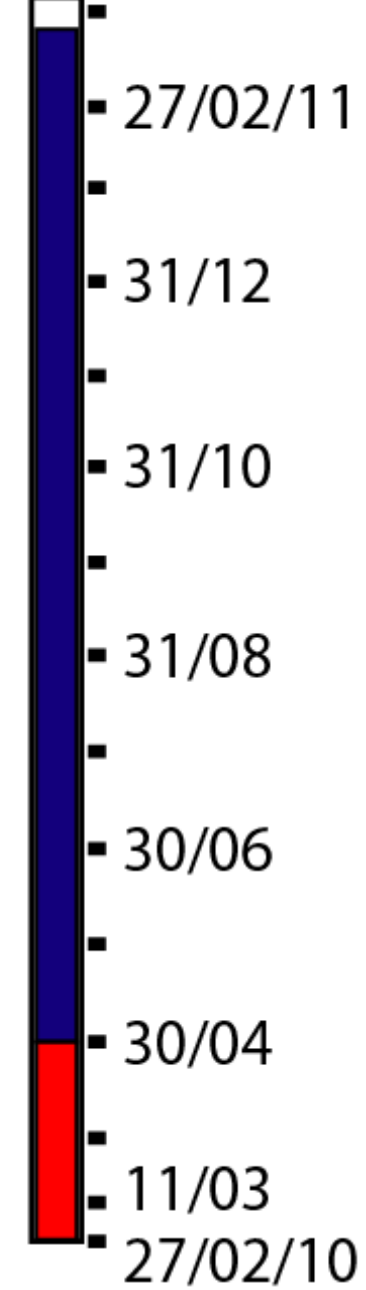
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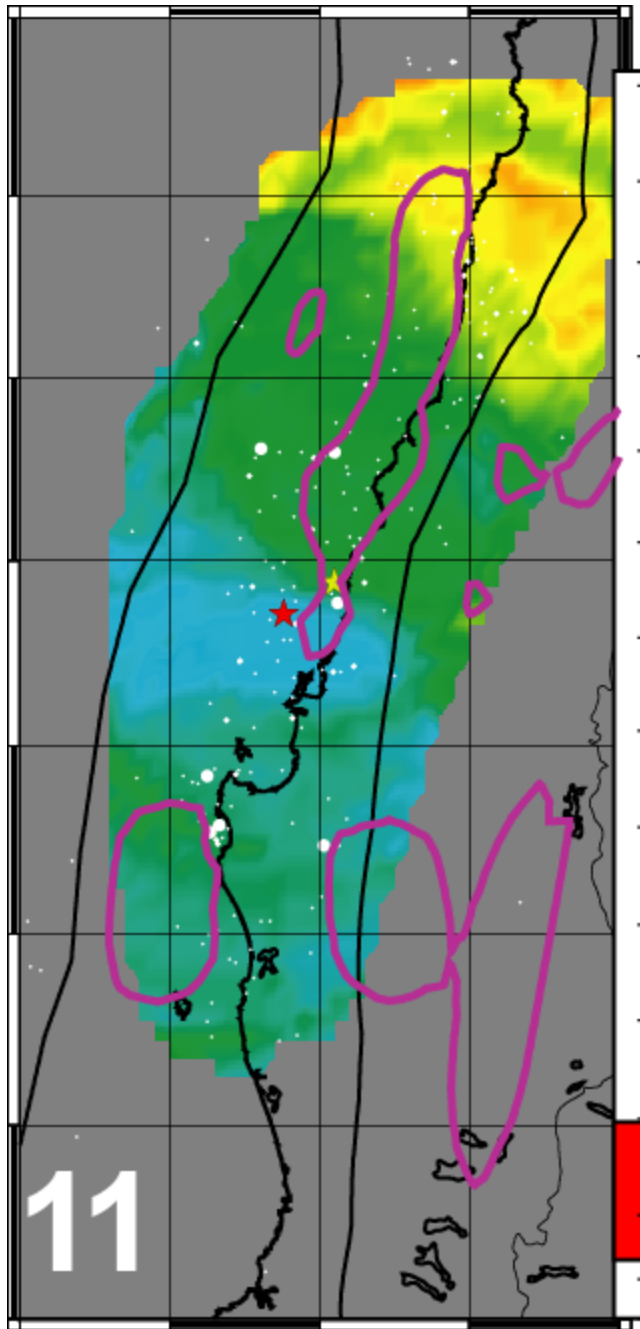
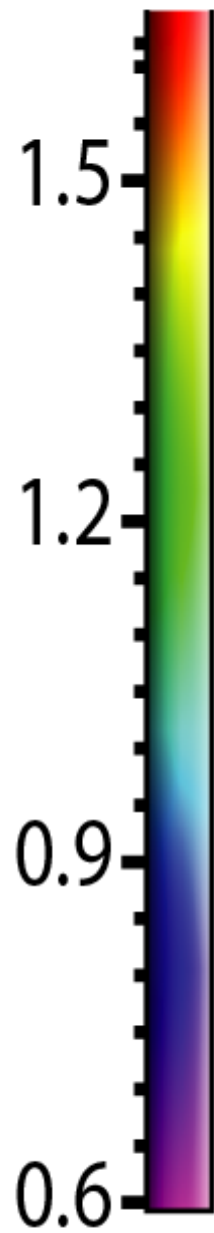
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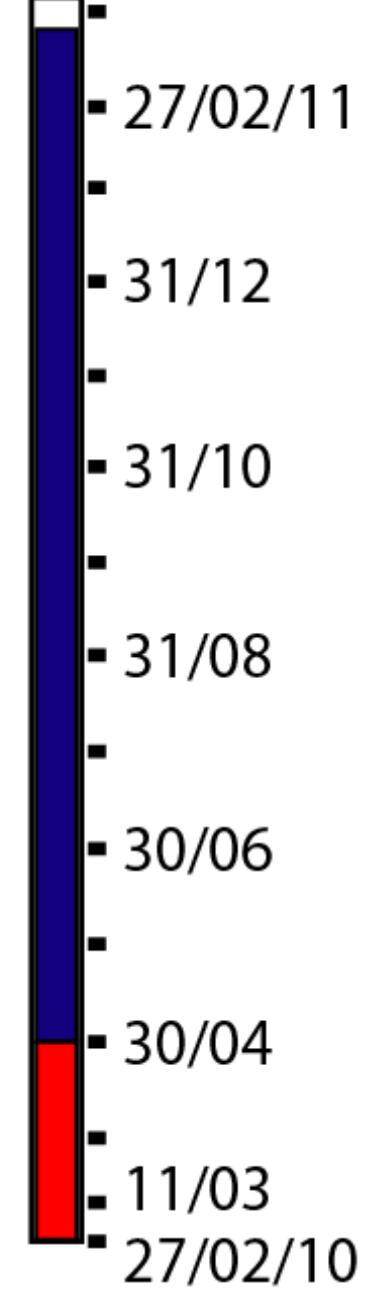
TIME



