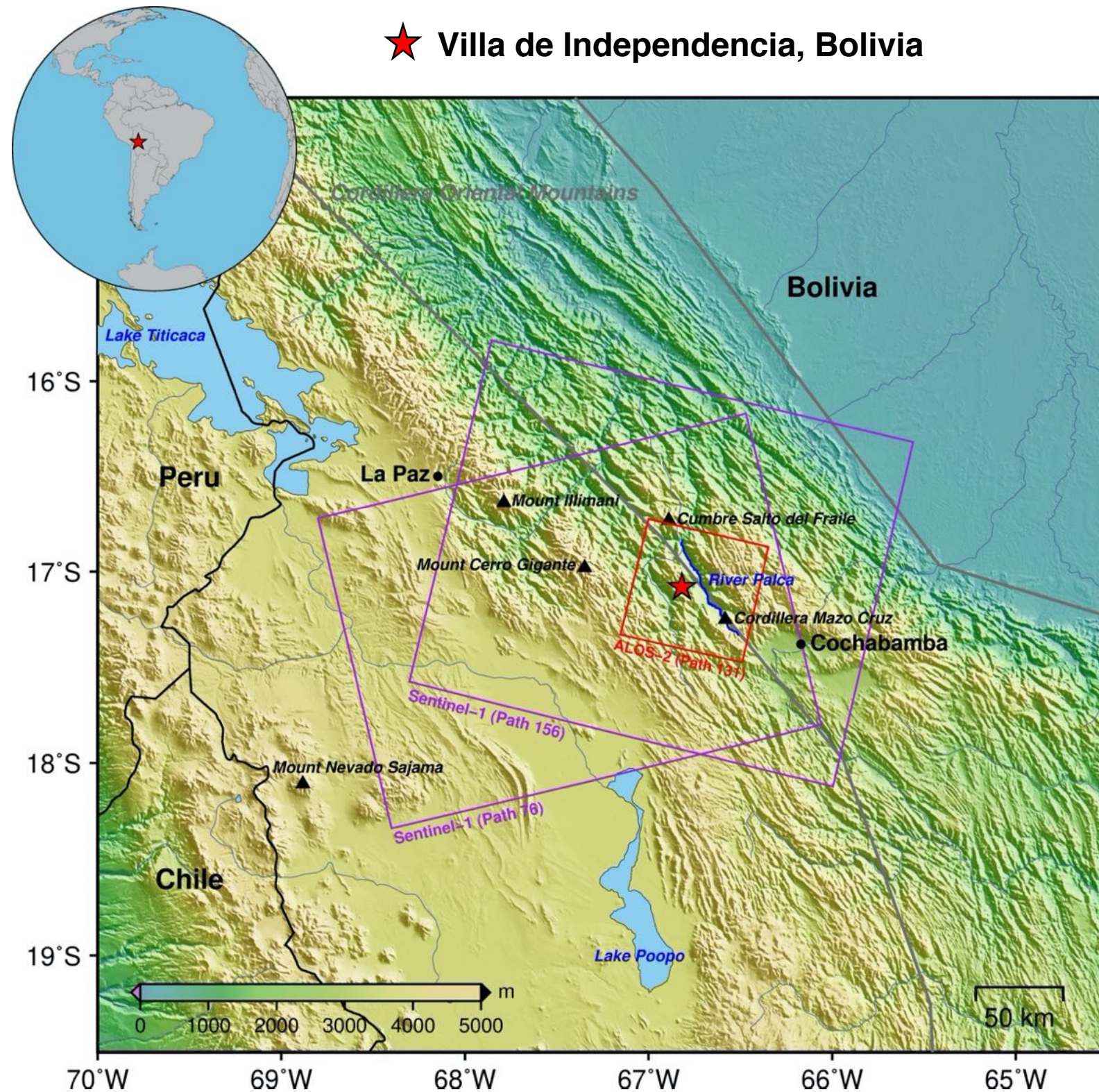# Twelve-Year Landslide Risk Assessment in Villa de Independencia, Bolivia, with Sentinel-1 and ALOS-1/2 InSAR Observations

