



## Line of Sight Displacement from ALOS-2 Interferometry: M7.8 Gorkha Earthquake and Mw 7.3 Aftershock

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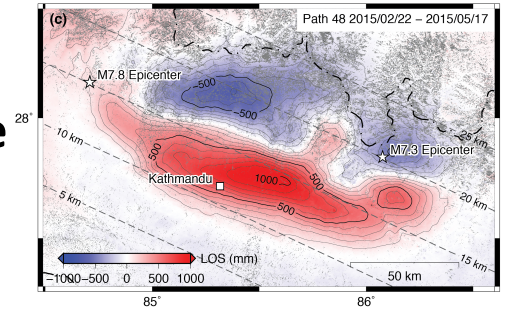
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Interferograms and LOS displacements (JPEG, KML, ASCII data) are available at: <http://topex.ucsd.edu/nepal>

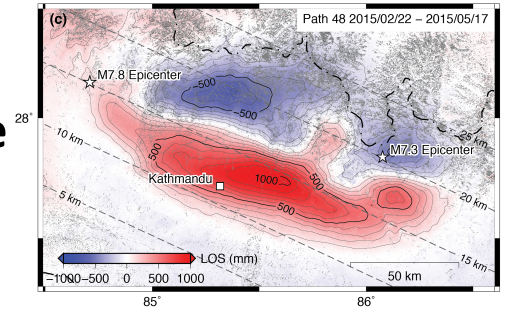
Data provided by JAXA through PI investigations.

All data processed with GMTSAR, SNAPHU, and GMT.

Funding from NSF, JAXA and SCEC.

