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From little whorls to the global atmosphere

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Big whorls have little whorls, ..., and so on to viscosity." This famous poem by Lewis F. Richardson describes what is now well-known as the inertial range energy cascade from large to small scales. However, the transfer of energy does not follow a one-way street. Some energy gets backscattered from small to large scales. This is one of the early topics of my work of which consequences will be reviewed in this lecture. Others include the realisability constraint of the Reynolds stress tensor and its consequences. Finally, the paper will point to some recent findings of relevance for nonlinear geodynamics, such as the detection of an inversion layer at the tropopause, detection and modelling of ice-supersaturation in the atmosphere, and quantification of a possible climate feedback from lightning induced nitrogen oxides.