Chuang Song, Zhenhong Li, Stefano Utili, Chen Yu
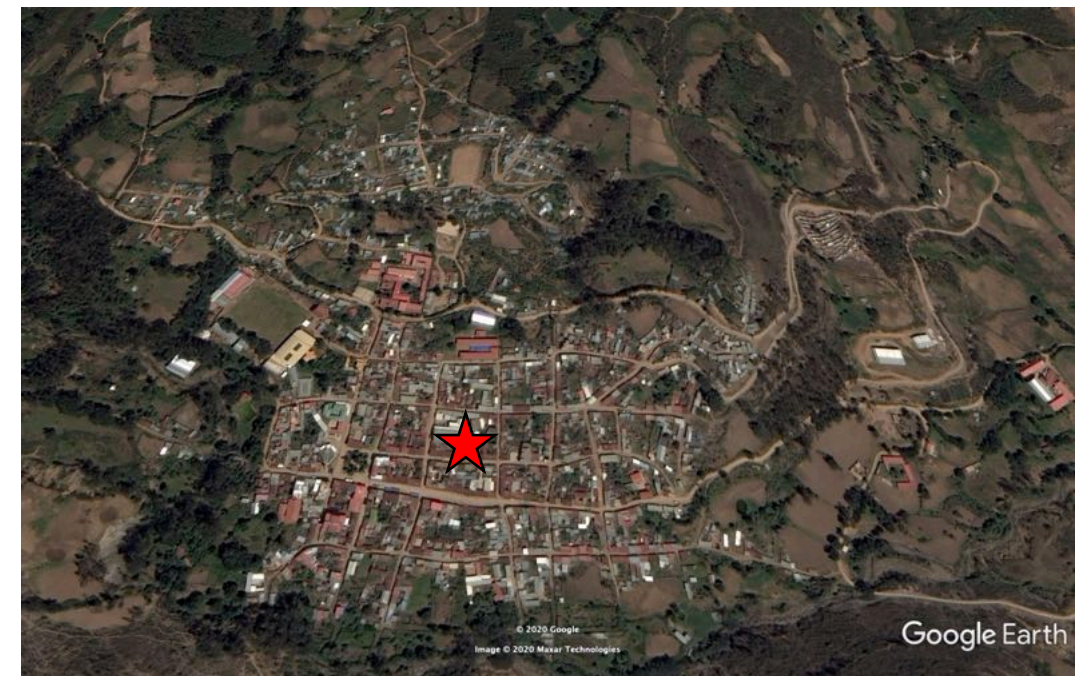
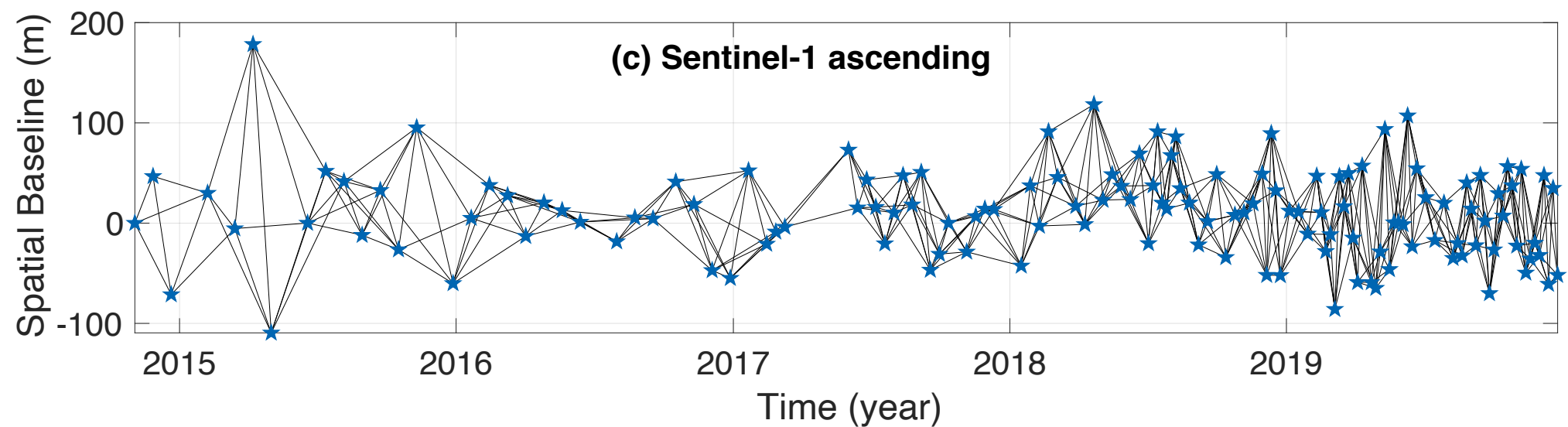