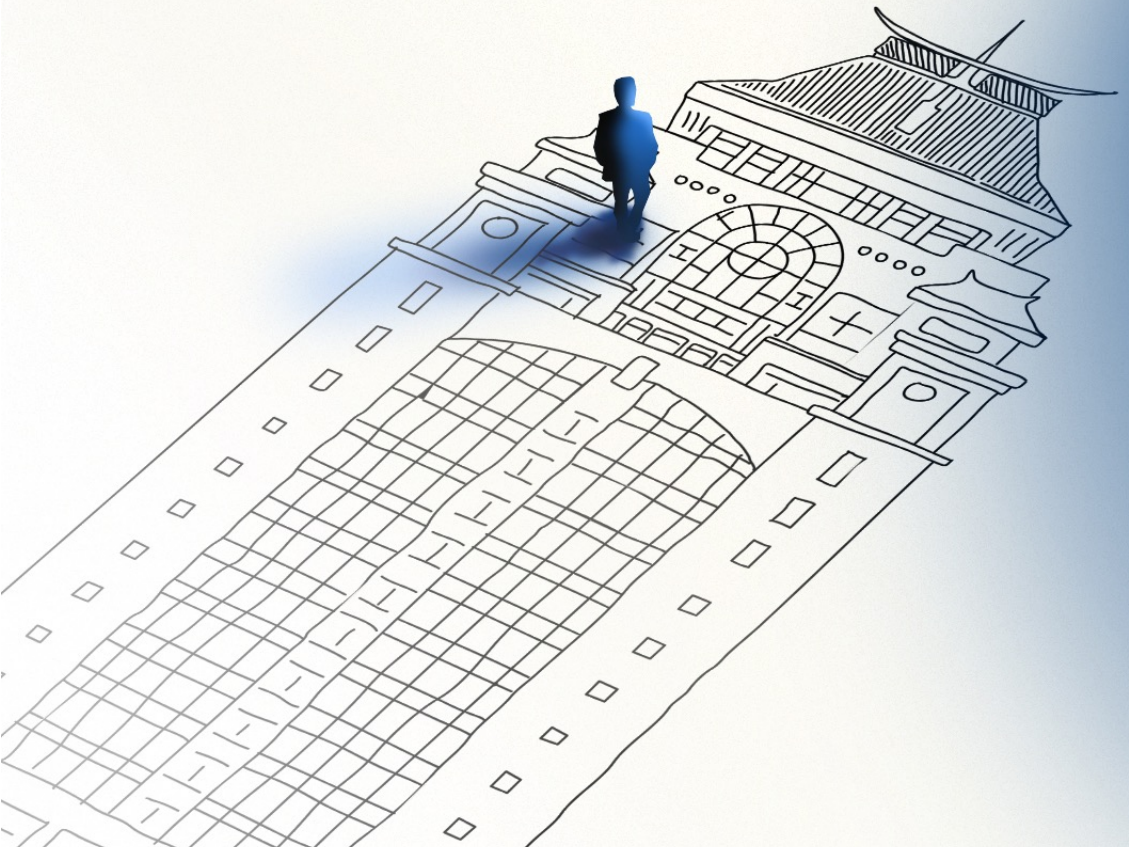
Turbulent lithosphere deformation in the Tibetan Plateau



