IMPACTS OF OCEAN TIDAL LOADING ON COASTAL DEFORMATION MAPPING WITH WIDE-SWATH INSAR OBSERVATIONS

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ABSTRACT

In this study, we used various ocean tidal models to investigate the ocean tidal load (OTL) effects on ALOS-2 PALSAR-2 wide-swath (WS) Synthetic Aperture Radar Interferometry (InSAR) deformation monitoring in three typical coastal regions including China, Chile and Canada. We demonstrated the method of three-dimensional component estimation of OTL and differential OTL phase for WS InSAR and further discussed the differences of ocean tidal models in the estimation of OTL displacements. We find that the magnitude of the OTL effects relates with the spatial range of the study regions, and there are strong correlations between the OTL deformation gradient and costal topography. Regarding to OTL effects that cannot be removed with traditional planar fitting methods, it is thus highly recommended in this paper that they should be estimated and corrected carefully in interferometric processing, particularly when long-wavelength crustal deformation is targeted.

1、INTRODUCTION

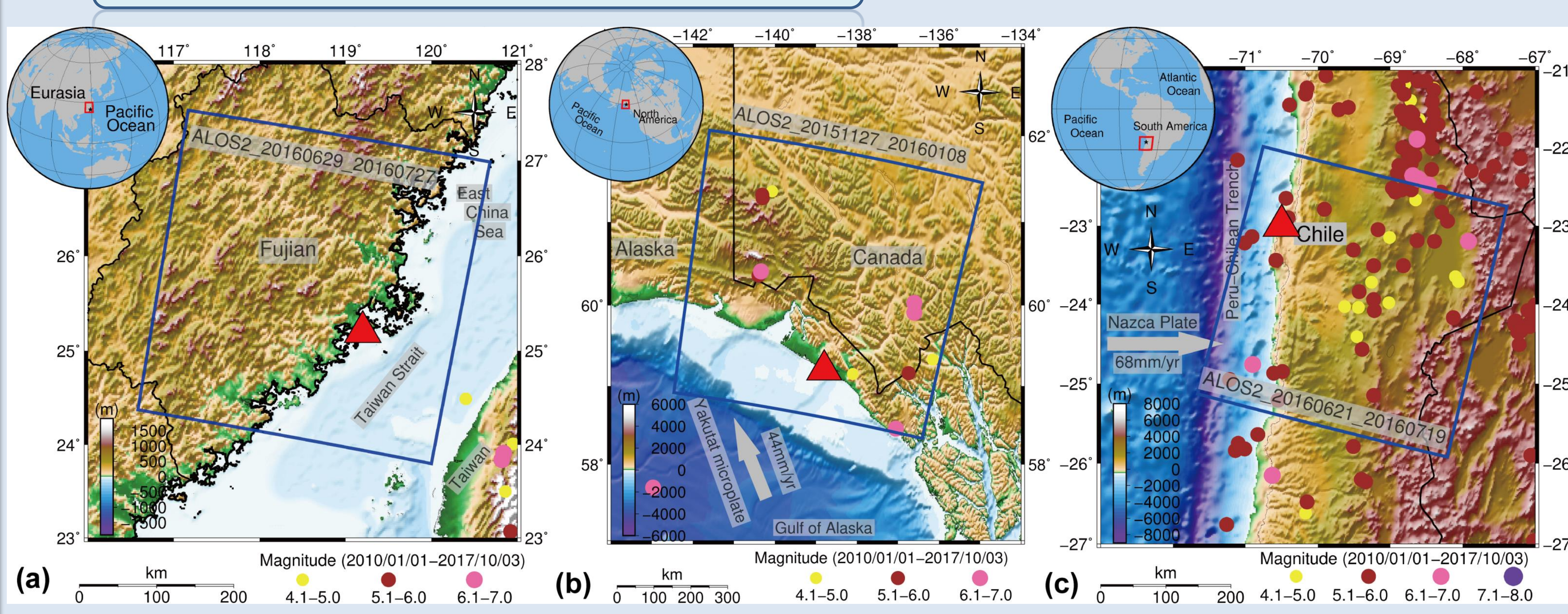

Figure 1. Study regions with the coverages of ALOS-2 PALSAR-2 WS images (blue rectangles). (a) Fujian, Southern China; (b) Gulf of Alaska and Canada; (c) Northern Chile. Note that (i) Solid dots represent recent earthquakes with Mw>4 from USGS earthquake catalogue, and (ii) Red triangles represent the stations shown in Figures 2 and 3.