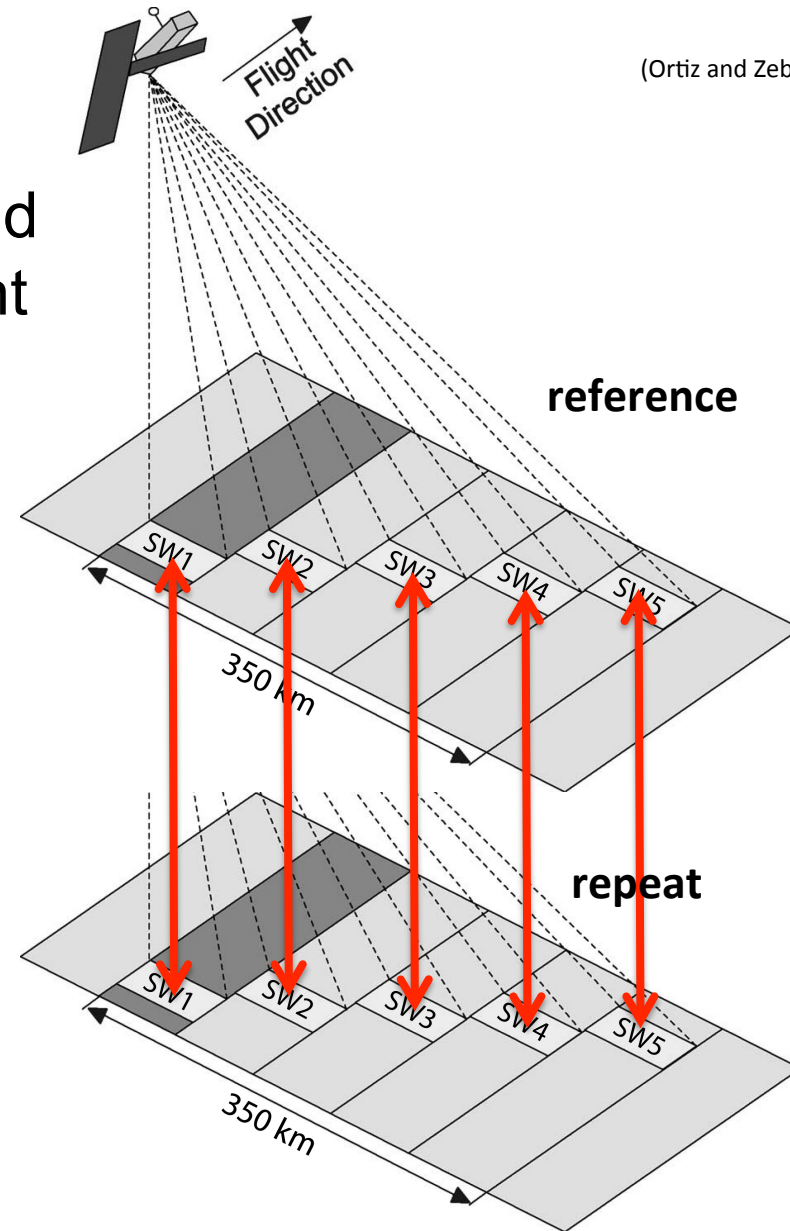


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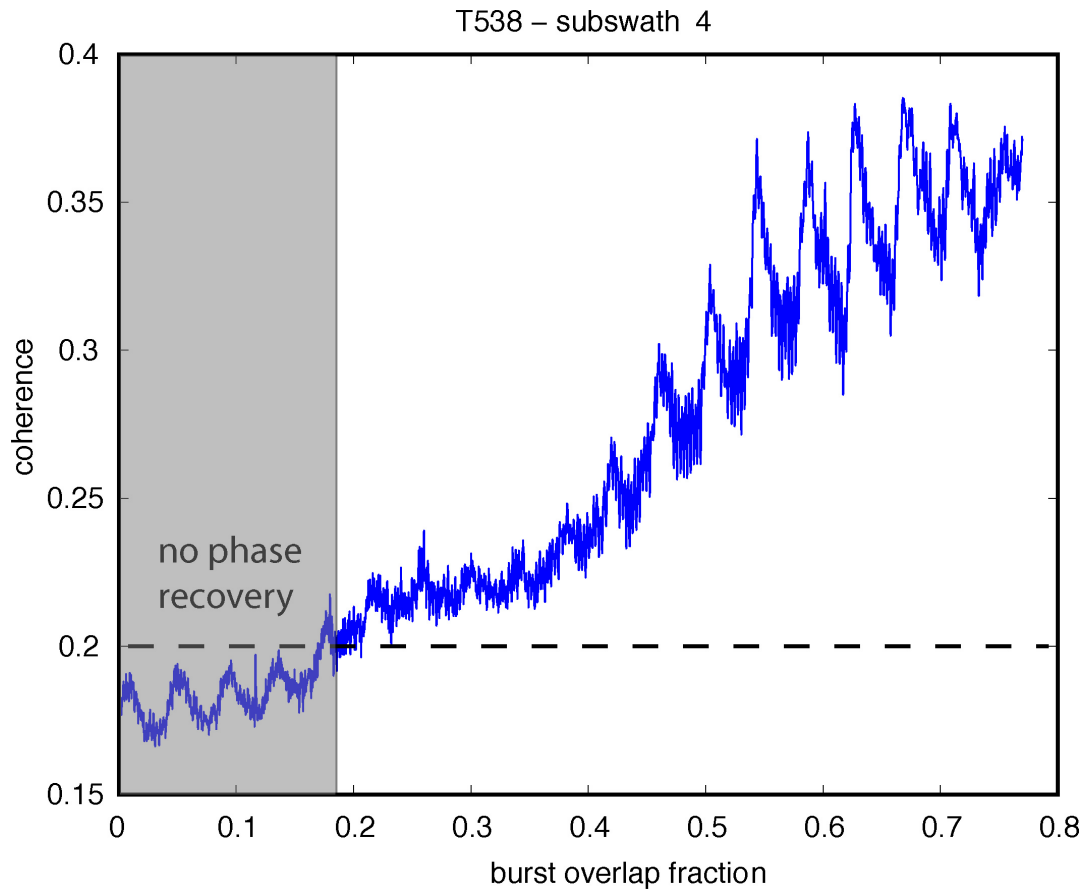
- ALOS-2 is the first L-band InSAR satellite optimized for measuring surface displacement over 350 km by 350 km areas.
  - ScanSAR with continuous phase across subswath boundaries
  - Excellent baseline control
  - Two look directions in basic observation scenario
- Burst alignment drifted between launch and February 8, 2015 and is now well controlled.