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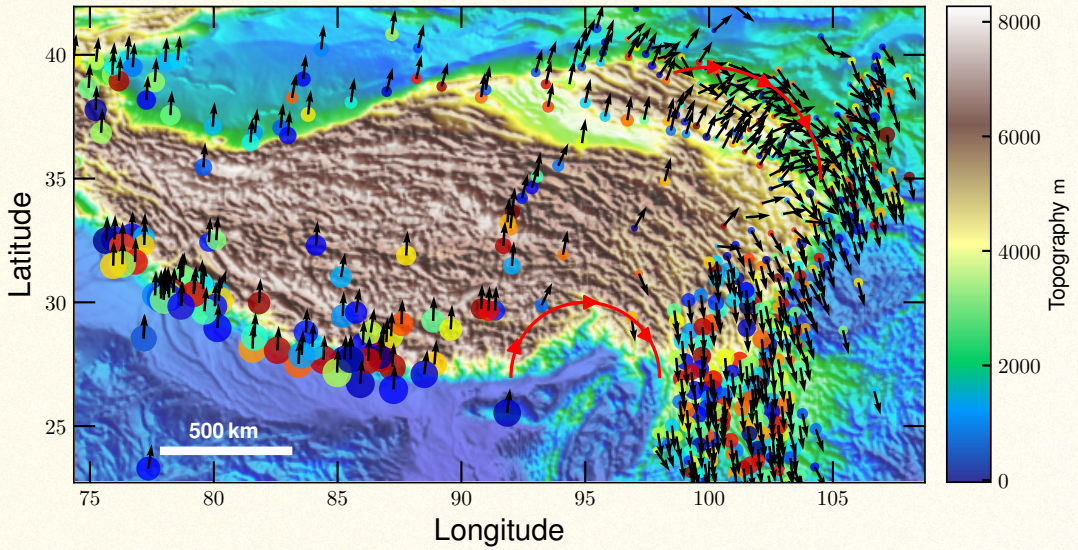
1 Background

A gaint eddy in the lithosphere deformation



(a)

Figure1(a) at the Tibetan Plateau, where the velocity amplitude in cm is encoded by symbol size