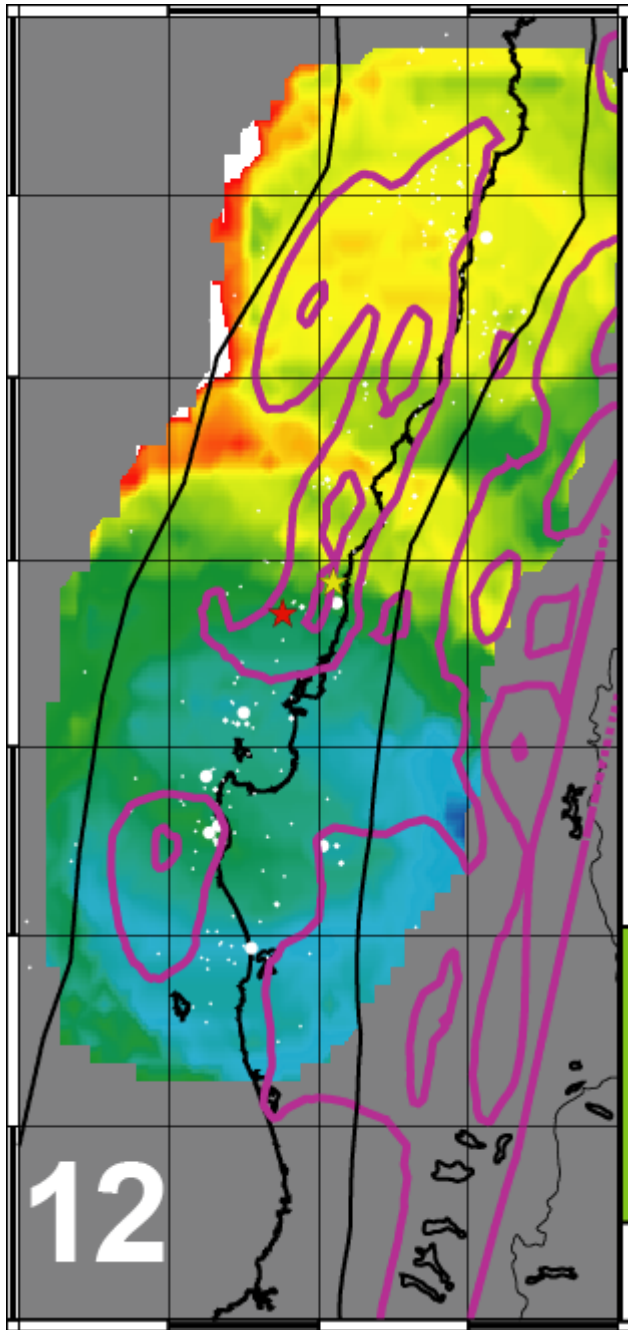
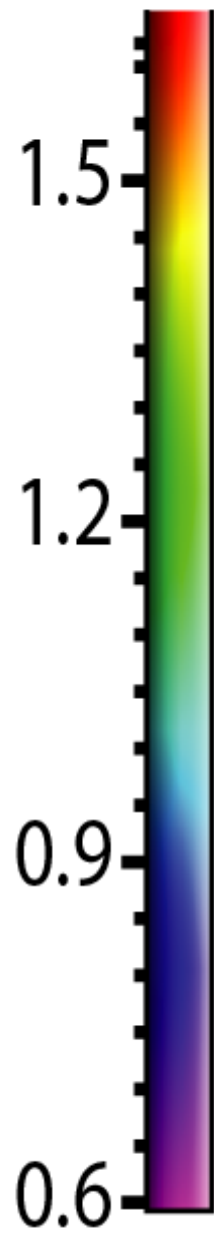
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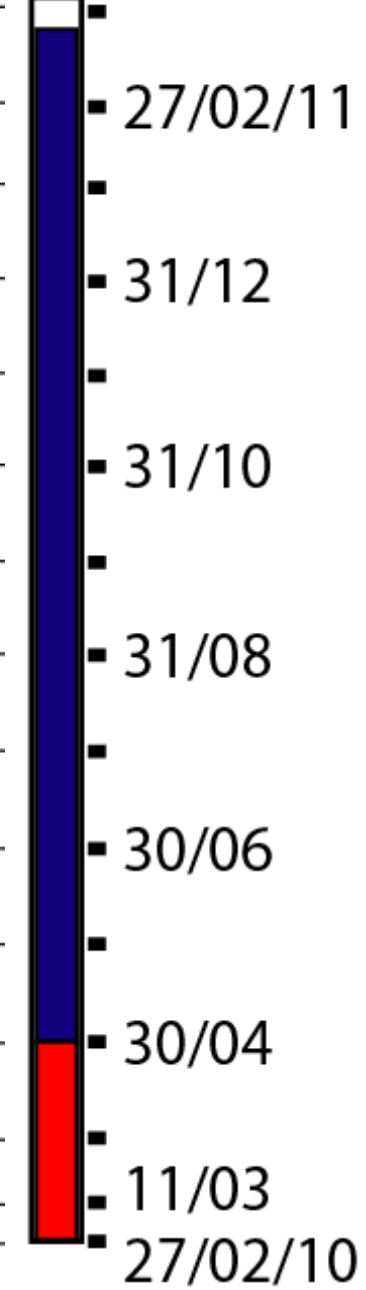
TIME