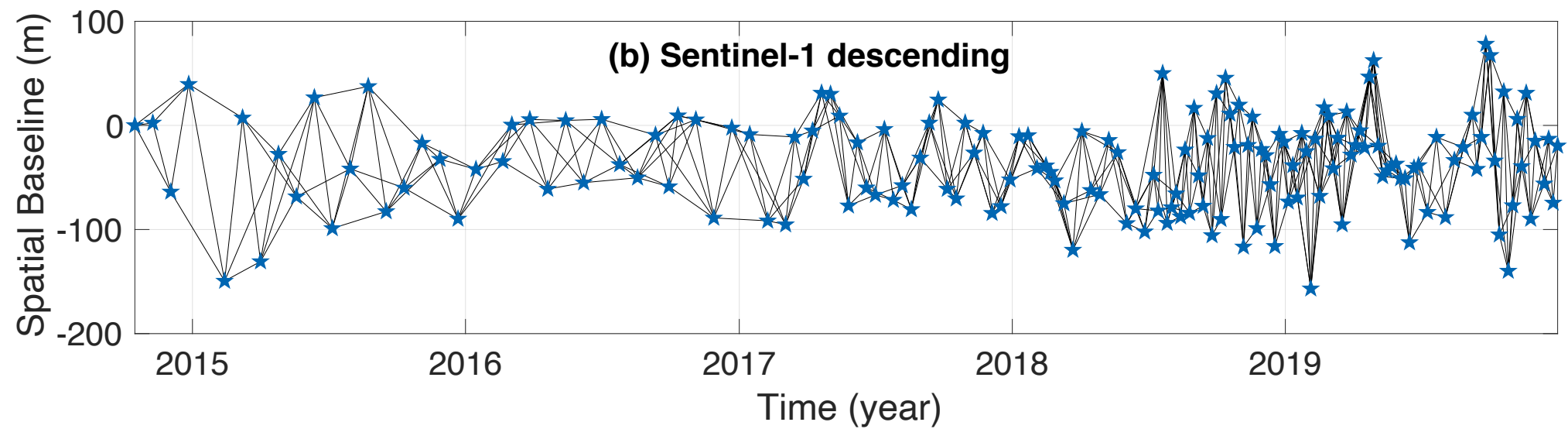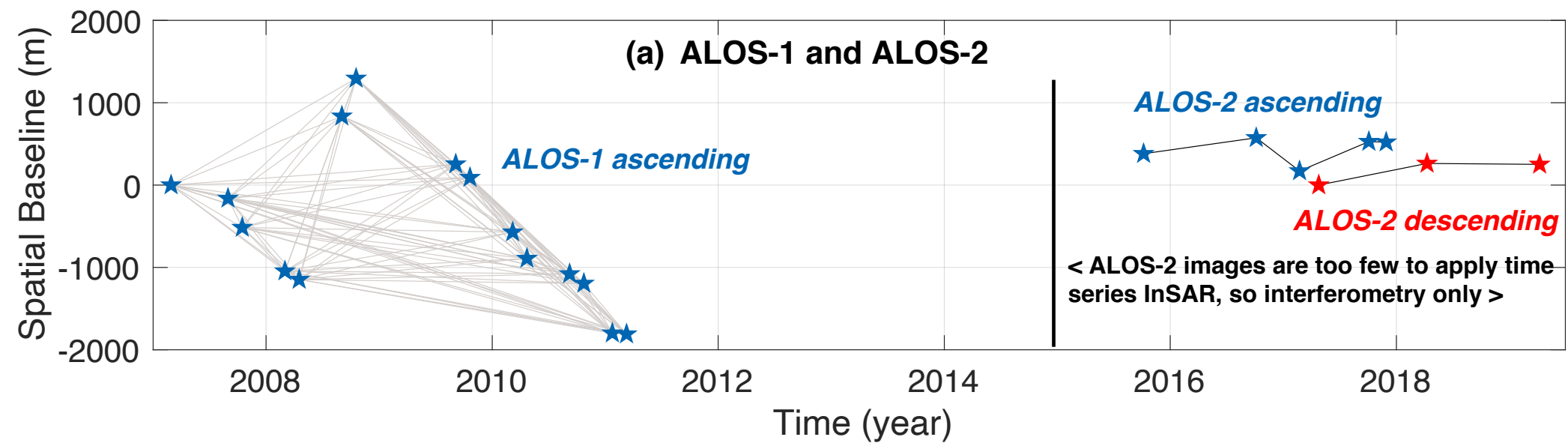