MUltiSCAle Turbulence Synthesis

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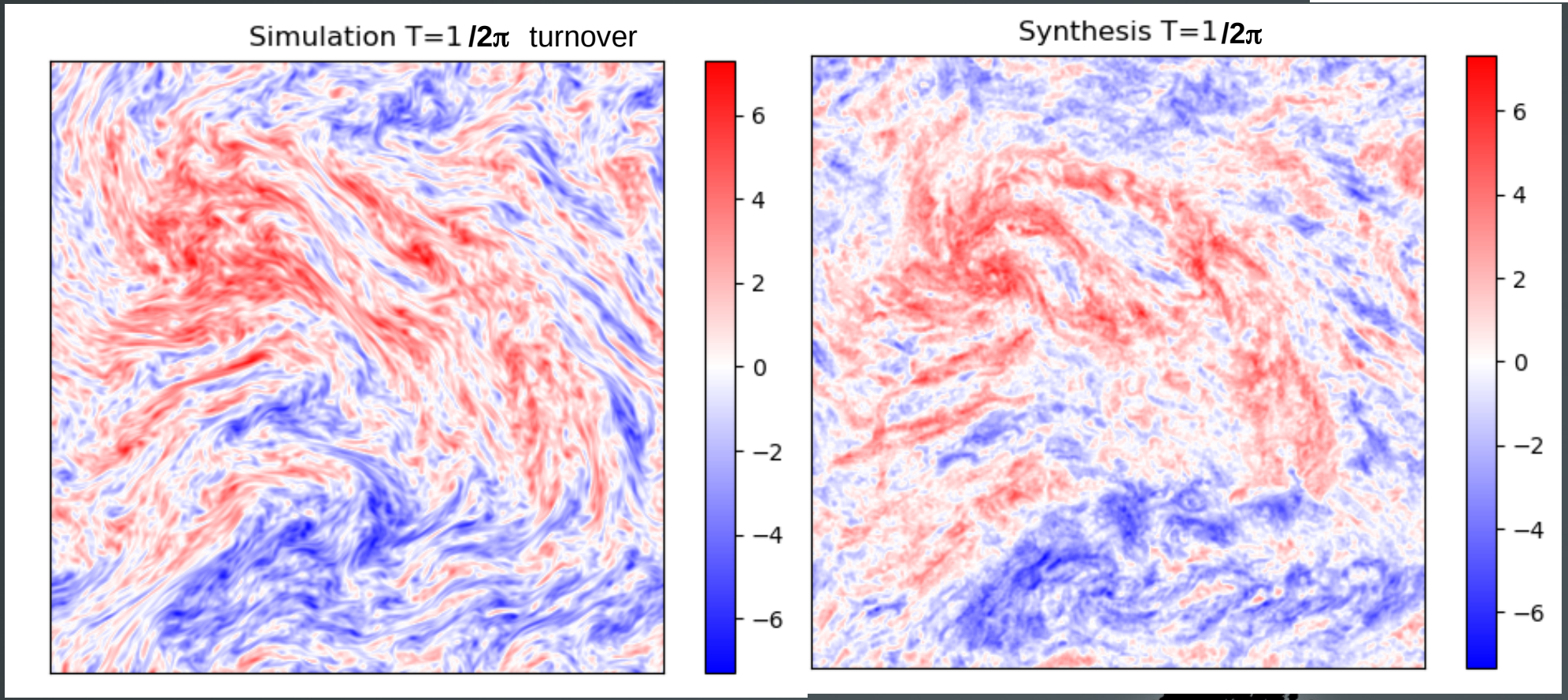
Vorticity maps in 2D incompressible decaying turbulence

$$\partial_t w + \boldsymbol{u}.\boldsymbol{\nabla} w = \nu \Delta w$$

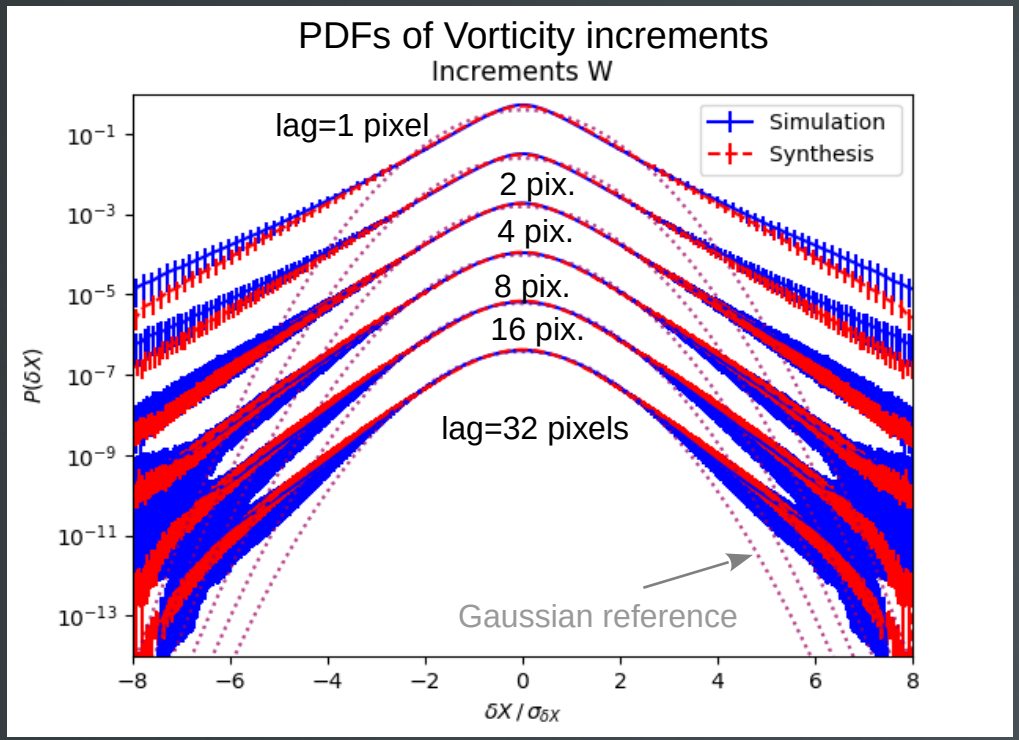


~150 Pseudo-spectral steps from a Gaussian vorticity field with a k^{-1} power spectrum. N=1024.

One MUSCATS step. ~ Multi-scale ballistic approximation. $\Delta t = 2\pi$

PDFs of increments averaged over 30 realisations

- Classical statistics are reproduced (including energy&enstrophy transfer functions)
- But texture sensitive coefficients (WST, see Allys+2020) can see the difference
- Synthesis is much less accurate at later times and for shallower spectra



Prospects:

- Improve scale interactions and time integration order
- Compressible 3D, MHD, gravitating...
- Turbulent initial or boundary conditions for simulations
- Sparse reconstruction, deprojection, components separation...