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Nonlinear Processes in Geophysics
Discussions

Interactive comment on "Direct numerical simulation of intermittent turbulence under stably stratified conditions" *by* P. He and S. Basu

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The paper adresses a very important point in prediction of environmental flows in general and here aimed towards the understanding of Stratified Atmospheric Wind Behaviour.

The authors simulate intermittent turbulence (as they loosely identify also as bursting events)They compare field situations in a wide range of conditions as they comment that "This type of non-stationary time-series has been widely observed in geographically and climatologically diverse regions around the world."

In spite of the interest and the new work reflected in the paper. The paper does not define in a clear way the different methods used in the literature to describe and define intermittency.

The long -lasting multiplicity of definitions could be clarified for the benefit of the readers, specially the new-comers from diferent aspects of the study of stratified flows.

Basic definitions and references from (Kolmogorov 1962),... (noting that scalingl at small scales of turbulence provides a key definition as (2 minus the sixth order velocity structure functions)only if the turbulent flow is local !.

The added complexities of the apparence of internal waves in stratified flows still cast a doubt of whether the spectra at small scales icreases or decreases its slope ?.

The extraction and comparison of intermittency related effects and descriptors in stably stratified open-channel flows using direct numerical simulation (Open Foam) is important and could clarify the many previous observations and methods previously used and discussed in the literature. Rurther references would be interesting.

As the Authors claim "Clear signatures of this intriguing phenomenon are observed for a range of stabilities. However, the spatio-temporal characteristics of intermittency are found to be strongly stability-dependent. In general, the bursting events occur often near the bottom wall than in the upper-channel region."

The lax definitions used and the effects at large scales, at integral scales and at cascade or disipative scales are confused often in the literature, but the paper does not attempt to clarify the issues.

It even attempts a Reynolds number dependent intermittency as " A steady coexistence of laminar and turbulent flows is almost always detected at various horizontal planes. This spatially intermittent pattern is found to propagate downstream and strongly correlate with the temporal evolution of intermittency. The forcing of the flow may be a cause or an effect, and it seems that this is not clear !, even in the definitions.

The hypothesis by Blackadar(1979), strong connection between local stability and intermittent turbulence, is claimed to be corroborated by this modeling study, but this would occur due to internal wave (or coherent structure) resonance.

The existence of global intermittency (Mahrt, 1989) (also known as turbulent bursting events) in the atmospheric boundary layer (ABL) is well known but very often confused.

Intermittent turbulence is usually characterized as alternately quiescent and bursty portions of an observed time-series, representing laminar and turbulent states of the ABL flow, respectively, but this Reynolds number effect may be just forcing intermittency, or due to a larger scale effect or resonance. Stratification itself introduces internal Non-Linear waves, the spectral regions between integral and Taylor microscales may behave one way, while the dissipation range turbulence has another type of intermittency (at small scale !)

Intermittent turbulence was generated in wind-tunnel experiments under idealized settings may be used to compare loose definitions such as: TBE, TF, Ratio of vertical velocity variance,... PDF Kurthosis, Scaling exponents, Modulation of Gradient Ri,... etc.

As the Authors discuss, It is well known "That intermittent turbulence is a truly multiscale (bursting duration ranging from seconds to hours) and a dynamically complicated (and perhaps complex) phenomenon. It is also known in the literature that this phenomenon portrays intriguing spatial characteristics" (also temporal !)

With these considerations in mind and considering that the paper performs DNS using OpenFoam, by running an statistical ensamble of cases, the paper could attempt to clarify these controversial issues (separating effects like due to non-stationarity, to non- homogeneity (different in the vertical/horizontal. even non-locality and 3D and 2D effects. The large potential of this paper is to clarify both the definitions, the ranges, the effects and the causes of intermittency.

The stress on the large scale (or forcing intermittency) should be made clearer pointing out the comparison of the simulation conditions with the range of real conditions in the Atmosphere, Many relevant measurements of high frequency in the ABL under stratified conditions (e.g. SABLES, SHEEBA,.. Antartic wind data,...) have peen

parametrized. How do the DNS compare with the scope of existing intermittency data.

Interactive comment on Nonlin. Processes Geophys. Discuss., 2, 179, 2015.