Jian et al., Phys. Rev. E, 2019

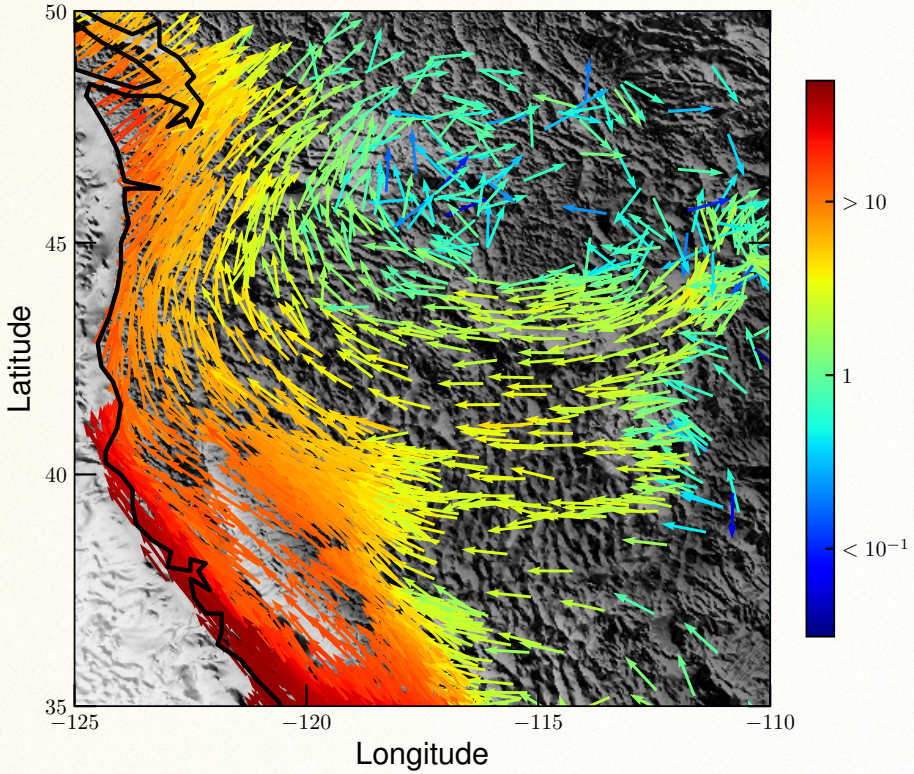
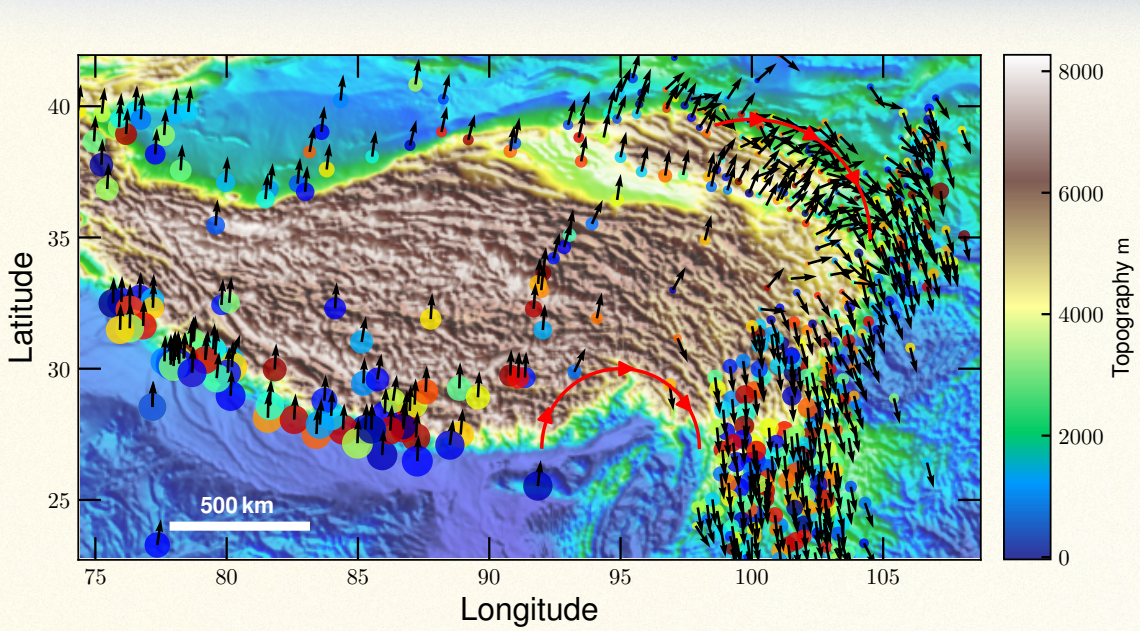
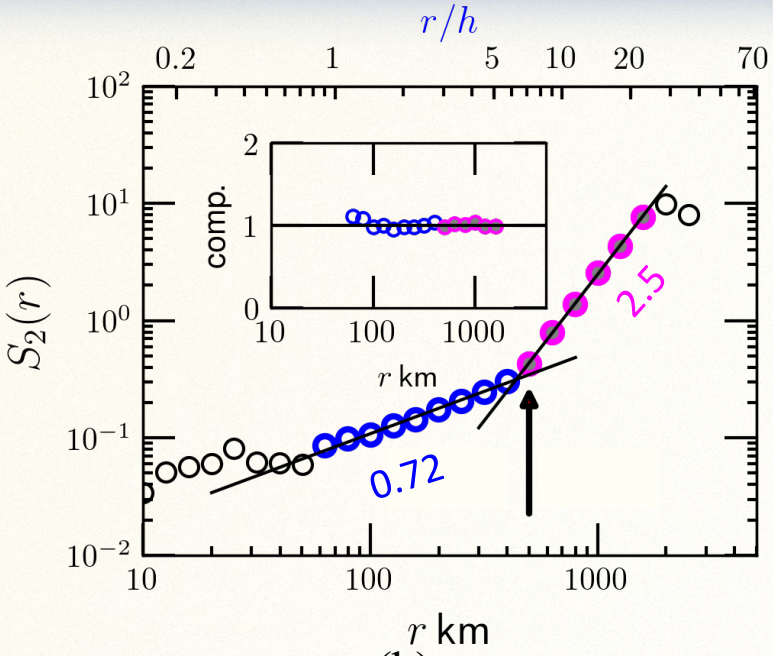