- Both the M7.8 and the M7.3 earthquakes were imaged independently from both look directions.
- Phase can be unwrapped across all subswaths and across the snow-capped Himalaya mountains!
- Displacement maps and slip model.

ScanSAR interferometry requires that the reference and repeat images have significant overlap in their bursts on the ground.



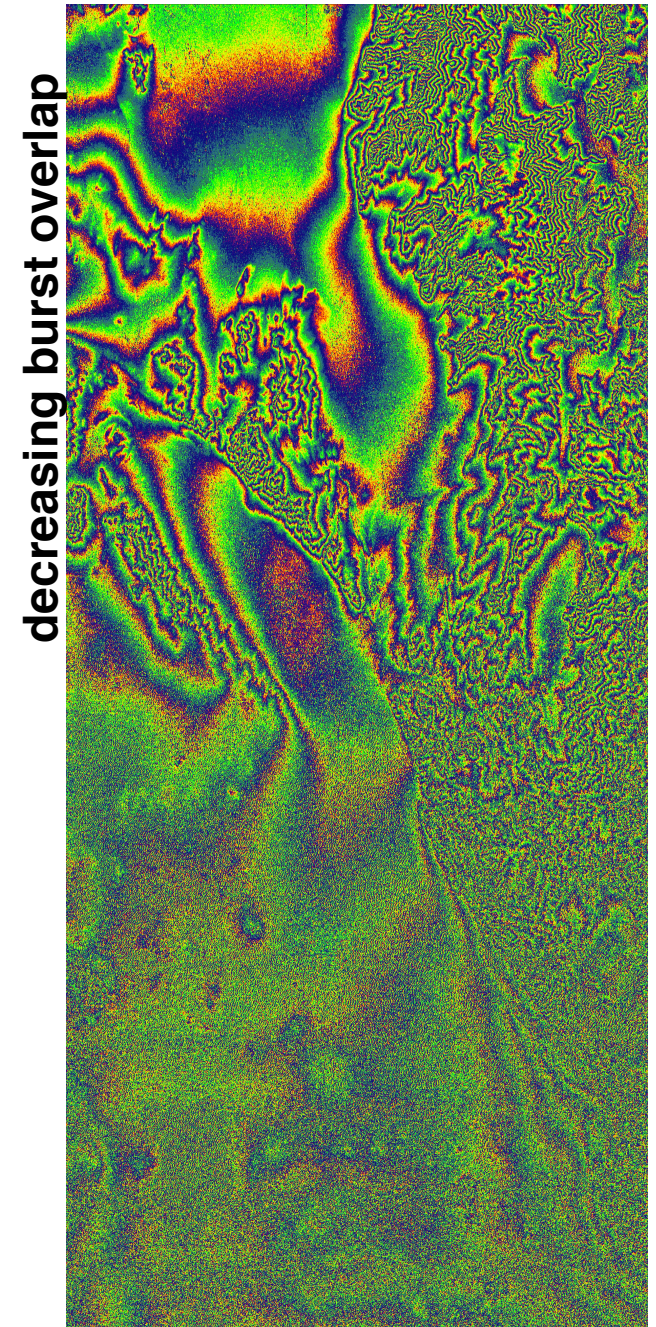
(Ortiz and Zebker, 2007)

