Geophysical Research Abstracts
Vol. 18, EGU2016-8976, 2016
EGU General Assembly 2016

Subgrid modeling in two-dimensional turbulent flow using the principle of maximum entropy

Wim Verkley (1), Peter Kalverla (2), and Camiel Severijns (1)

(1) Royal Netherlands Meteorological Institute, R&D Weather and Climate Models, De Bilt, The Netherlands (verkley@knmi.nl, severijn@knmi.nl), (2) Wageningen University, Meteorology and Air Quality Section, Wageningen, The Netherlands (peter.kalverla@wur.nl)

We consider the problem of parameterization of subgrid processes in the context of two-dimensional incompressible fluid flow on a doubly periodic domain. In this idealized context we address the question how the small scales of a high-resolution reference simulation can be parameterized in a low-resolution model aimed at reproducing the reference simulation. The basis of the parameterization that we propose is a probability density function of the small, unresolved, scales that has maximum information entropy, constrained by normalization and averaged budgets of energy and enstrophy.

Due to the generality of the constraints, the parameterization that results is completely fixed in terms of the parameters of the reference model. The advantage is that the parameterization needs not to be tuned and automatically adjusts itself to any change in the parameters of the reference model. To assess its merits in practice, it has been tested with regard to short-term performance in reproducing vorticity fields and with regard to long-term performance in reproducing the statistics of energy and enstrophy. In both respects the proposed parameterization outperforms conventional parameterizations such as eddy viscosity.