There is a current debate on whether the spectrum power law $E(k) \approx k^{-3}$ on scales $\geq 600$ km obtained with the help of commercial jetliner trajectory deviations (GASP and Mozaic databases) could be brought into question (Lovejoy et al., 2009) or not (Lindborg et al., 2010) because it corresponds to the quasi-geostrophic turbulence (Charney, 1971). We therefore critically analyze the scale analysis leading to the quasi-geostrophic approximation, particularly the linearization of the stretching vector. We discuss how to go from scale analysis of the original equations, followed by a scaling analysis of the approximated equations, to a direct scaling analysis of the original equations with the help of Generalized Scale Invariance (Schertzer and Lovejoy 1985). We show that the fact that vorticity is dominated by the Earth’s angular velocity at large scales may induce a statistical breaking of the isotropy of the vorticity equations. It therefore generates a set of dynamical equations for vorticity with a (fractional) dimension $D = 2 + H_z$, where $0 \leq 1 - H_z \leq 1$, measures the scaling stratification of atmospheric turbulence. These equations correspond to a plausible dynamical alternative to quasi-geostrophic approximation and turbulence.