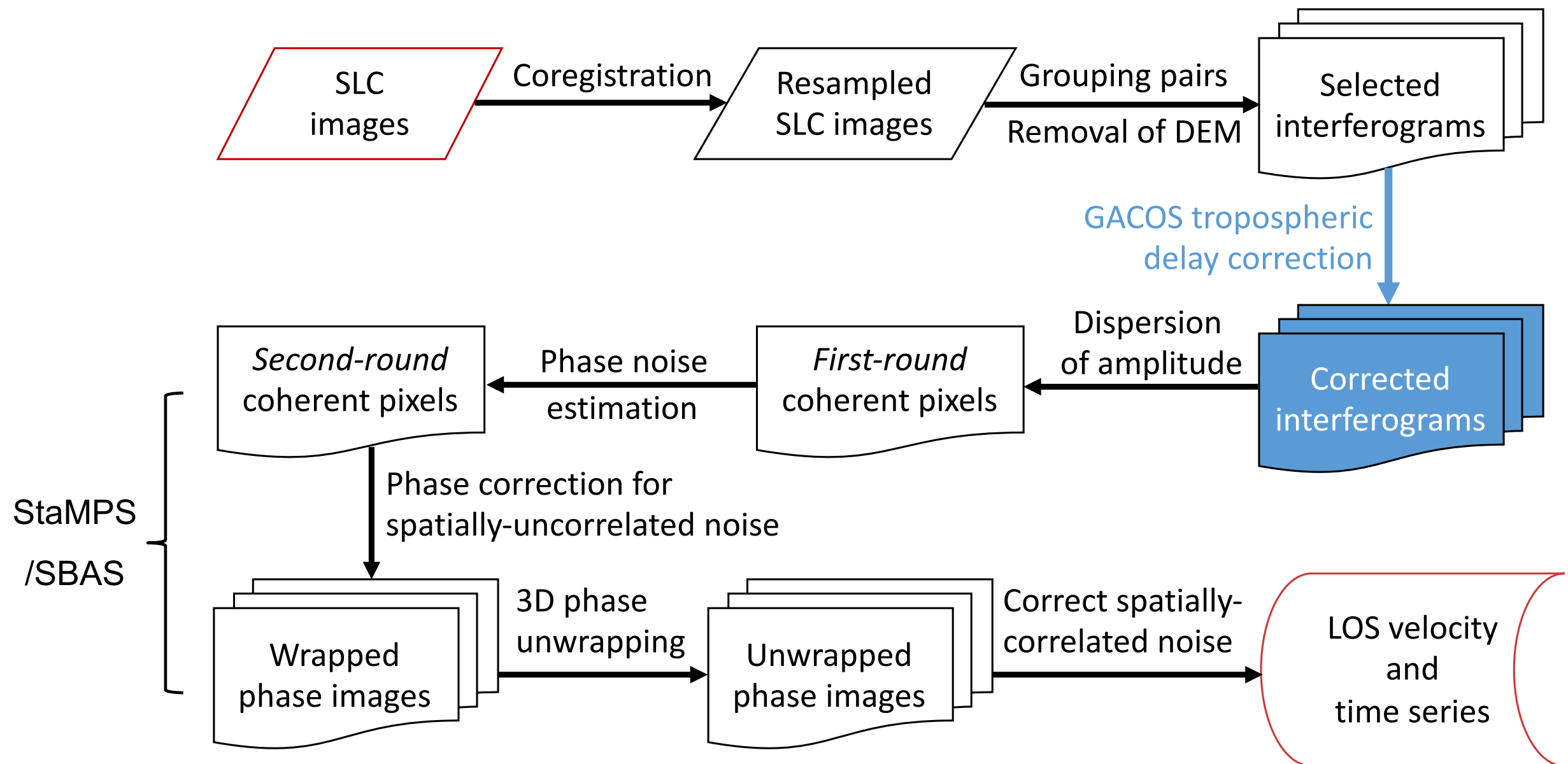**Newcastle University**