**ALOS-1 results:  
Need  $> 0.2$  burst overlap  
to recover phase from  
ScanSAR to ScanSAR  
interferometry.**

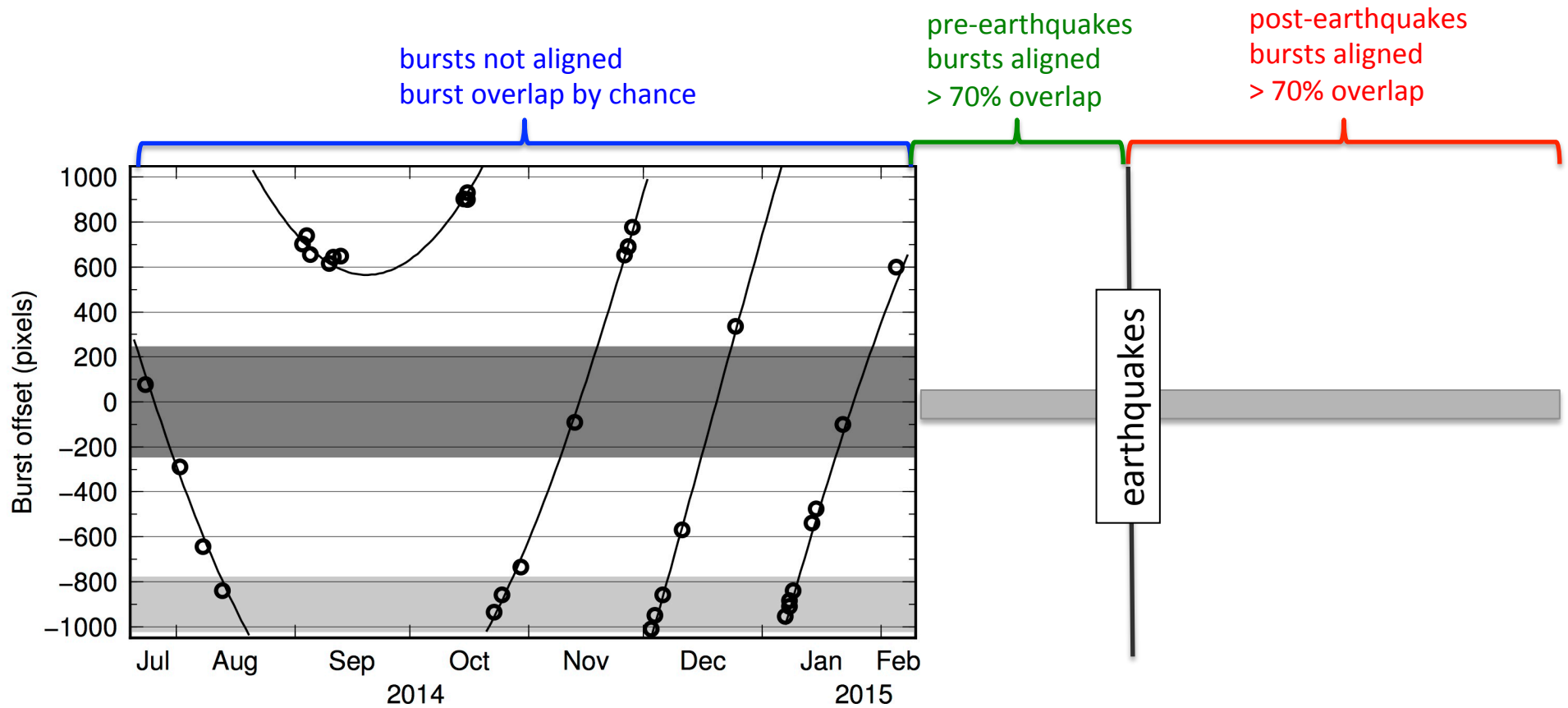


[Tong et al., 2010]

phase



ALOS-2 burst alignment drifted from June 2014 until February 8, 2015.



