Boulder Fluid Dynamics Seminar Series

Tuesday, September 17, 2013
3:30pm-4:30pm (refreshments at 3:15pm)
Bechtel Collaboratory in the Discovery Learning Center (DLC)
University of Colorado at Boulder

Multi-decadal trends in the advection and mixing of carbon in the Southern Ocean

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The intermediate and deep waters of the ocean store nearly 40,000 petagrams of carbon, more than 60 times that of the atmosphere. In the Southern Ocean, ventilation along isopycnals connects carbon-rich deep water to the surface, permitting carbon dioxide (CO_2) stored in the deep ocean to escape to the atmosphere. As such, the Southern Ocean is a significant source of CO_2 for the atmosphere.

Observations over the last 50 years indicate that the westerly winds over the Southern Ocean have strengthened, due to anthropogenic-induced changes in the climate system. Here, I assess the impact of this multi-decadal increase in wind intensity on the advection, mixing, and air-sea exchange of carbon in the Southern Ocean using a coarse-resolution ocean model with a variable eddy-induced advection coefficient. The model predicts an increase in the sea-air flux of CO_2, caused by wind-driven increases in the advection and diapycnal mixing of carbon into the surface ocean. The trend toward enhanced outgassing is countered by a simultaneous increase in the eddy-induced advection of carbon, which opposes the Eulerian flow.

Sparse spectrum random fields in fluid mechanics and optics

Mikhail Charnotskii, *Zel Technologies, LLC and NOAA/ESRL*

Recently introduced Sparse-Spectrum (SS) model for random processes and fields is based on the trigonometric series with discrete random spectral support and random amplitudes. SS model offers a simple and computationally effective presentation for wide band random fields and processes. SS fields are non-Gaussian and have richer statistics than Gaussian fields with the same power spectrum. We present the general concept of the Sparse Spectrum and discuss its applications for the modeling of the surface waves and phase perturbations of the optical waves propagating through atmospheric turbulence. We address the issue of the sparsity metrics and present the experimental evidence of the spectral sparsity found in the surface elevation data.