2、METHODS

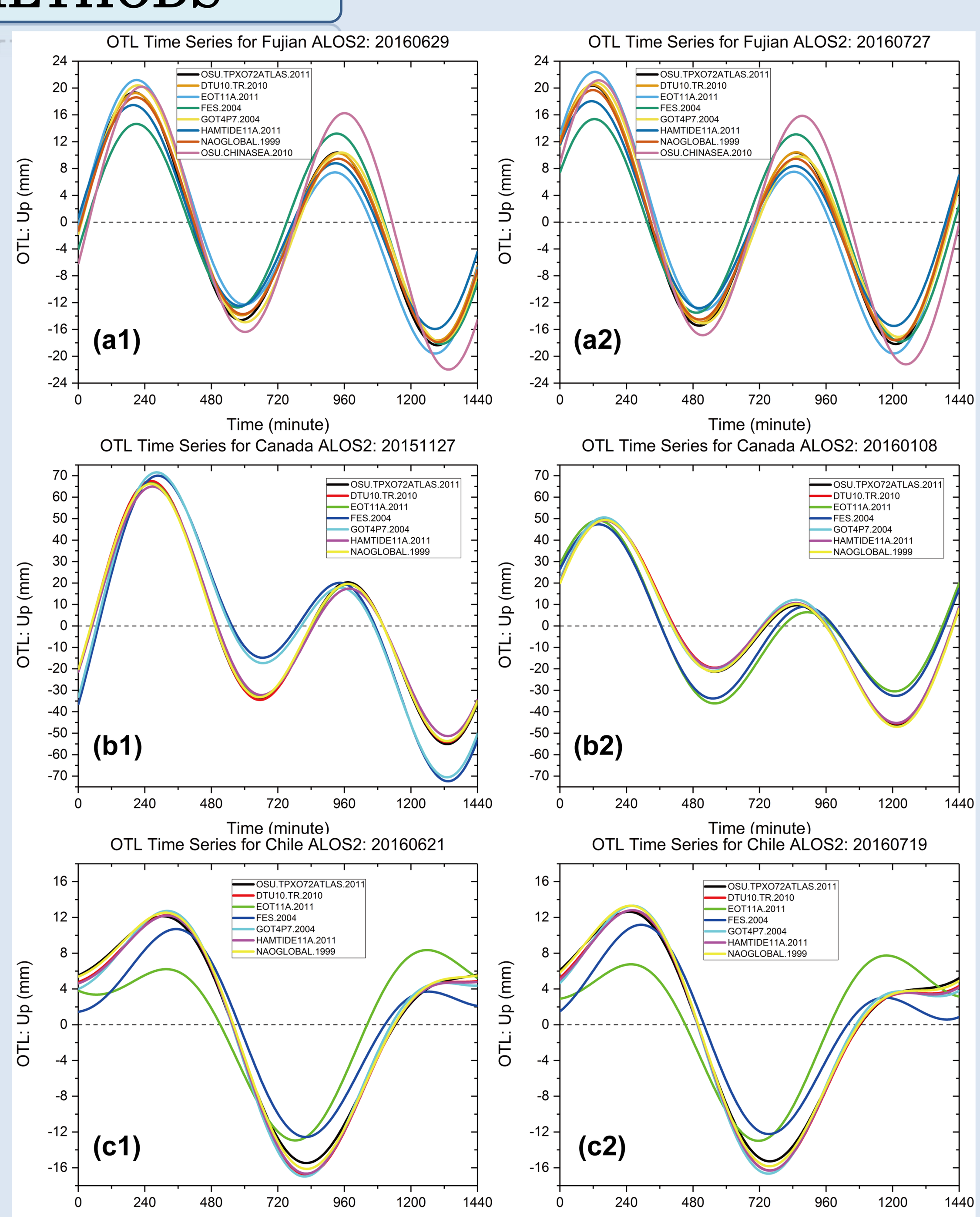

Figure 2. Time series plot of OTL vertical displacement with 24 hours estimated from multiple OTLs. The starting time is identical with the observation time of ALOS-2 PALSAR-2 master image.