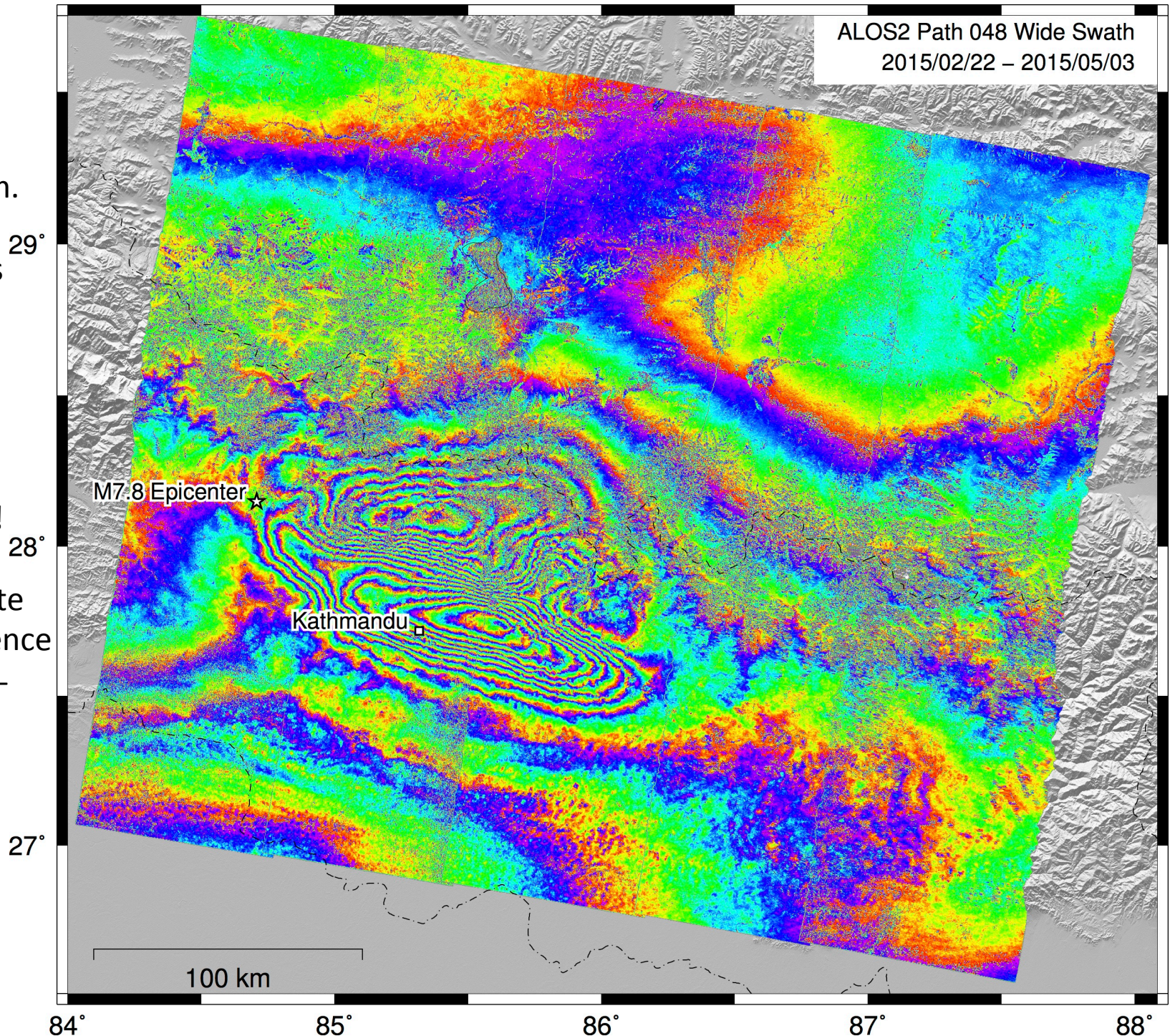
ALOS-2 CALVAL team detected alignment problem in November 2014 and JAXA implemented fix in February.

ALOS2 Path 048 Wide Swath  
2015/02/22 – 2015/05/03

Single 350km  
by 350 km  
interferogram.

Note phase is  
continuous  
across the  
subswath  
boundaries  
with **NO**  
**adjustments!**

Note adequate  
phase coherence  
even in snow-  
capped  
mountains.