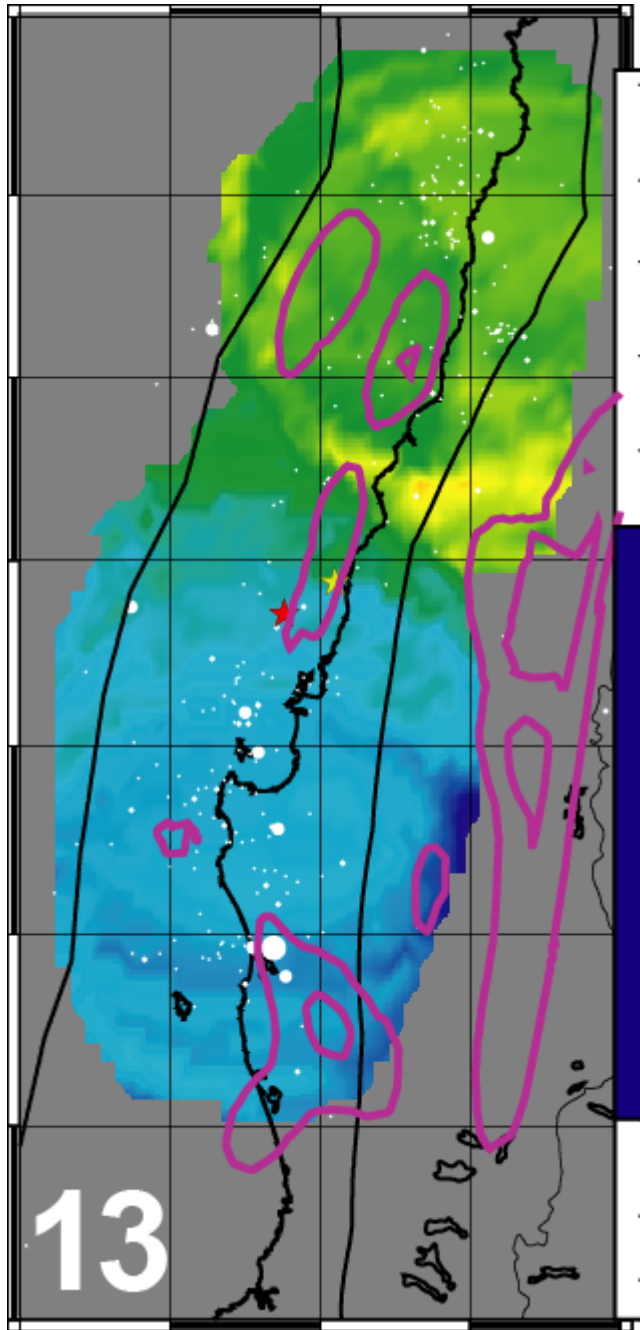
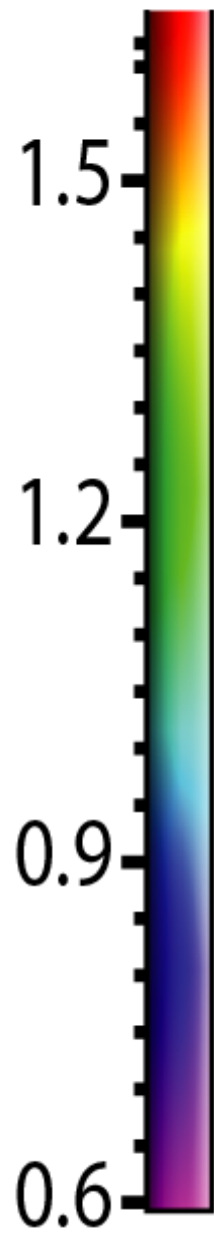
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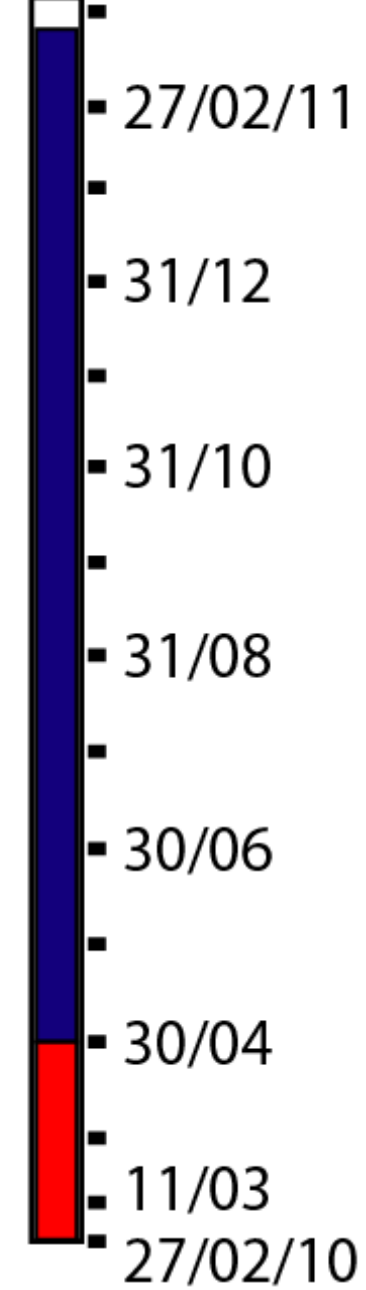
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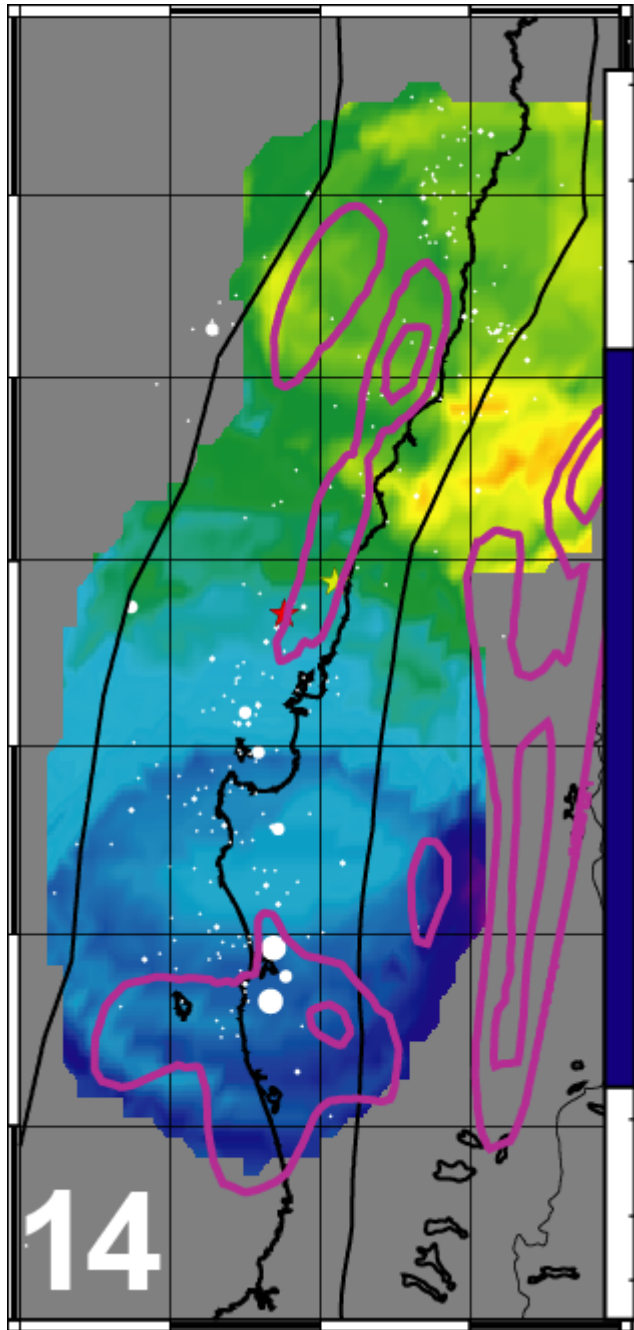
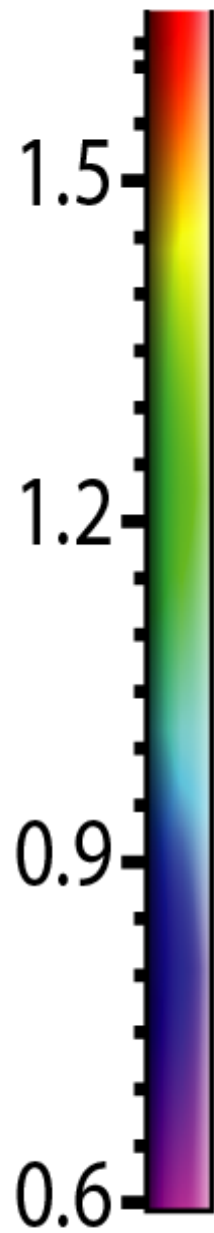
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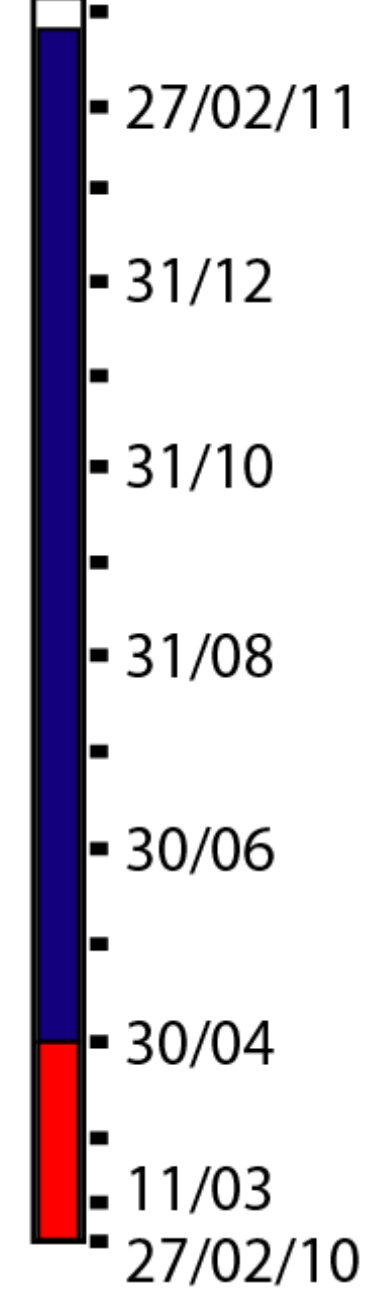
