

Formulations, Fallacies and the Future of the Quasi-Geostrophic ω -Equation.

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Consideration is given to the dynamics and the basic kinematics associated with the quasi-geostrophic ω -equation. Attention is focussed on the formulation(s) of the equation's so-called 'Forcing Function' that have been proposed to enable the qualitative inference and the dynamical interpretation of the synoptic-scale regions of ascent from direct inspection of synoptic charts. A critique of four extant formulations of the 'Forcing Function' (viz. the traditional, the extended-Sutcliffe, the Q-vector, and the PV forms) serves to pinpoint their shortcomings, and prompts the derivation of some (yet more!) alternative forms.

Attention is also drawn to the utility and value of the quasi-geostrophic ω -equation given that nowadays the vertical velocity is available as a model output field and the finer meso-scale patterns of the flow captured in NWP models are assumed to be beyond the restrictions of quasi-geostrophy. Co-examination of model-based Q-vectors and vertical motion patterns reveal a surprising degree agreement as well as distinctive and major disagreements. The attendant dynamics is shown to be subtle and integral to the nature of:- balanced flow, the development of intricate patterns of near-surface baroclinicity, and the character of baroclinic development.

Finally it is argued that deployment of a 'balanced flow' Omega equation is both warranted (- and arguably necessary) when considering the NWP issues of model resolution, stochastic representation of near-grid scale processes, and the assimilation of meso-scale cloud-diabatic effects.