84°

85°

86°

87°

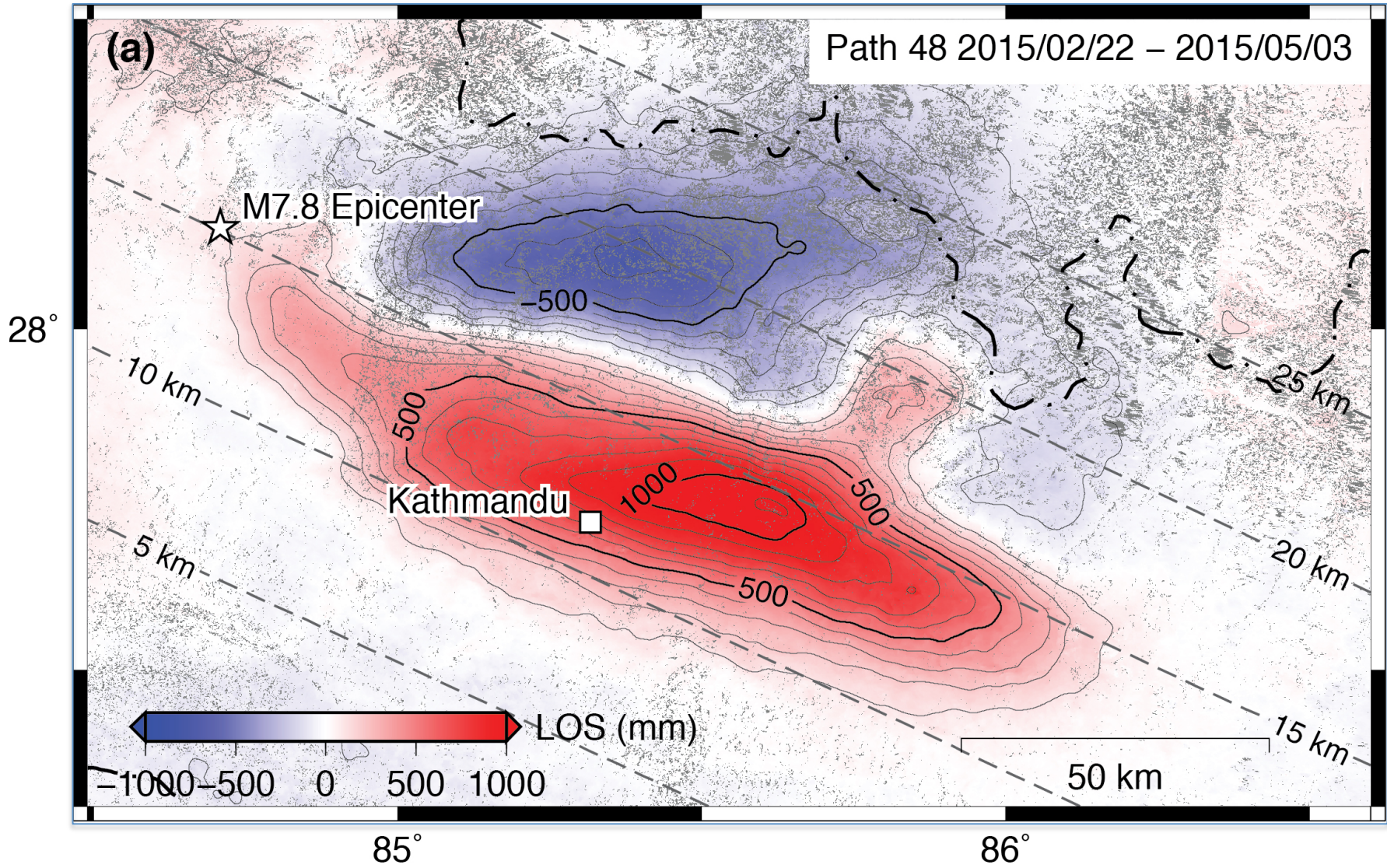
88°

27°

28°

29°

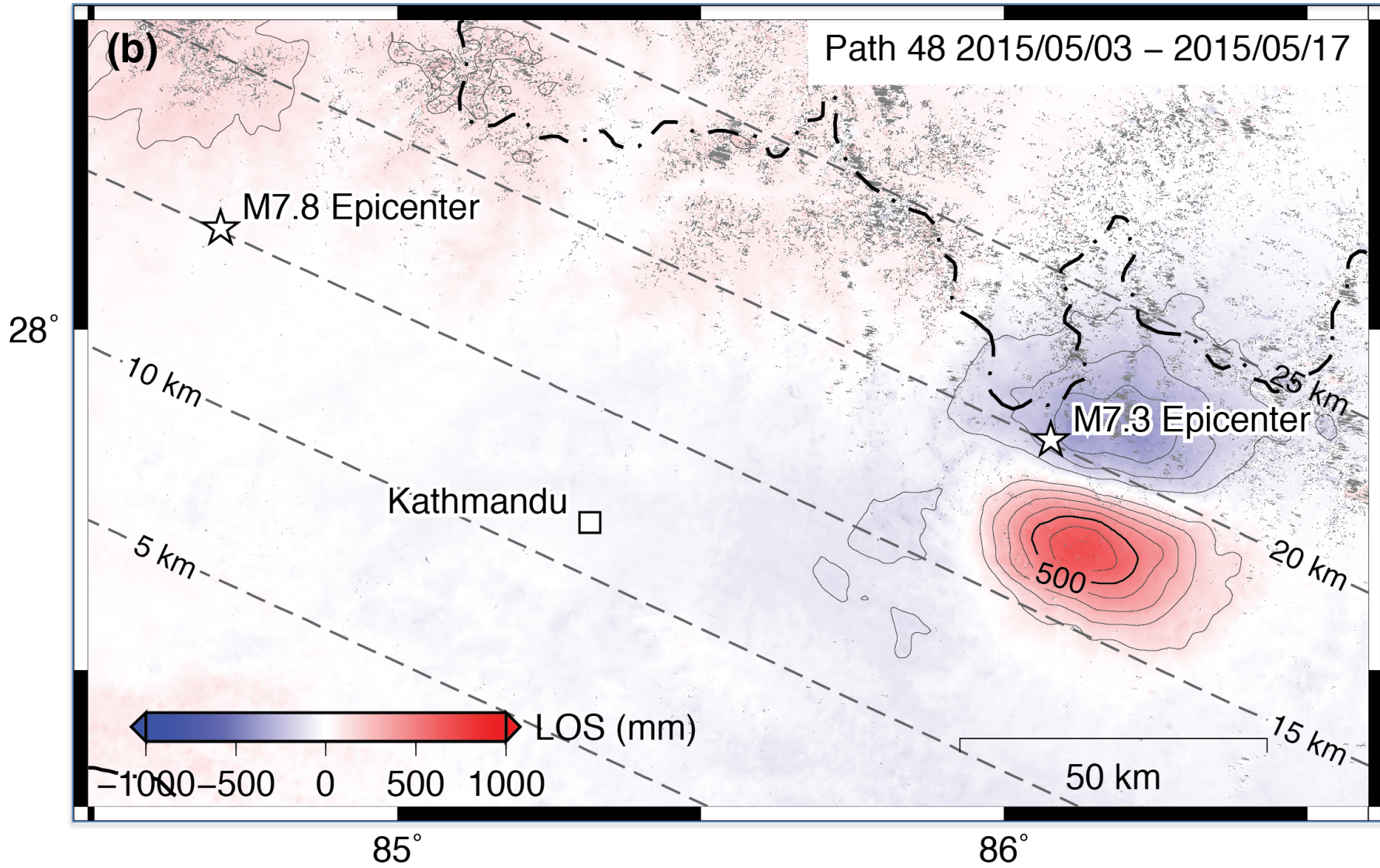
# LOS displacement for M7.8 – Descending - detrended