Figure1(b) at the west coast of the United States

1 Background



(a)



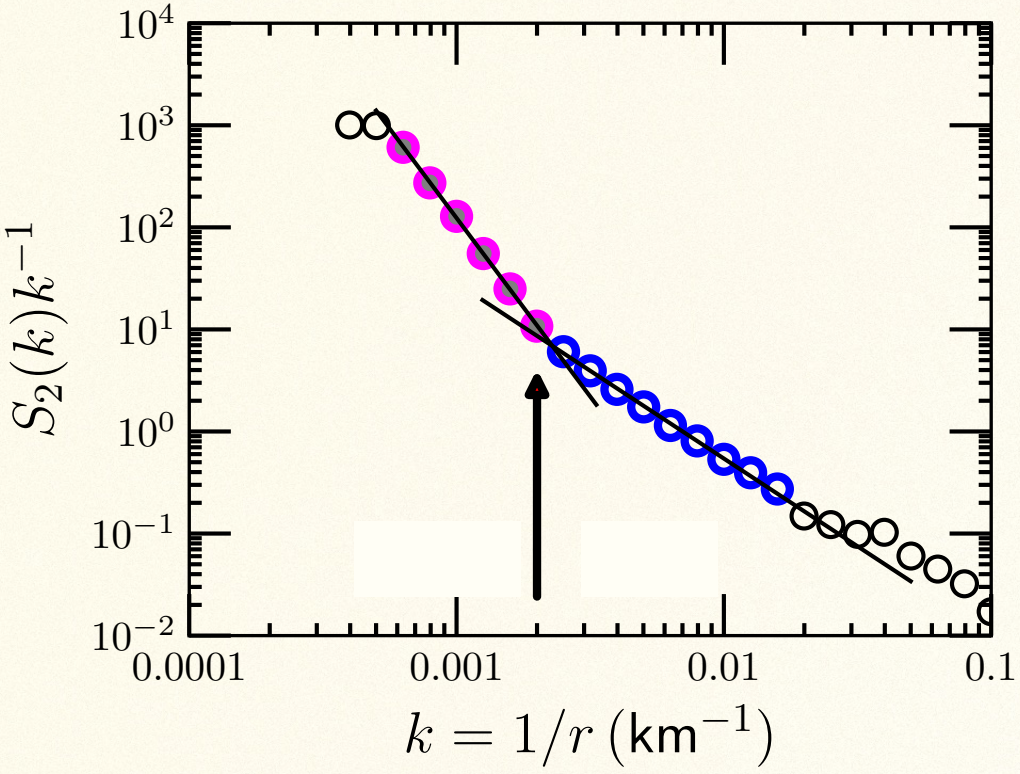
(b)

Figure 2(a) shows the deformation velocity unit vector collected from 553 monitoring locations.