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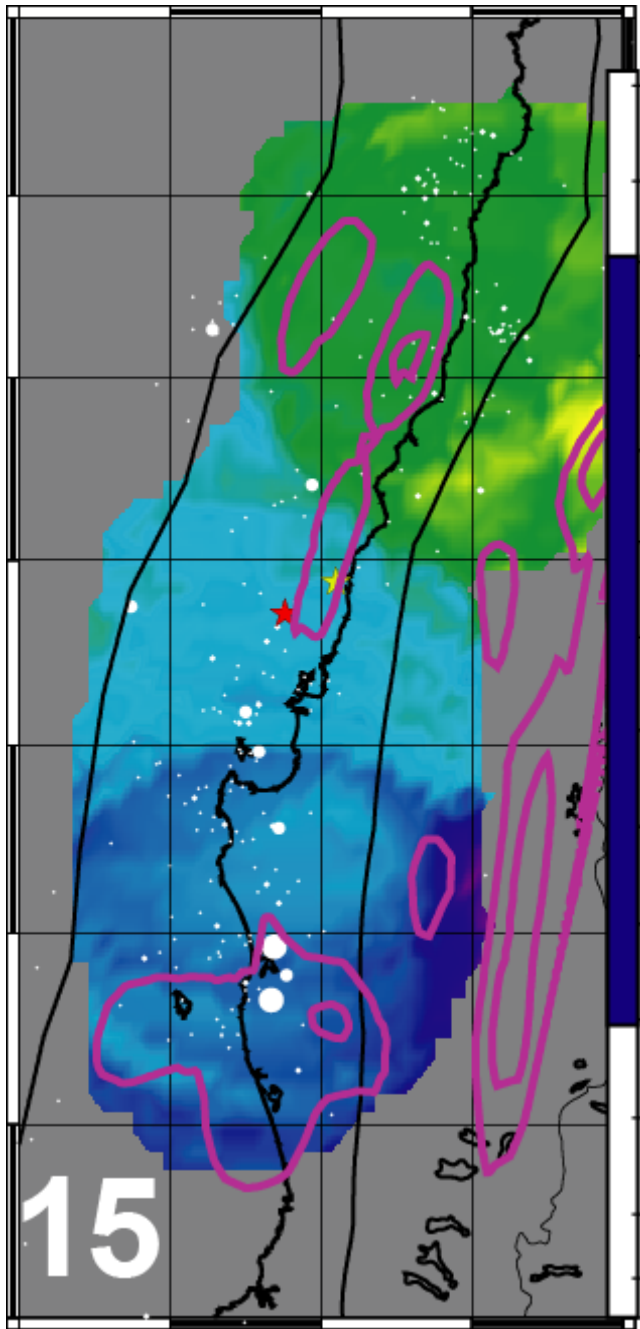
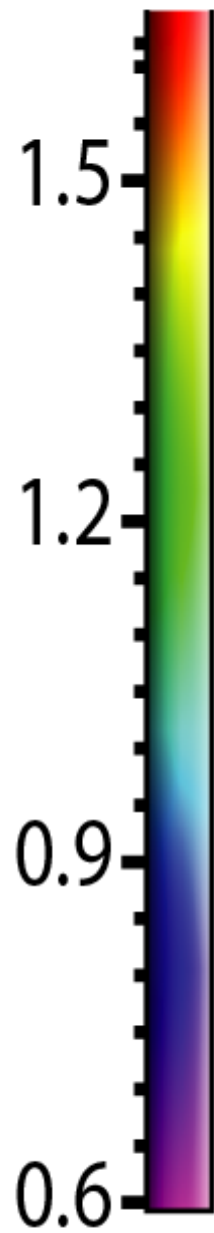
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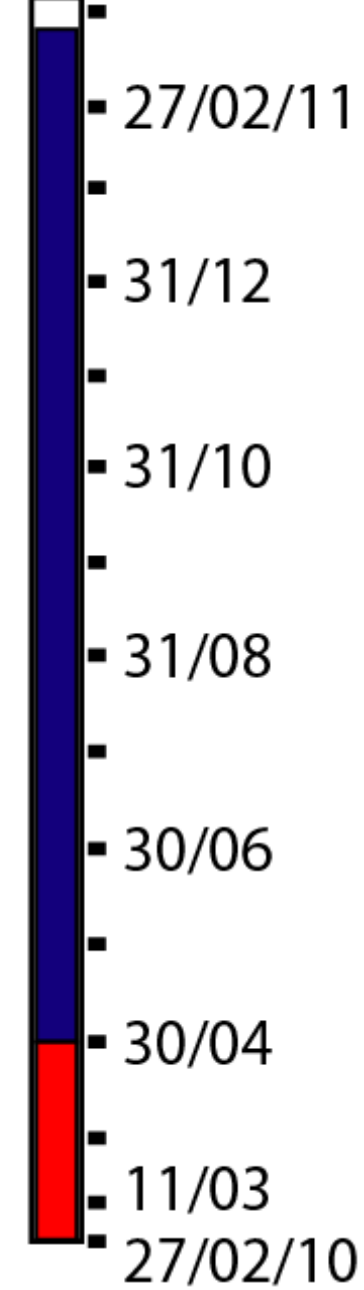
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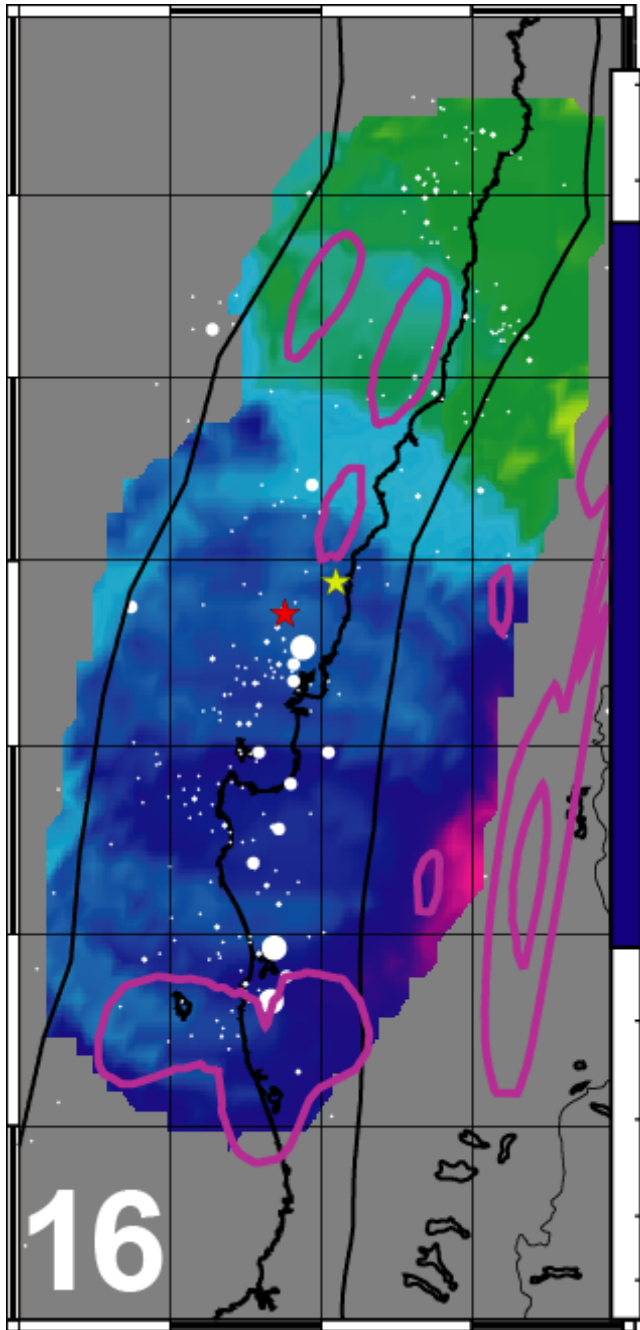
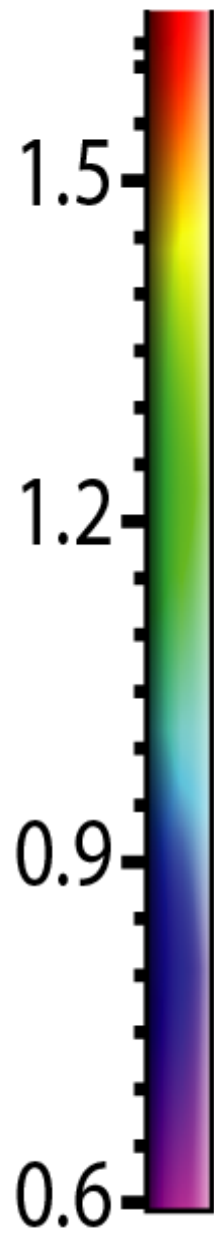
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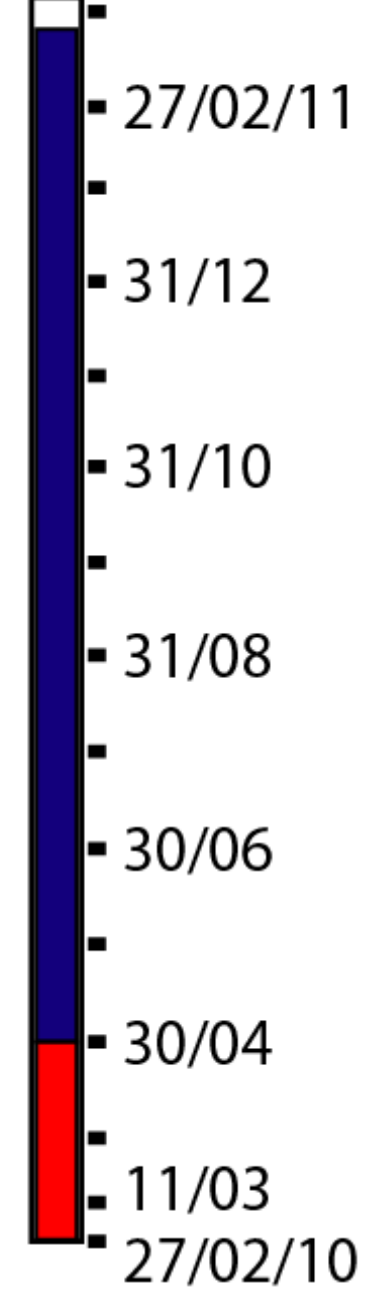
