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Studying the vertical cascade structure of the atmosphere using dropsondes

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Systematic study of horizontal satellite radiances (visible, infra red, passive and active microwave) show that to within roughly $\pm 1\%$ they follow the predictions of cascade models from planetary scales down to kilometric scales (possibly less). Similarly, the study of ERA40 reanalyses and numerical weather forecast models gives further support to the idea that in the horizontal, the atmosphere has a cascade structure. However due to (scaling) stratification, the vertical structure is quite different; in this paper, we use over 200 state-of-the-art drop-sondes to demonstrate that the vertical structure of horizontal wind, temperature, pressure, humidity, potential temperature, equivalent potential temperature, density and vertical acceleration all accurately follow the predictions of cascade models with outer scales in the range 1-10 km (depending on the field and also altitude). We quantify the corresponding statistical properties and discuss the implications.