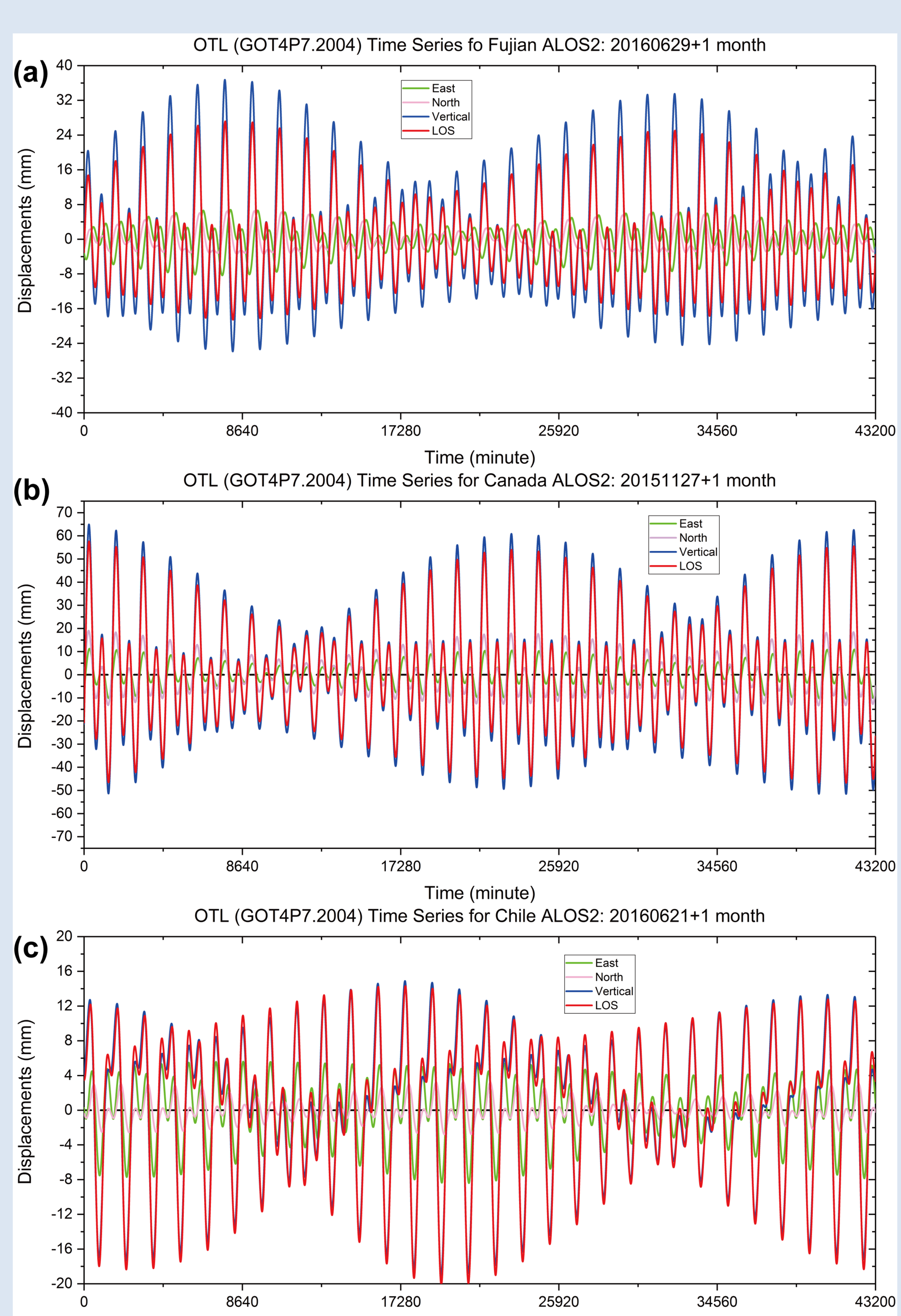

Figure 3. Time series of OTL N/E/U/LOS displacement with 30 days estimated from GOT4.7 model. The starting time is identical with the observation time of ALOS-2 PALSAR-2 master image.