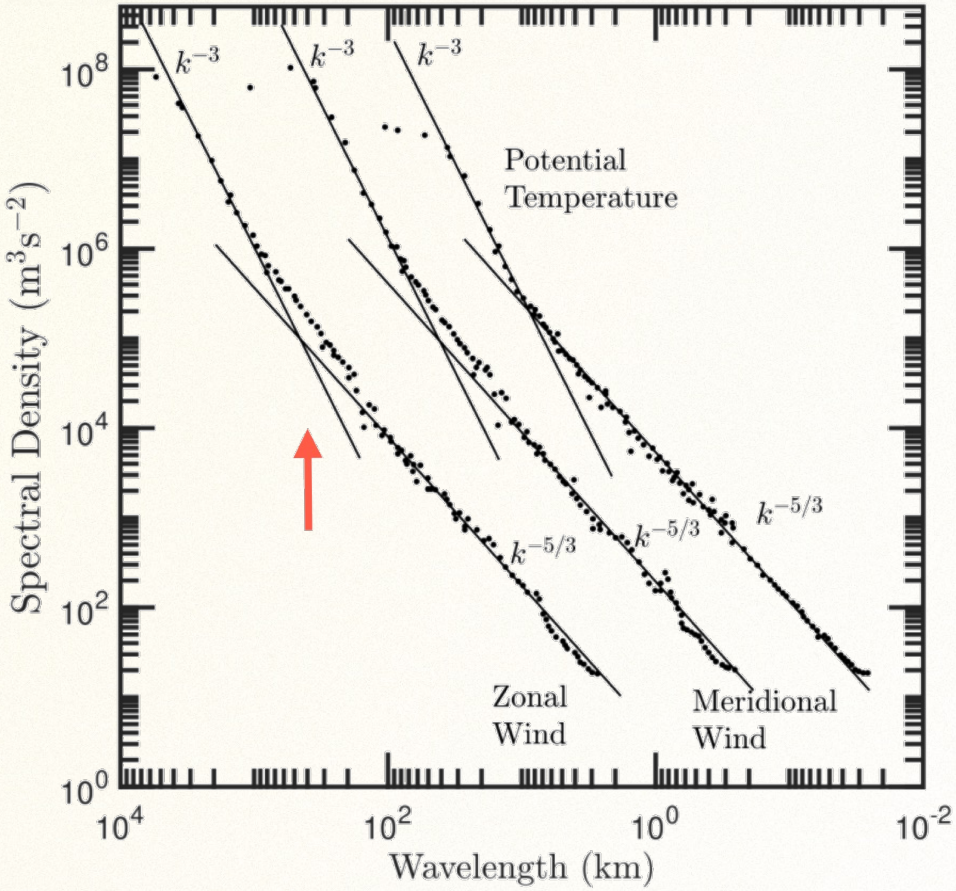
Figure 2(b) shows measured second-order structure functions(SF).

