

Surface Quasi-Geostrophy : A Proxy for 3D Turbulence ?

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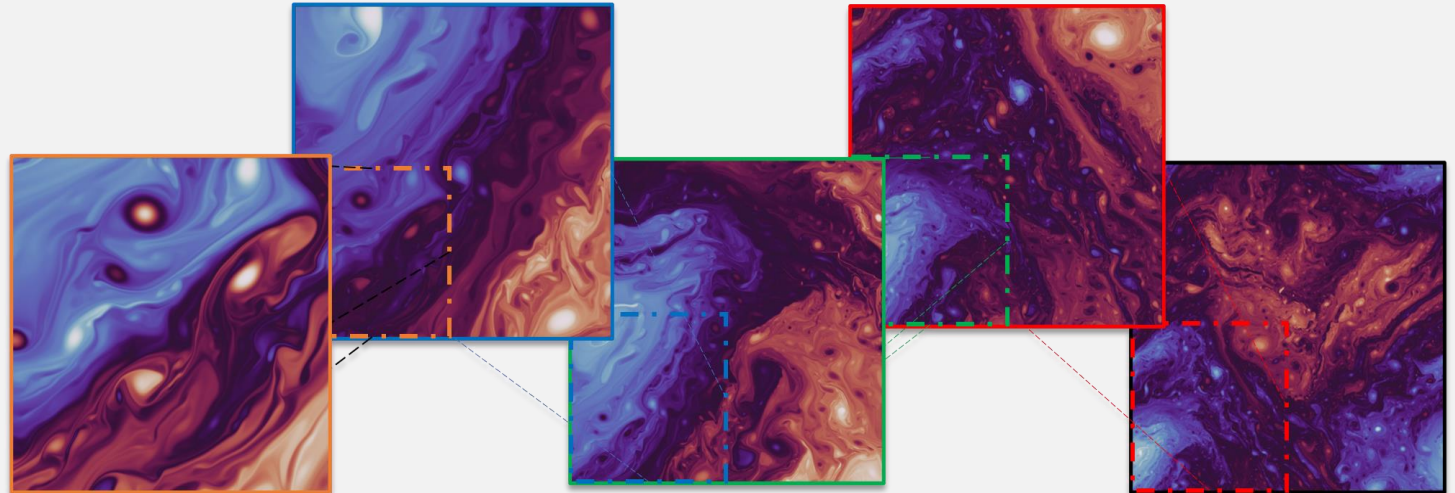
Forced and Dissipated SQG:

$$\partial_t \theta + (\mathbf{u} \cdot \nabla) \theta = \nu \Delta \theta + f + D_{LS},$$

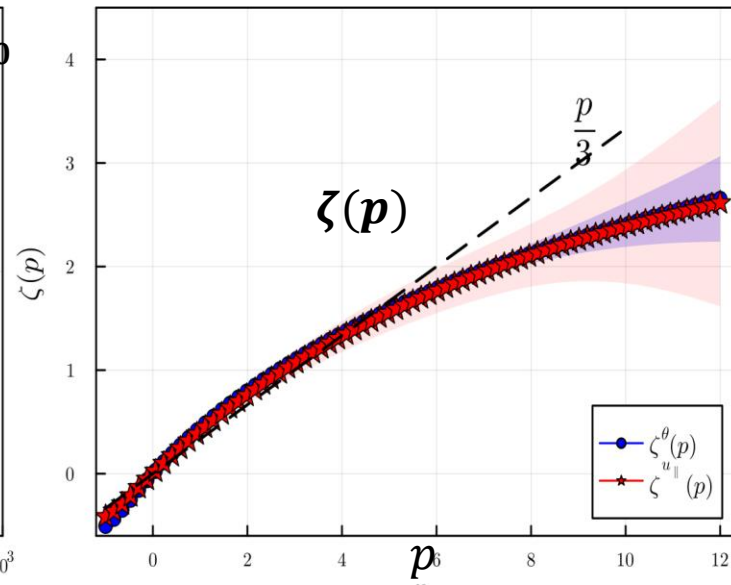
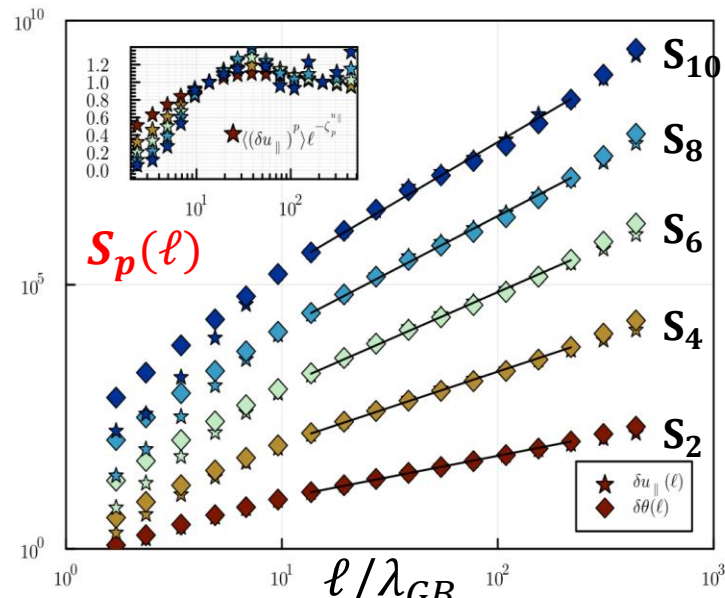
$$\text{with } \hat{\mathbf{u}} = i \frac{\mathbf{k}_\perp}{|\mathbf{k}|} \hat{\theta},$$

- Two dimensional system
- Focus on the direct cascade of energy:

$$E = \|\theta\|_{L^2}^2 = \|\mathbf{u}\|_{L^2}^2$$



16,384² SQG under large scale forcing and dissipation



Single field structure functions (N=8192):

$$\star S_p^{u_\parallel}(\ell) = \langle |\delta_\parallel u|^p \rangle(\ell) \quad \blacklozenge S_p^\theta(\ell) = \langle |\delta \theta|^p \rangle(\ell)$$

- Same scaling for the scalar and the velocity structure functions within a tiny decade
- Convex anomalous exponent function $\zeta(p)$
- Only a tiny decade ? Definition of Inertial range ? Pure scaling or corrections ?