3、RESULTS

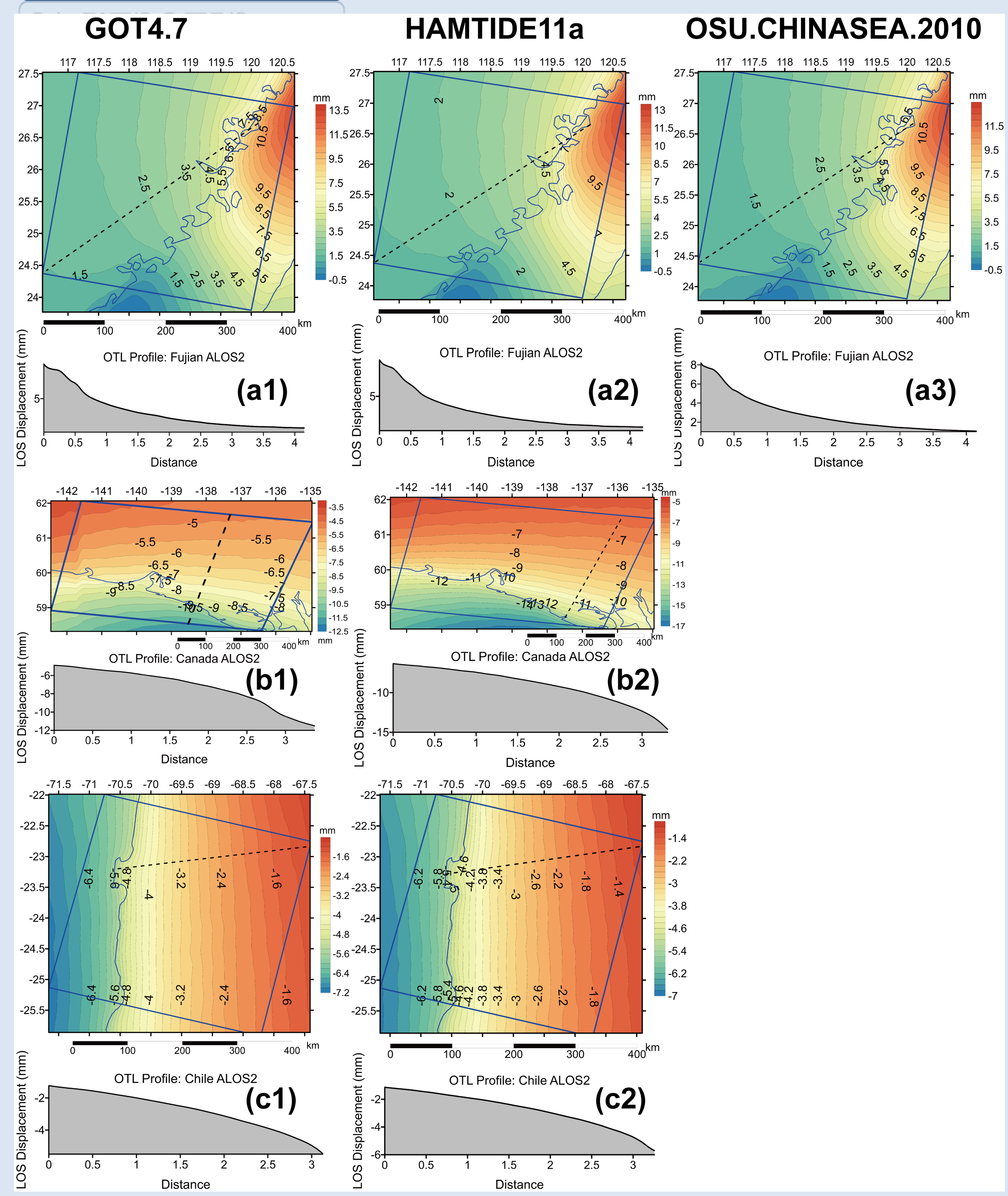

Figure 4. Differential maps of OTL displacements estimated from different ocean tidal models (GOT4.7, HAMTIDE11a and OSU.CHINASEA.2010). (a) Fujian, Southern China; (b) Gulf of Alaska and Canada; (c) Northern Chile.