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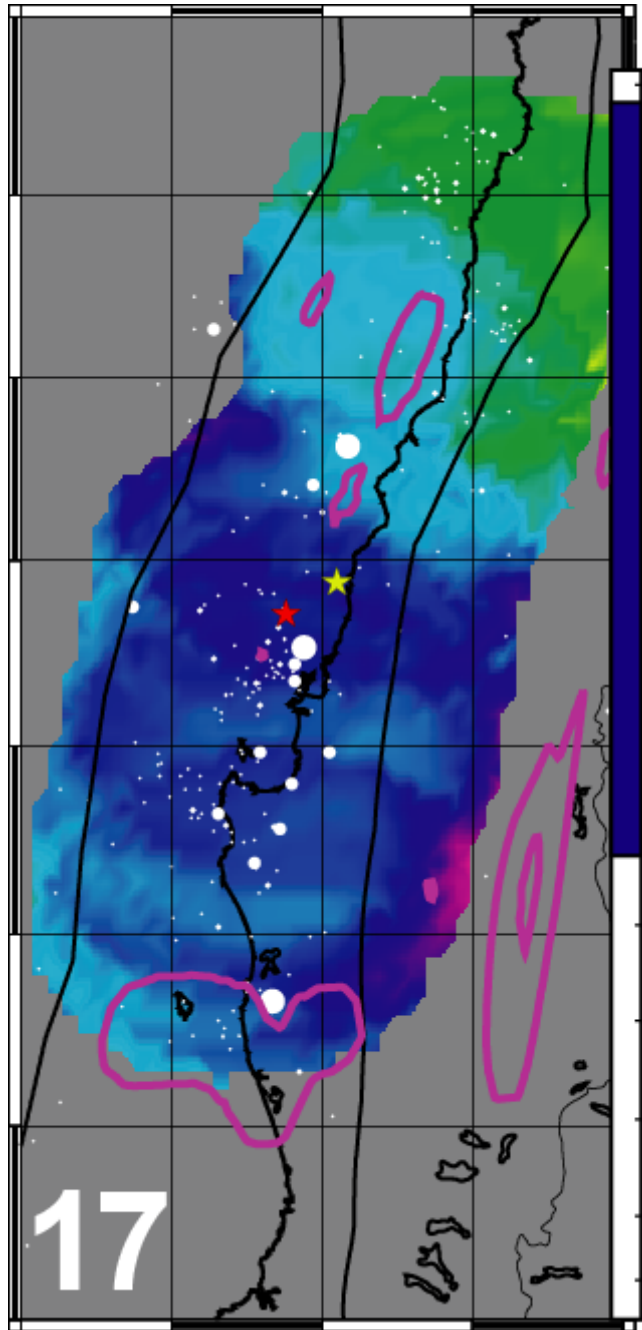
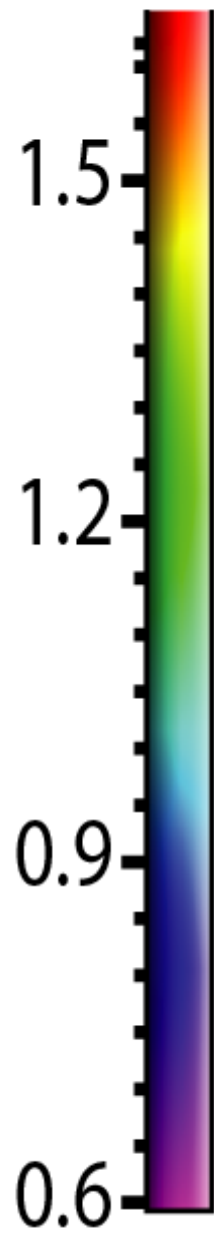
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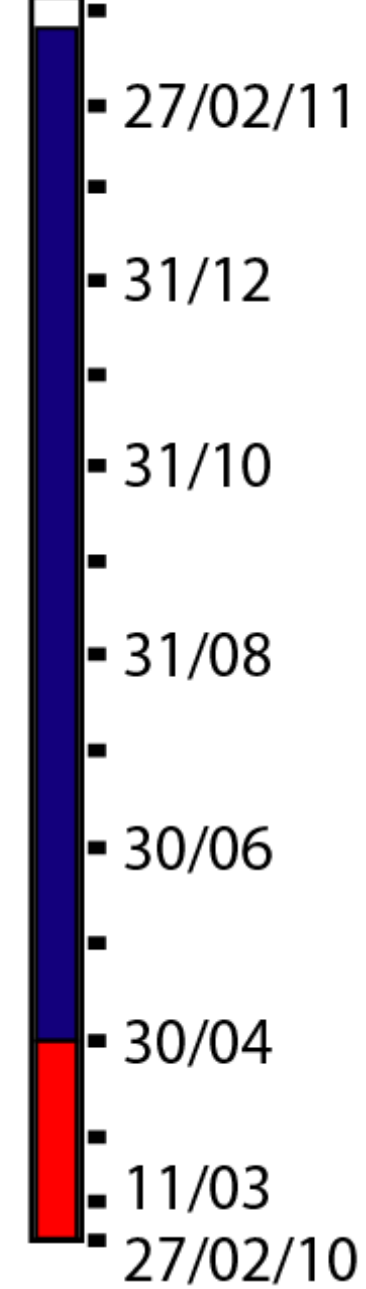
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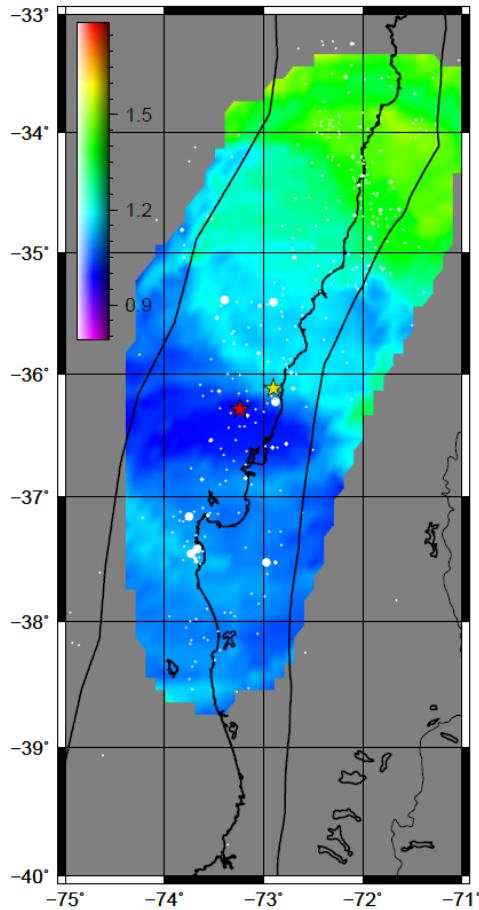
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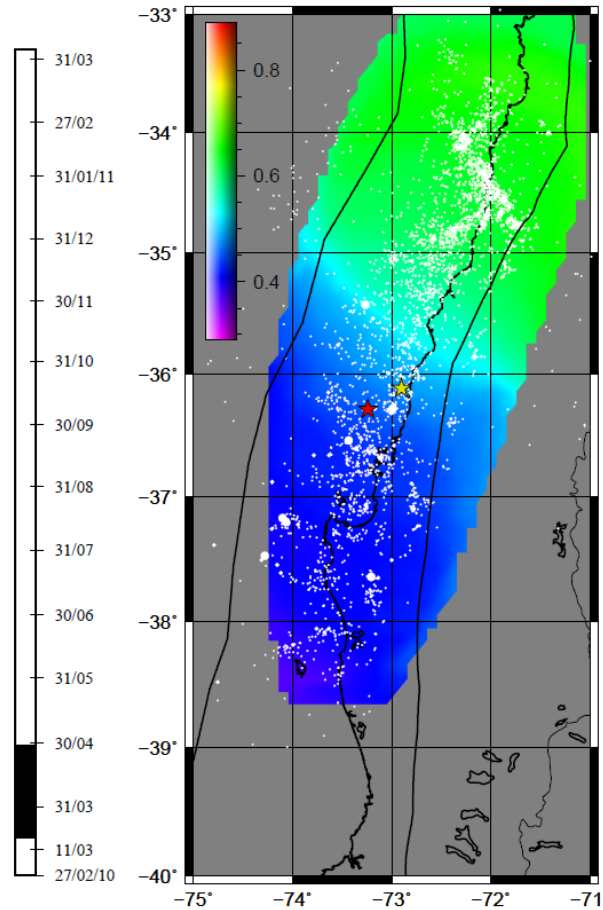
TIME