Jian et al., Phys. Rev. E, 2019

1 Background

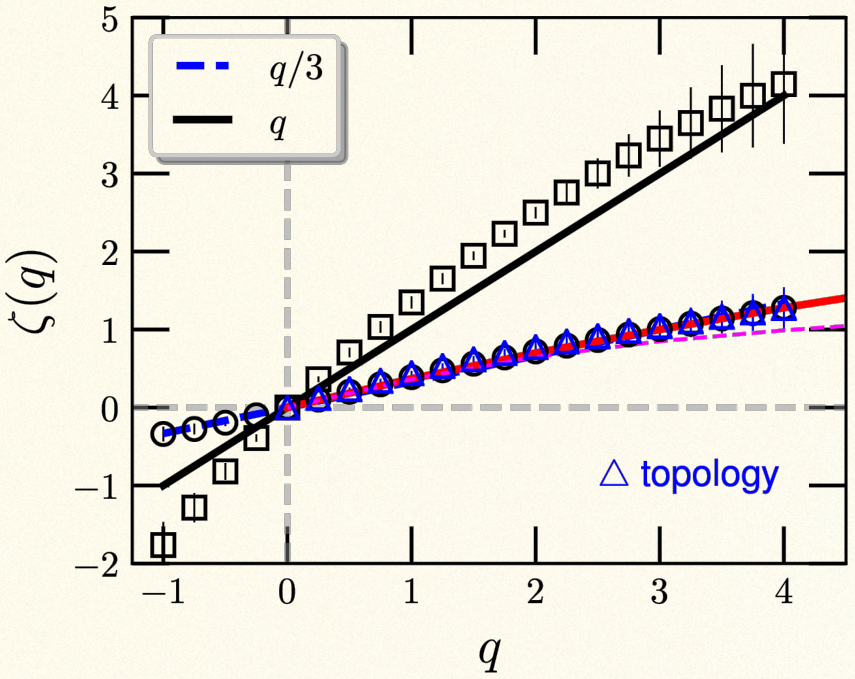


Jian et al., Phys. Rev. E, 2019



Nastrom et al., Nature, 1984

1 Background

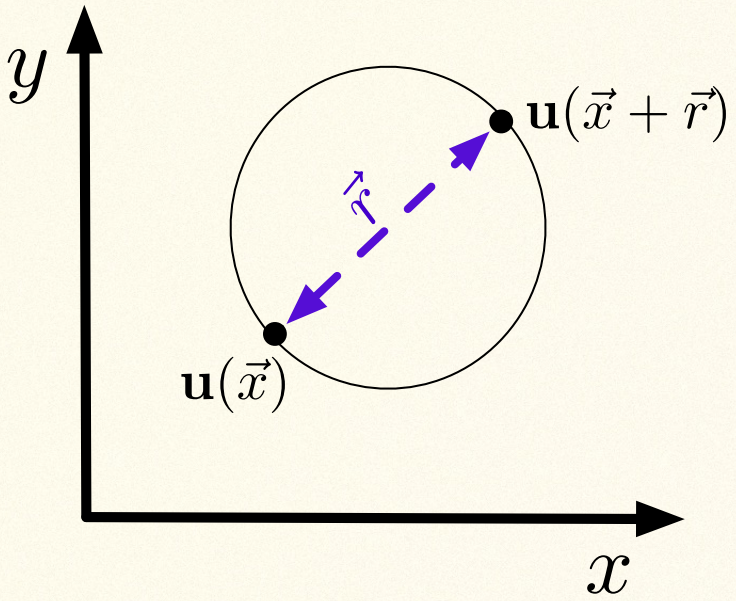


Does cascade really exist or not?

Figure3 Measured high-order scaling exponent ζ(q) of small-scale (◯) and large-scale (□) motions for −1≤q≤4, where ζ(q)=q/3 (dashed line) and ζ(q)=q (solid line) are illustrated for reference

2 Method

$$\Delta_L \mathbf{u} = (\mathbf{u}_{\vec{r}}(\vec{x}+\vec{r}) - \mathbf{u}_{\vec{r}}(\vec{x}))$$