4、DISCUSSION

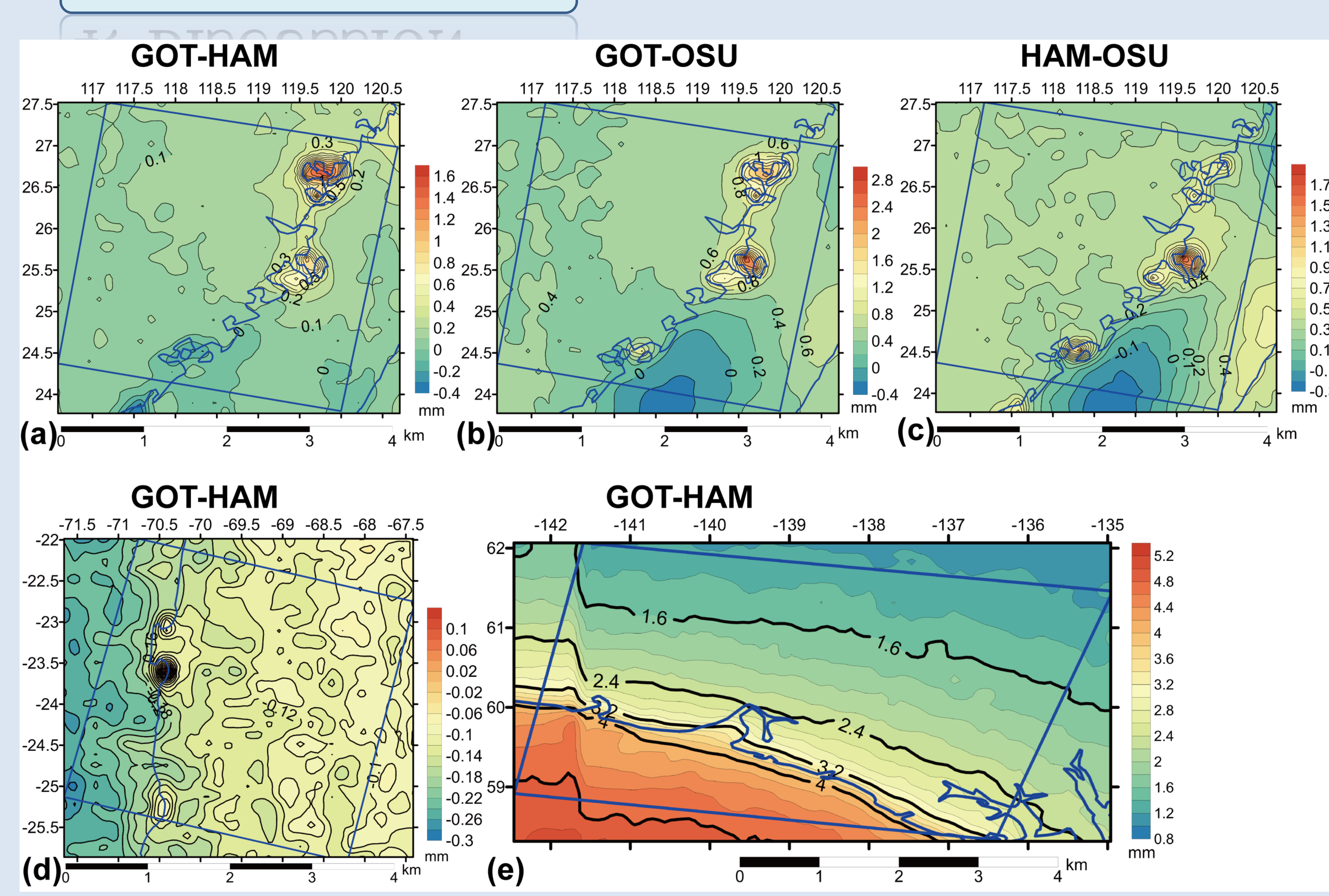

Figure 5. Double differential maps of OTL displacements estimated from different OTLs (GOT4.7, HAMTIDE11a and OSU.CHINASEA.2010). (a, b, c) Fujian, Southern China; (d) Gulf of Alaska and Canada; (e) Northern Chile.

5、CONCLUSION

(1) OTL effects on InSAR deformation monitoring with the land to the coastline is inversely proportional to the distance;
(2) SAR acquisition time should consider to try to stay away from astronomical tide and tidal changes in the peak time, otherwise you need to consider how to effectively estimate and correct OTL effects;
(3 Deformation gradient changes associated with study area topography is strong and traditional flat or curved surface fitting method is difficult to effectively separate the tide load displacement.

6、MAJOR REFERENCES

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