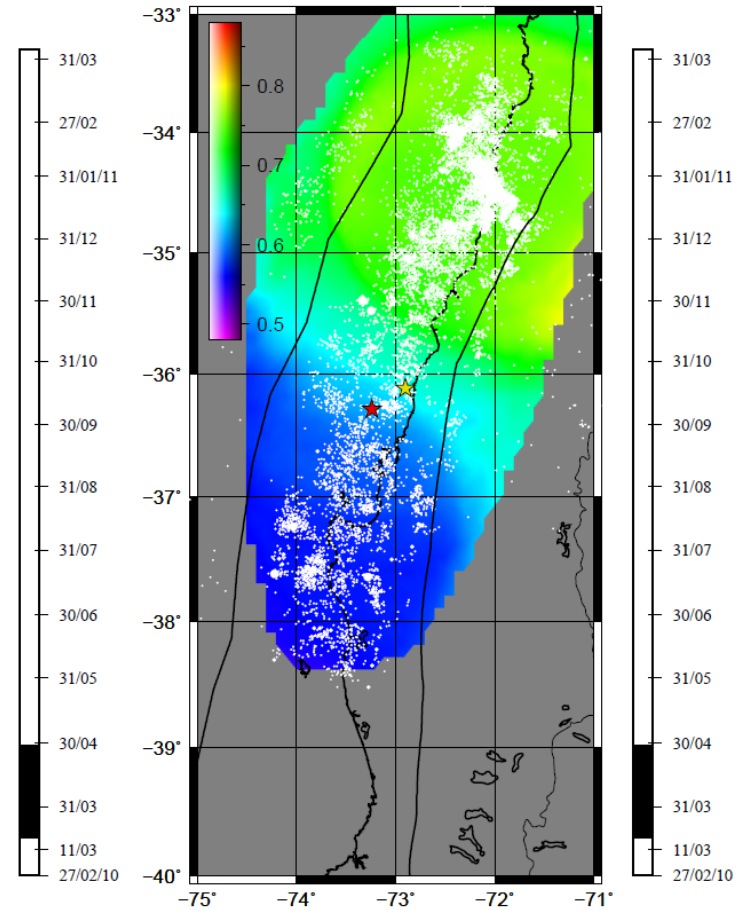
COMPARING RESULTS WITH OTHER HIGH-RESOLUTION CATALOGUES FROM IMAD NETWORK



NEIC



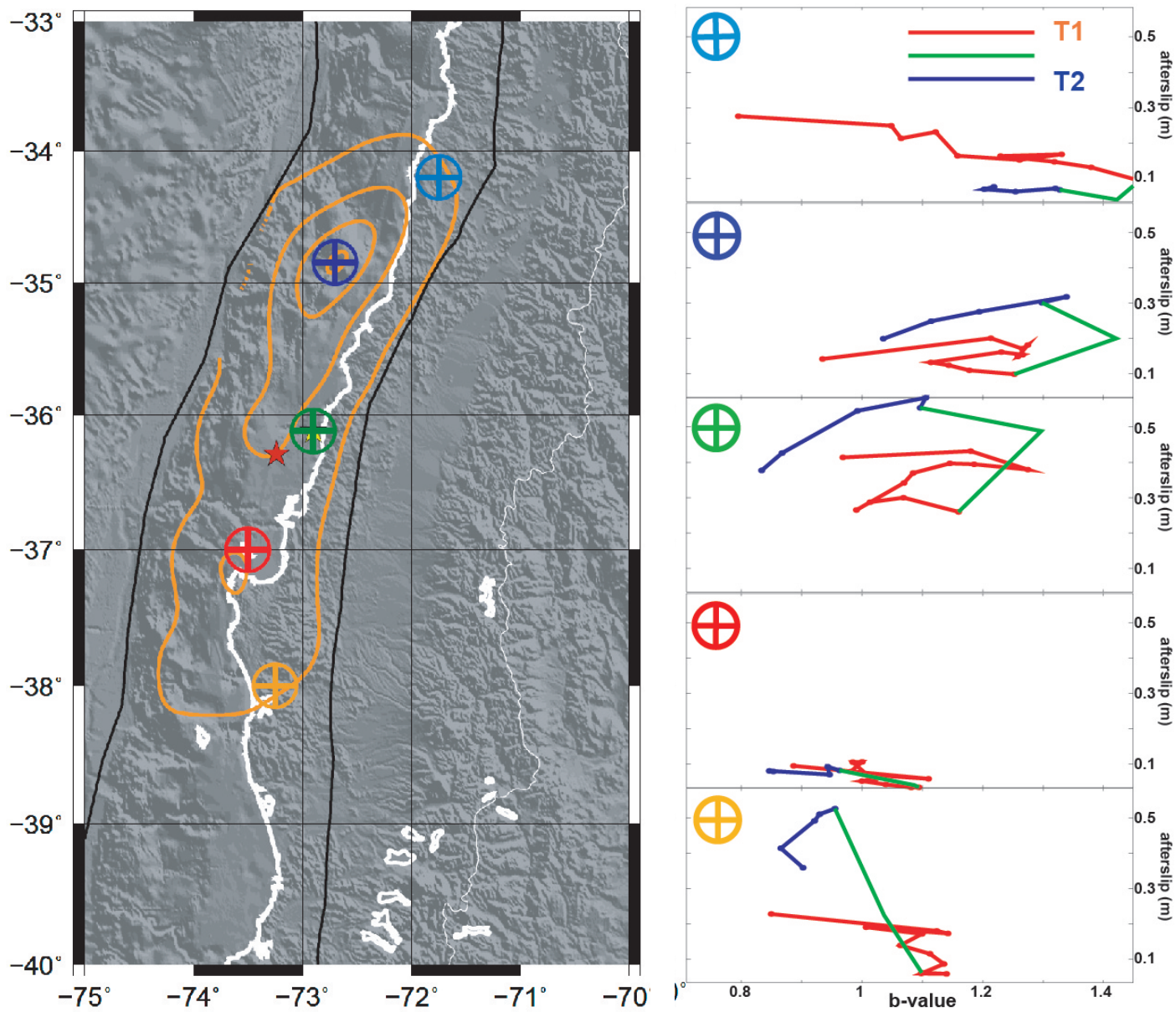
LANGE



RIETBROCK



ATTEMPTING TO QUANTIFY THE CORRELATION BETWEEN B-VALUE AND AFTERSLIP

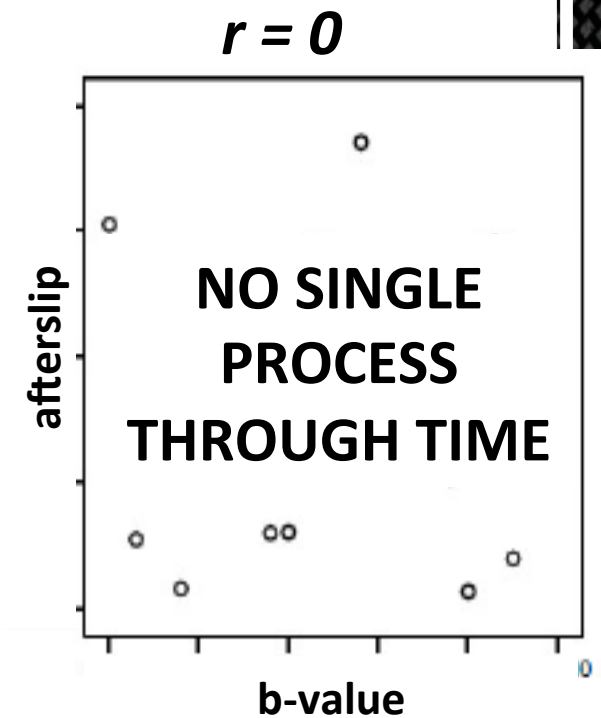
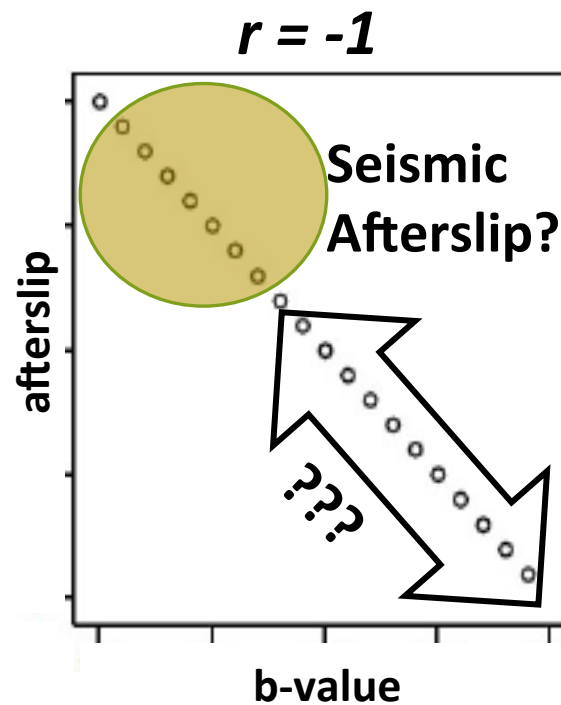
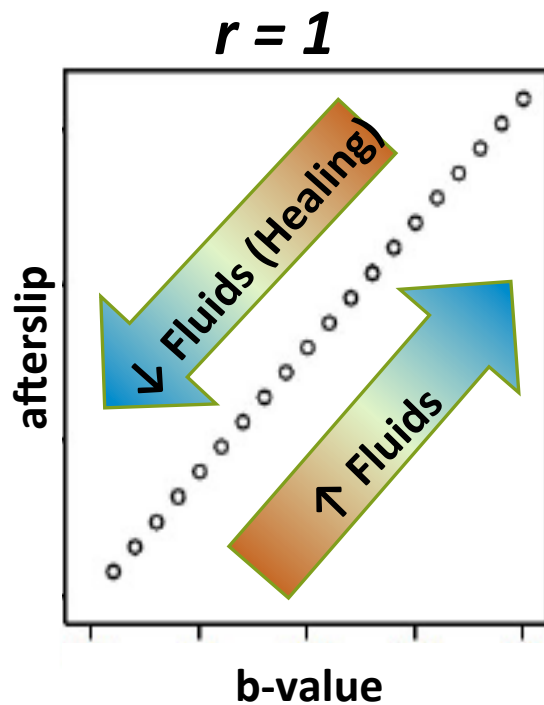