Study Area

★ **Villa de Independencia, Bolivia**

There were observed cracks in the downtown walls and wall collapse at the eastern bus station.

Data

Flowchart of Time Series InSAR

(a) ALOS-1 ascending *(2007 to 2011)*

Town Centre

Risky Area

Highway 25

A landslide risky area below Highway 25, with the displacement velocity of about *30 mm/yr* in the Line of Sight (LOS), is detected.

(b) ALOS-2 ascending *(2015 to 2017)*

Town Centre

Risky Area

Highway 25

(c) Sentinel-1 descending *(2014 to 2019)*

Town Centre

Risky Area

Highway 25

The town centre needs a further check using Sentinel-1 results in high temporal resolution.

(d) Sentinel-1 ascending *(2014 to 2019)*

Town Centre
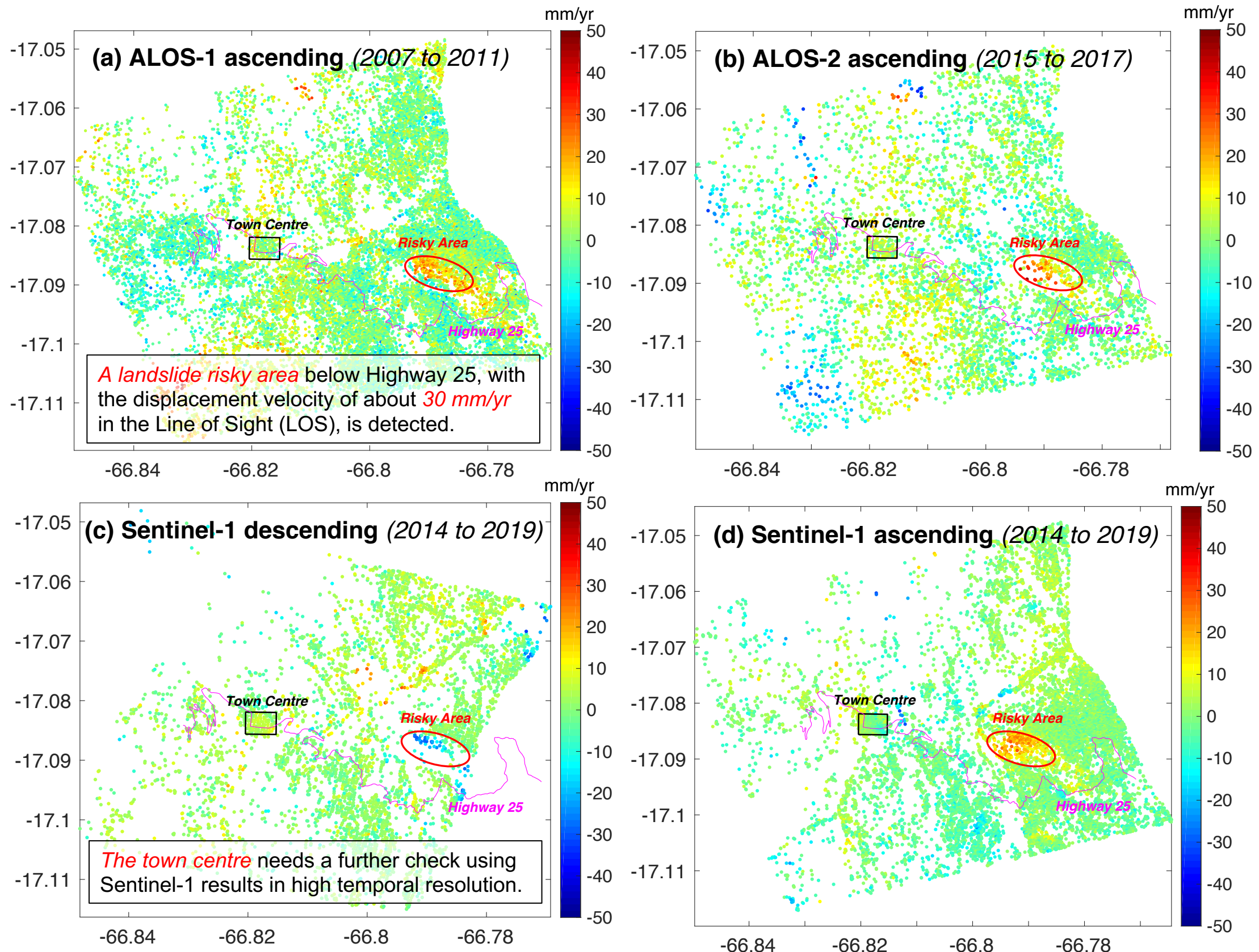
Risky Area

Highway 25

The temporal behaviour in descending and ascending LOS coincides well illustrating a slowdown process from mid 2017.

