Many idealized models of atmospheric and oceanic flows reduce to the two-dimensional (2D) advection of a tracer that in turn determines the flow field. The classic example is non-divergent 2D flow on a plane (or a sphere), where the tracer is the vertical (or radial) component of the vorticity. Of special interest is the "geostrophic turbulence" generated in systems with two interacting active tracers, representing flow at the tropopause and the earth’s surface in the simplest atmospheric case. Another example of special interest is surface quasi-geostrophic (SQG) flow, in which the state of the system is determined by the completely temperature at the surface. SQG flows bear some formal resemblance to 3D incompressible flows – for example, dimensional arguments suggest a -5/3 kinetic energy spectrum for the direct turbulent cascade to small scales, just as in 3D. SQG has developed into a model problem for those interested in singularity formation in 3D Euler or Navier-Stokes. The possible formation of singularities in SQG remains unsolved. There is also interest in possible blow-up of active scalar equations with more singular constitutive laws and in questions relating to long time behavior in the limit of small dissipative mechanisms. Our goal in this interdisciplinary workshop is to familiarize mathematicians and atmosphere/ocean scientists with ongoing research outside of their fields, and possibly fertilize new work within both groups.

CONFIRMED SPEAKERS

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Tom Hou, CalTech
Alex Kiselev, University Wisconsin

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Antoine Venaille, CNRS, Lyon
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