ATTEMPTING TO QUANTIFY THE CORRELATION BETWEEN B-VALUE AND AFTERSLIP

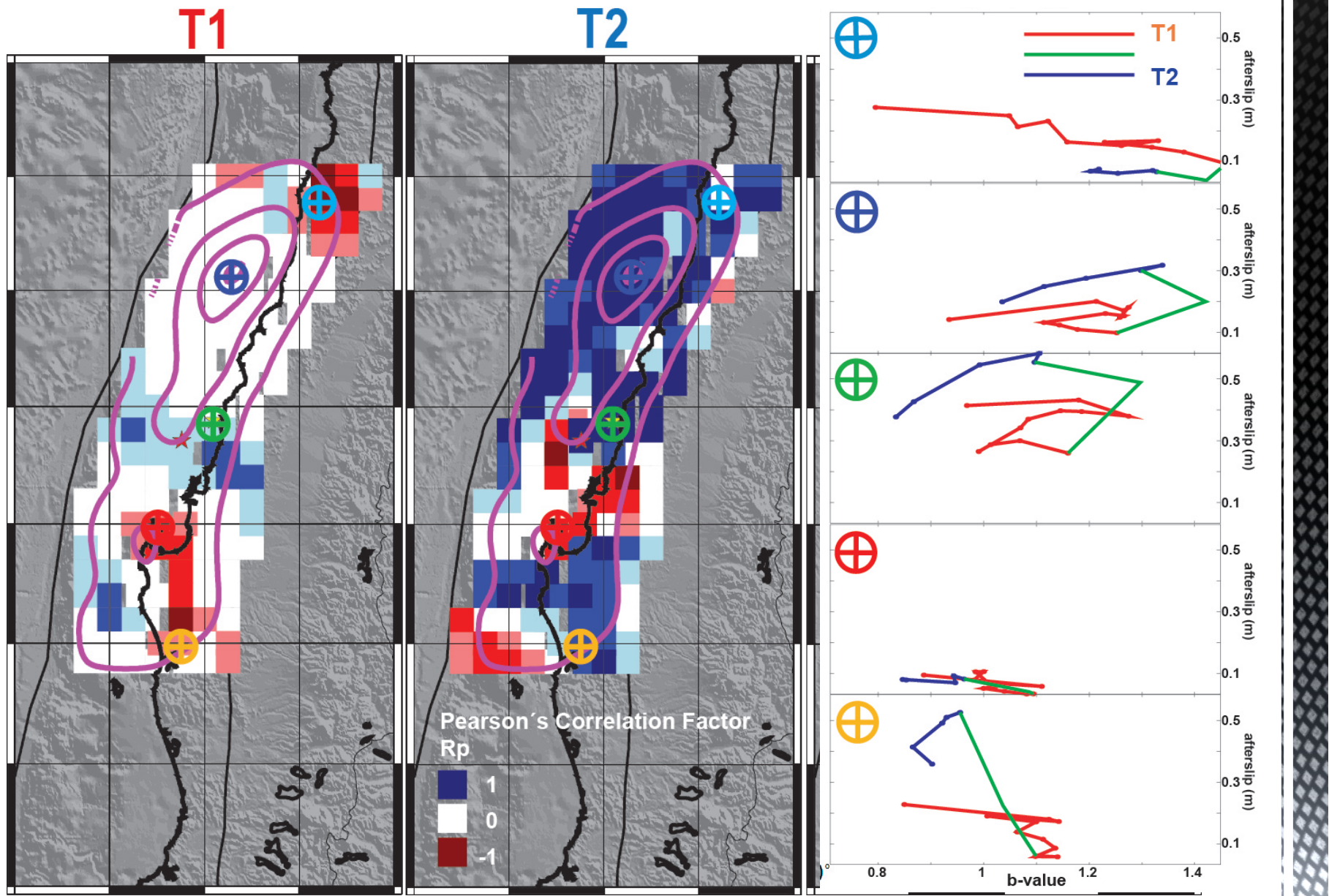
Pearson's correlation factor r

$$r = \frac{S_{xy}}{\sqrt{S_{xx}S_{yy}}}$$

$$S_{xx} = \sum_{i=1}^n (x_i - \bar{x})^2 \quad ; \quad S_{yy} = \sum_{i=1}^n (y_i - \bar{y})^2 \quad ; \quad S_{xy} = \sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})$$



