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**Dynamic sub-grid scale modelling: a wave action approach** C.C. ARMAS, D.J. FOSTER, C.J. MCDEVITT, P.H. DIAMOND, U.C.S.D. — Modelling disparate scale interactions remains an ongoing theoretical and computational challenge. In order to facilitate computation, high Reynolds number systems are often described via the introduction of phenomenological dissipation coefficients as a means of modelling stresses exerted by the unresolved scales. The temporal and spatial evolution of these phenomenological coefficients are usually described via heuristic turbulence models. As the dynamics of the unresolved scales play a crucial role in the evolution of the overall system, especially in cases where inverse cascades are present, a simple dynamic sub-grid scale model for the unresolved turbulent scales, that is rigorously derivable from the original fluid equations, is clearly desirable. In particular, systems which possess strong uniform magnetic fields or under go rapid rotation exhibit quasi 2-D behavior which may lead to an inverse cascade of energy. Here a self-consistent model describing nonlocal interactions between the large resolved scales and the small unresolved scales is discussed. The unresolved scales see the resolved scales as a slowly evolving background, allowing for the use of wave kinetics and adiabatic theory. The stresses exerted by the self- consistently evolved wave population density on the large scale flows are calculated by mean field methods. This model has the advantage of being both systematically derivable from the fundamental fluid equations without introducing any free parameters, as well as being simple to implement.

Christopher McDevitt
University of California at San Diego

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