The detected landslide risky area below Highway 25 is in a lower failure risk than before, but the low risk may be temporary considering the same slowdown process from 2008 to 2010.
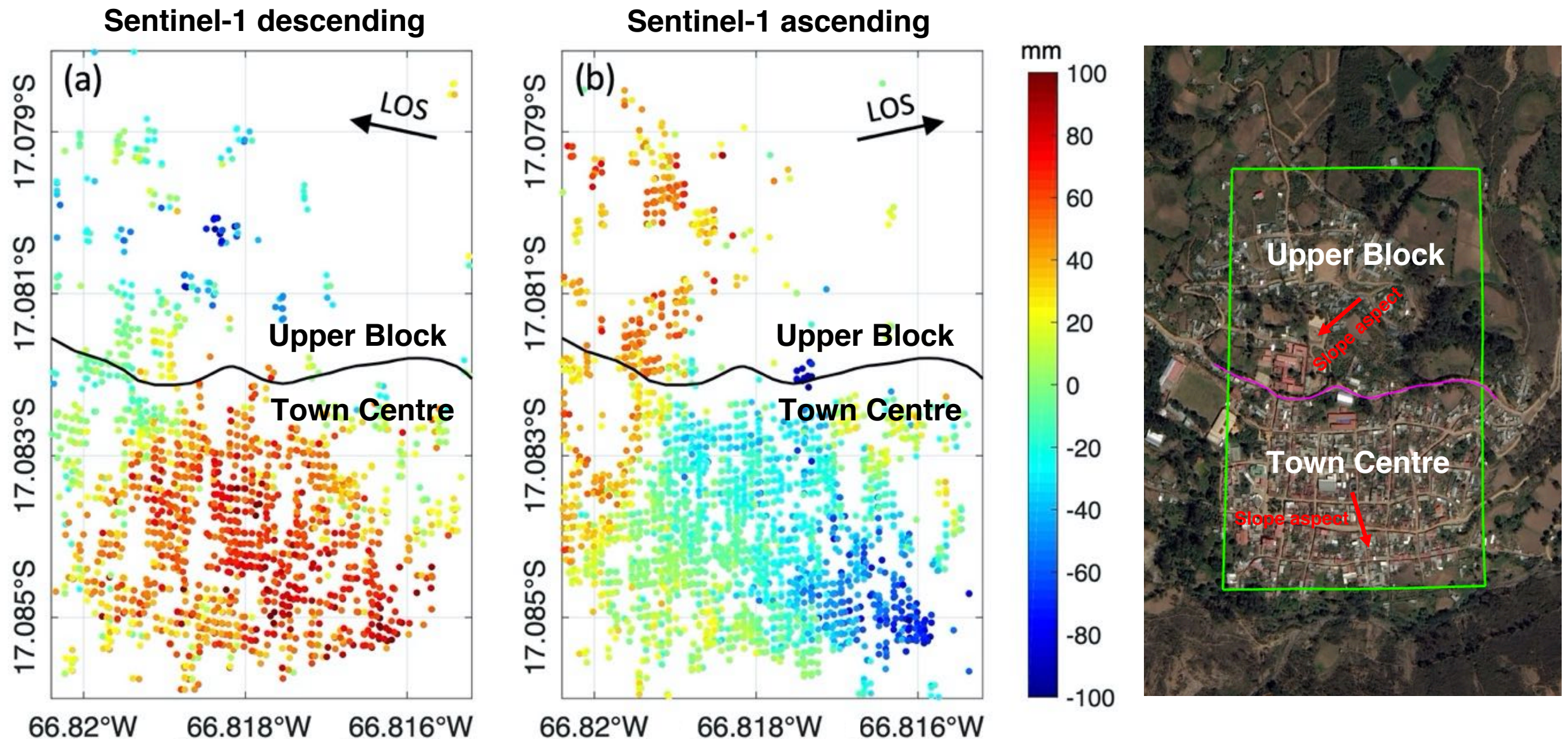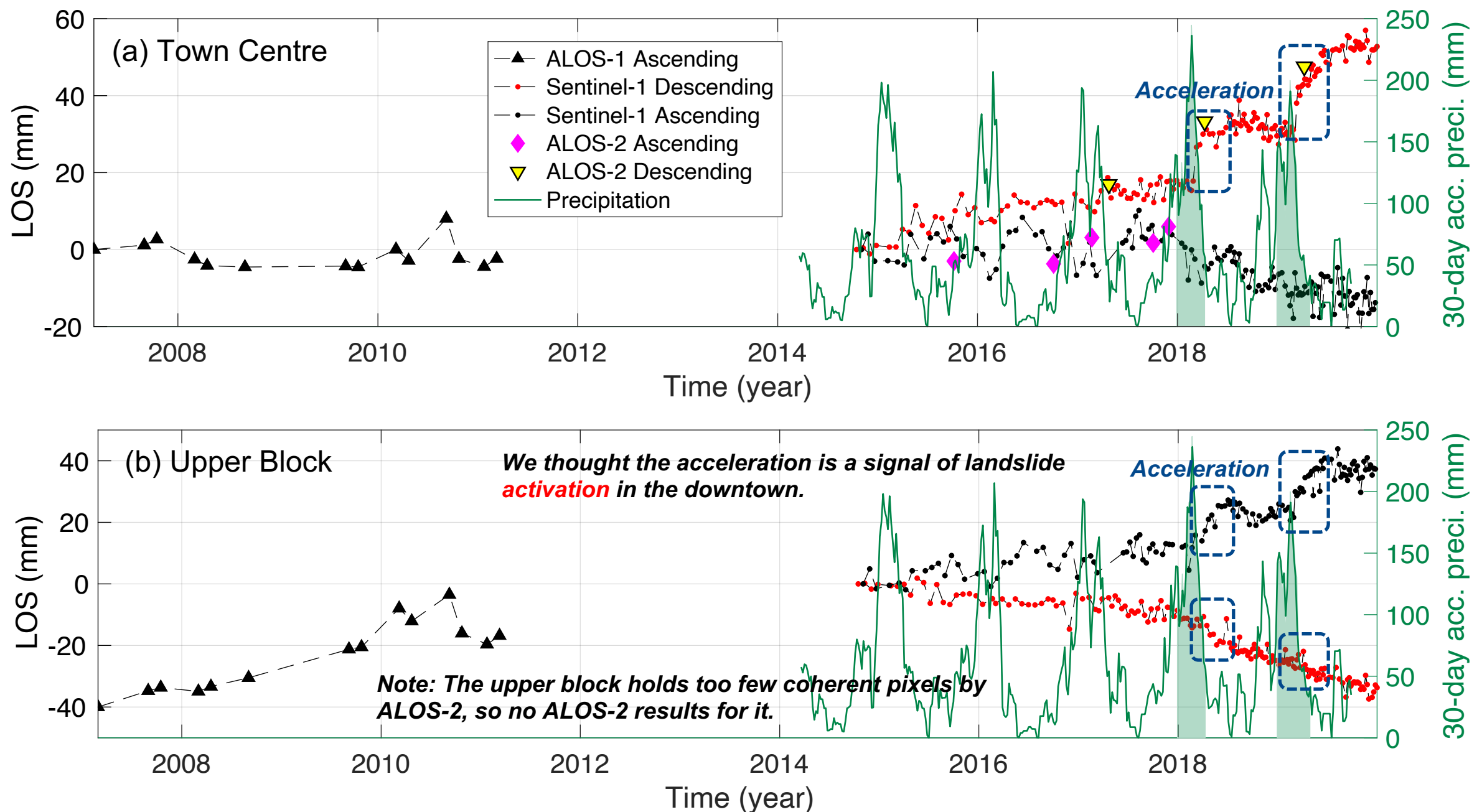
The spatial distribution of Sentinel-1 LOS displacements in descending and ascending modes suggests that the town centre and its upper block move with different east-west sliding due to different slope aspect.

- The deformation time series from Sentinel-1 present acceleration in early 2018 and 2019, which is cross-validated by ALOS-2 measurements.
- The two accelerations have similar initiating time and durations, in response to increase precipitation in the late rainy season.

Note: The daily precipitation data was collected from NASA GPM and converted to 30-day accumulated precipitation totals.

LOS deformation in descending and ascending modes have different sensitivities to the slope geometry.

(a) Town Centre

— ALOS-1 Ascending
— Sentinel-1 Descending
— Sentinel-1 Ascending
◆ ALOS-2 Ascending
▽ ALOS-2 Descending
— Precipitation

Acceleration

(b) Upper Block

We thought the acceleration is a signal of landslide activation in the downtown.

Acceleration

Note: The upper block holds too few coherent pixels by ALOS-2, so no ALOS-2 results for it.

Conclusion

➤ Displacement velocity from Sentinel-1, ALOS-1 and ALOS-2 data spanning twelve years revealed a landslide risky area below Highway 25.

➤ Combining InSAR measurements in descending and ascending modes helps identify two sub-blocks of landslides in the town.

➤ The activation of landslides from 2018 in Villa de Independencia was found, possibly being related to the increased precipitation in the late rainy season.

Thanks!
Email: c.song4@newcastle.ac.uk