$$S_{LLL}(r) = \langle \Delta_L \mathbf{u}^3 \rangle = -\frac{4}{5}\epsilon r$$

3D HIT
Kolmogorov 1941

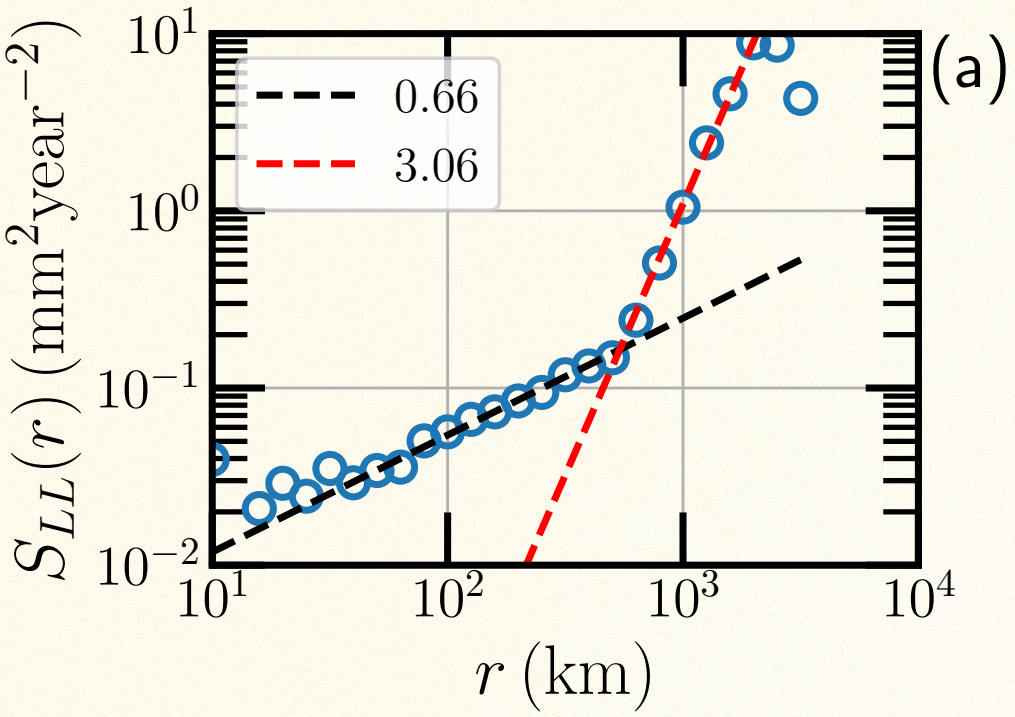
$$S_{LLL}(r) = 0$$

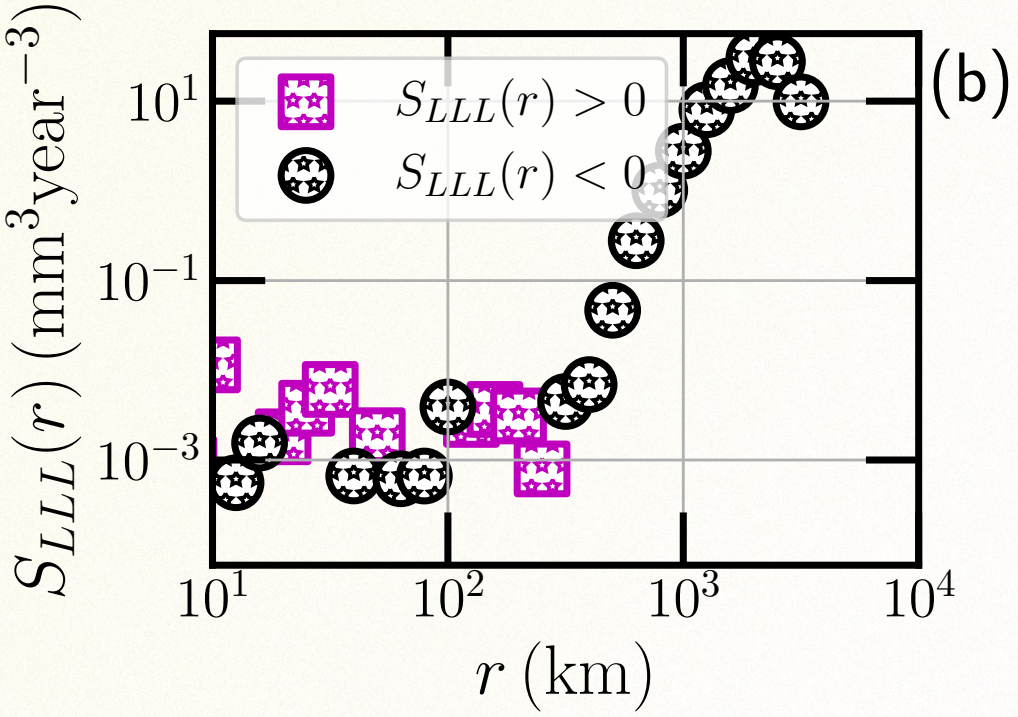
no cascade

$$S_{LLL}(r) = f(r)$$

Yes, cascading

3 Results





$$S_{LLL}(r) = f(r)$$ Yes, cascading

4、Conclusion

The lithosphere deformation of the Tibetan Plateau is analyzed in the spirit of the multiscale statistics from turbulence community.

1) Previous work: High-order SFs are estimated and intermittency correction is detected

2) Recent work : 3rd SFs is retrieved to examine the existence of cascade

$$S_{LLL}(r) = \langle \Delta_L \mathbf{u}^3 \rangle = f(r)$$

Yes, turbulent cascade does exist!