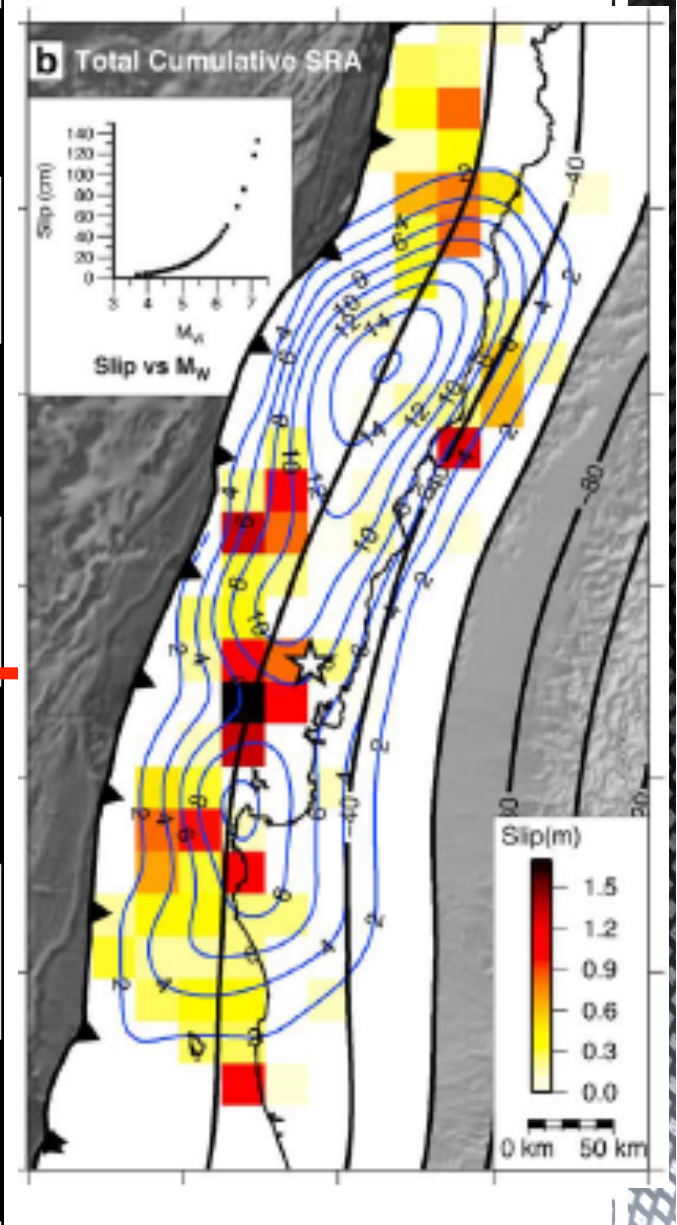
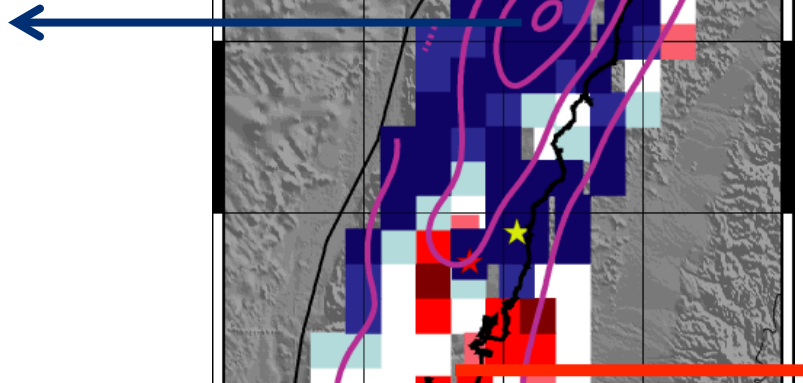
ATTEMPTING TO QUANTIFY THE CORRELATION BETWEEN B-VALUE AND AFTERSLIP



OUR INTERPRETATION IN TERMS OF MEGATHRUST NATURE (DURING THE HEALING PULSE T2)? Agurto et al. (2012)

FLUID-DOMINATED

DELEYED HEALING
CONTROLLED BY
CLOSURE OF PORES
AND LOSS OF
PERMEABILITY,
PERHAPS DUE TO
MINERAL
PRECIPITATION
FROM FLUIDS

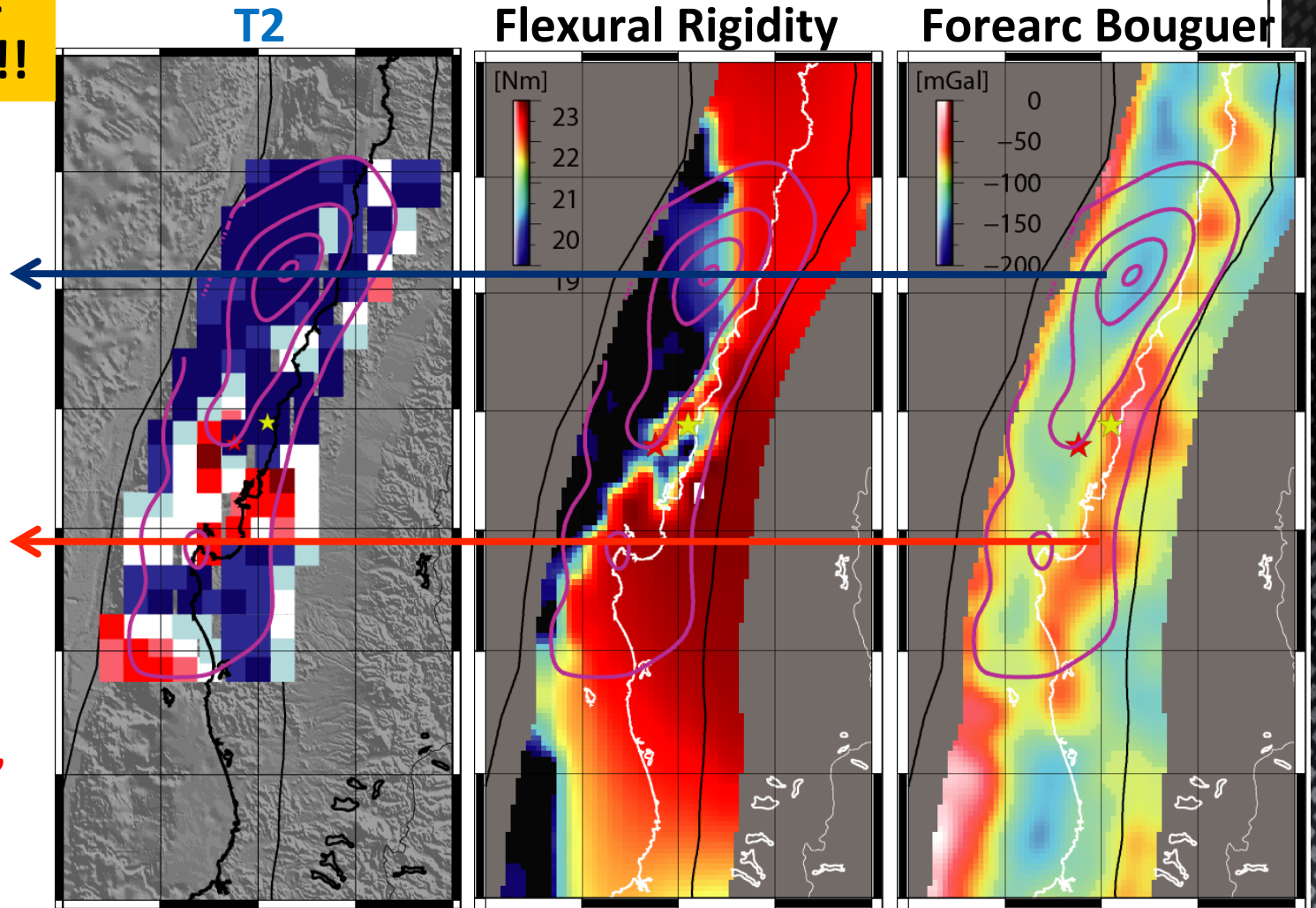


RELATION WITH LONG-TERM, GRAVITY-DERIVED FOREARC STRUCTURE?

**REMARKABLE
CORRELATION!!**

**Weak
megathrust
dominated by
high pore
pressure**

**Strong
megathrust
due to low
pore pressure,
almost dry
subduction
channel**



High/low Flex. Rig.



High/low coupling

High/low F. Bouguer



High/low density

CONCLUSION

POSTSEISMIC PHASE (AS IMAGED BY AFTERSLIP AND b-VALUE ANALYSIS) SHOWS COMPLEX SPATIO-TEMPORAL PATTERN SUGGESTING NORTHERN AREA DOMINATED BY FLUIDS AND SOUTH-CENTRAL DRY MEGATHRUST. THIS IS SIMILAR TO LONG-TERM STRUCTURE AS DERIVED BY GRAVITY-DERIVED MODELS