LOS displacement for M7.3 – Descending - detrended

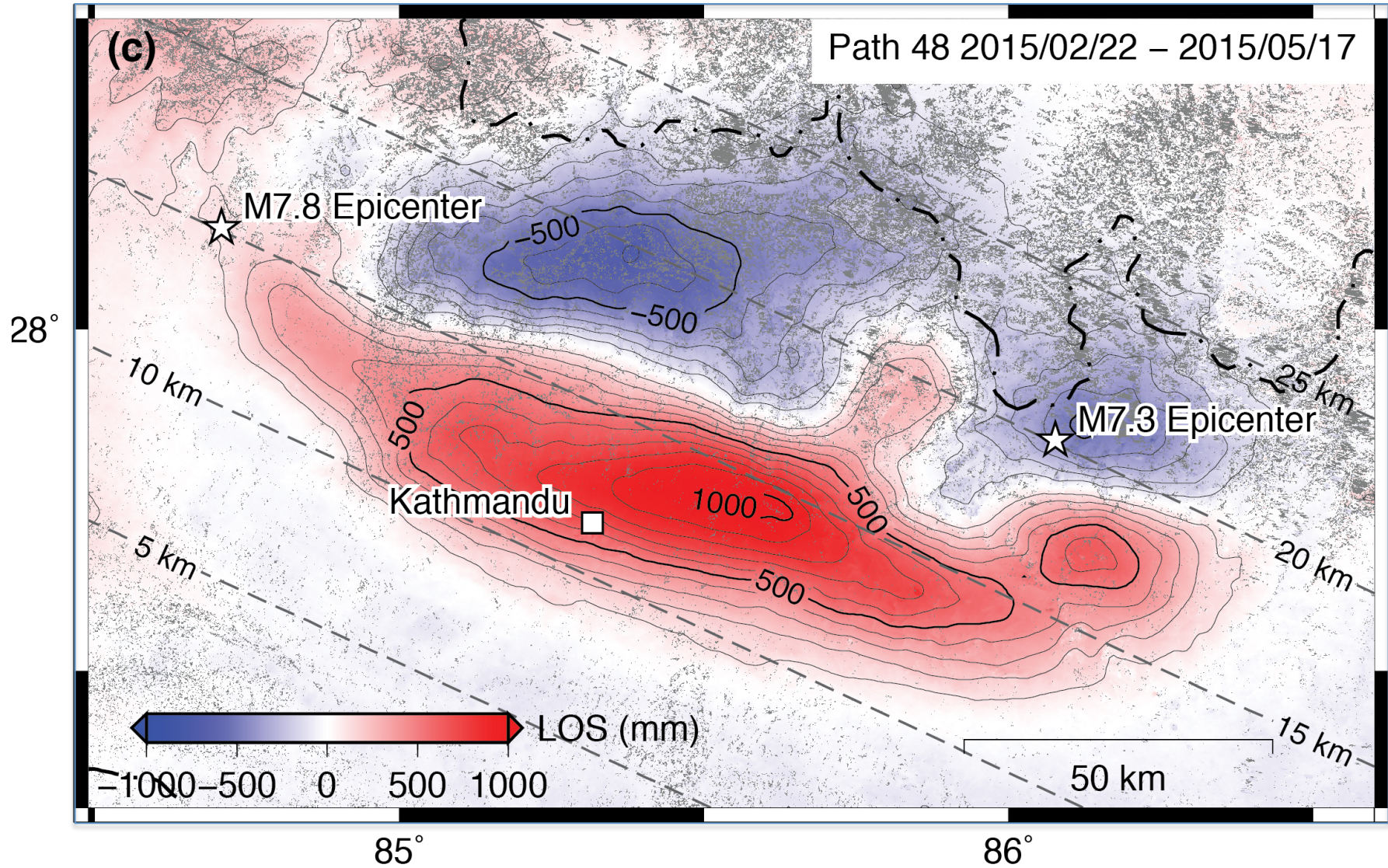
85°

86°

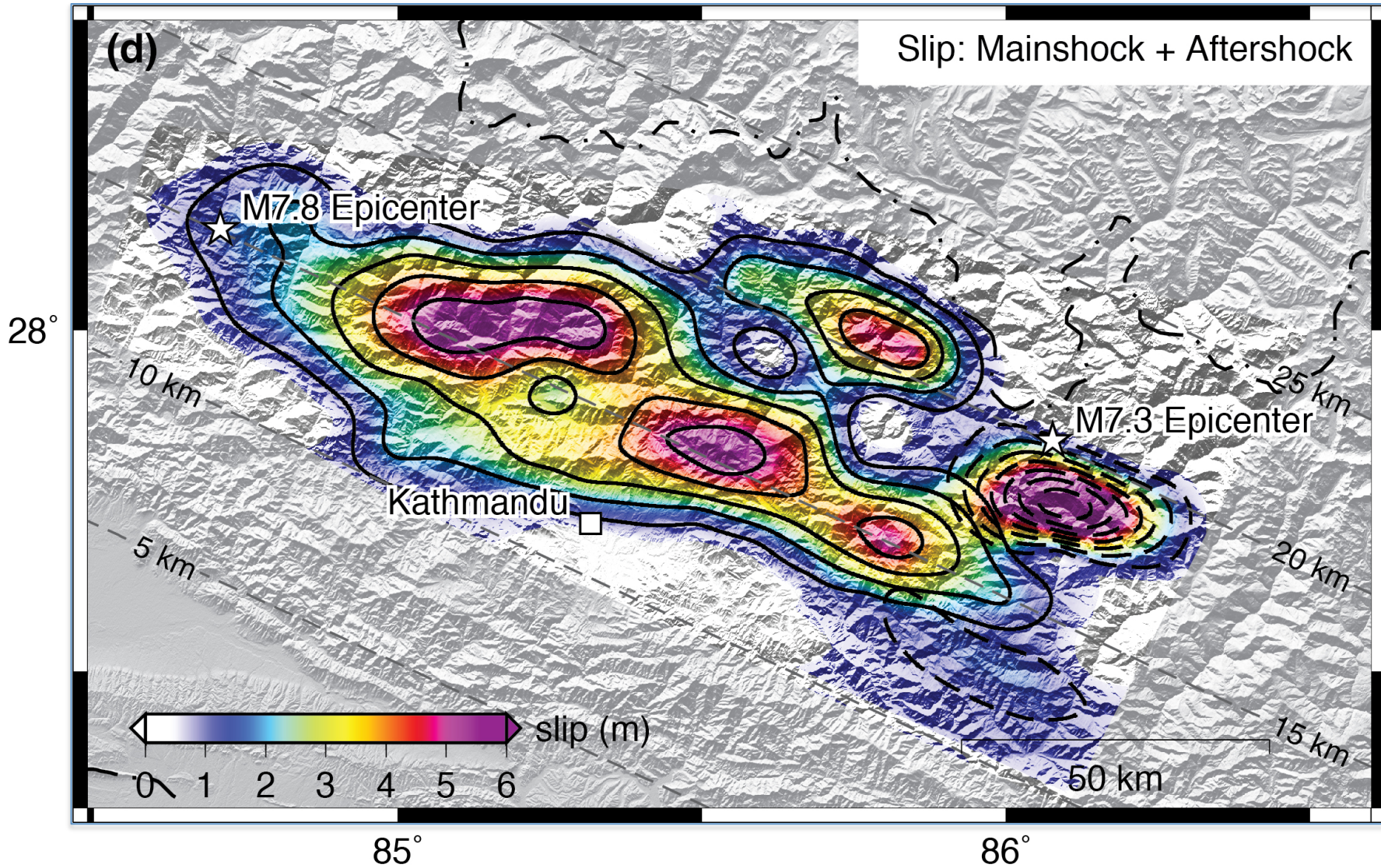




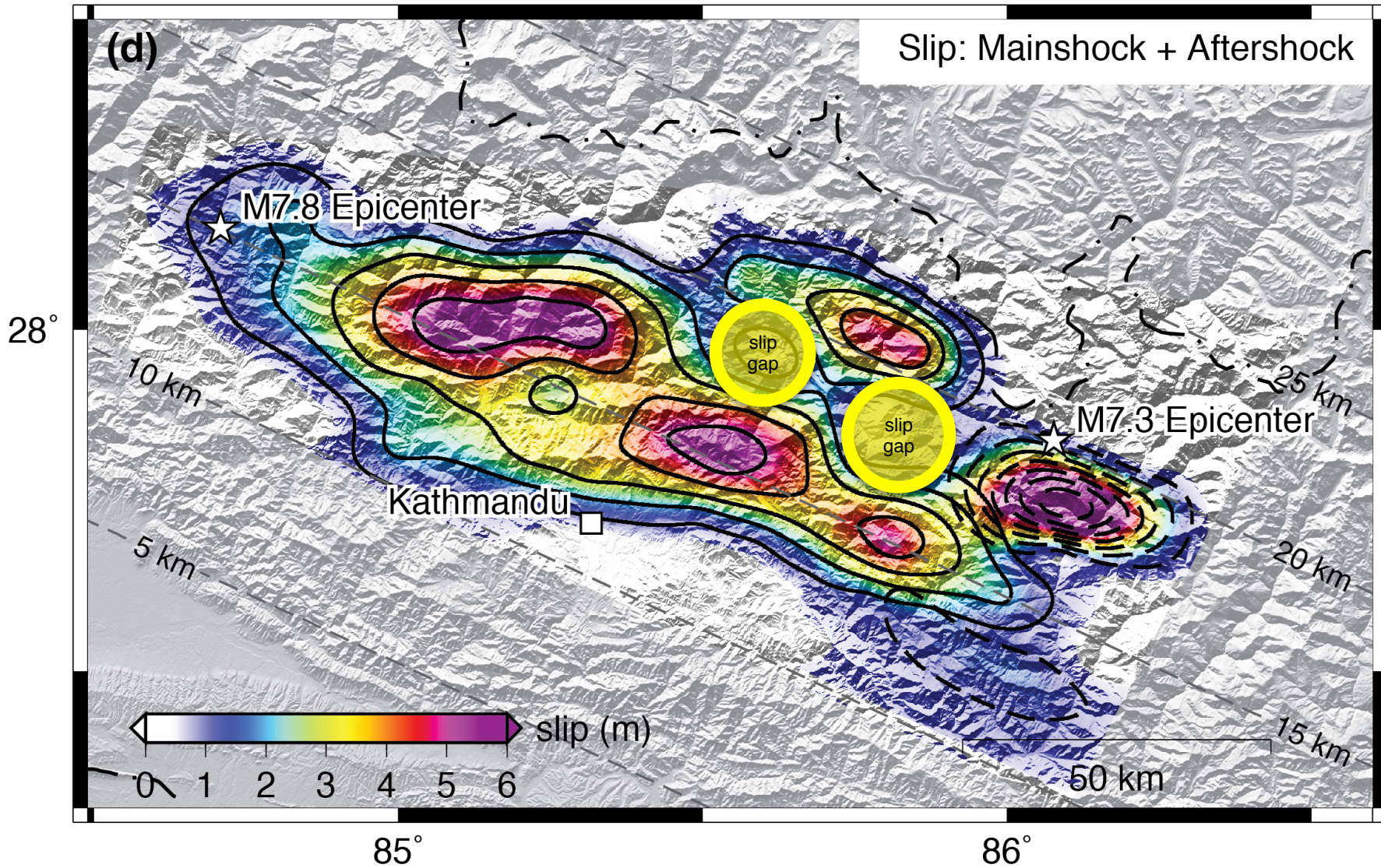
LOS displacement for M7.8 + M7.3 - Descending - detrended



Fault slip for M7.8 + M7.3 [Galetzka et al., 2015]  
strike 295°, dip 11°



Fault slip for M7.8 + M7.3 [Galetzka et al., 2015]  
strike 295°, dip 11°



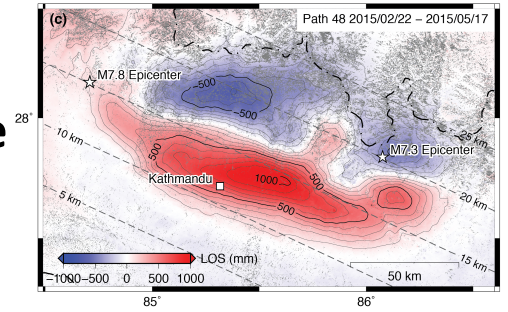


Co-seismic interferograms used in this study. Note small baselines and large burst overlap.

Track Mode	Reference Date Product	Repeat Date Product	B. perp. (m)	Az. shift (pixel)	Burst overlap	Mean coherence
T048 ScanSAR	FEB 22 2015 ALOS2040533050-150222	APR 05 2015 ALOS2046743050-150405	43.7	-18	95%	0.33
T048 ScanSAR	FEB 22 2015 ALOS2040533050-150222	MAY 03 2015 ALOS2050883050-150503	48.0	-106	72%	0.20
T048 ScanSAR	APR 05 2015 ALOS2046743050-150405	MAY 03 2015 ALOS2050883050-150503	4.3	-84	78%	0.27
T048 ScanSAR	MAY 03 2015 ALOS2050883050-150503	MAY 17 2015 ALOS2052953050-150517	-97.7	3	99%	0.43
T047 ScanSAR	MAR 31 2015 ALOS2046003050-150331	APR 28 2015 ALOS2050143050-150428	81.0	-91	76%	0.25
T157 Swath	FEB 21 2015 ALOS2040460540-150221	MAY 02 2105 ALOS2050810540-150502	-118.6	-3	N/A	0.23
T156 Swath	APR 27 2015 ALOS2050070550-150427	MAY 25 2015 ALOS2054210550-150525	-39.9	-2	N/A	0.29



## Line of Sight Displacement from ALOS-2 Interferometry: M7.8 Gorkha Earthquake and Mw 7.3 Aftershock



- ALOS-2 ScanSAR provides seamless interferograms over large areas.
- Short baselines and large burst overlaps enable complete phase unwrapping across snow-capped Himalaya Mountains (SNAPHU).
- Co-seismic interferograms from 2 look directions do not show fault surface rupture for either the M7.8 or M7.3 events.
- The M7.3 aftershock extended the deformation to the east along the same fault plane but left slip gaps between 15 and 20 km depth.
- It will be interesting to monitor the areas of low slip over the next years with GPS and InSAR.
- This earthquake has significant vertical deformation so should generate a large spatial scale viscoelastic response.
- Results available at <http://topex.ucsd.edu/nepal>.