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From the weather to the climate: a dimensional transition?

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Based on anisotropic space-time turbulence theory, on lidar and satellite radiances, on in situ spectra of temperature, humidity and wind measurements, and on numerical models of the atmosphere as well as reanalyses, we propose an objective basis upon which to distinguish the weather from the climate. We show that the latter accurately follow the predictions of multiplicative cascade models up to about 7- 10 days. This marks the beginning of a weather/climate transition region which extends up to the cascade outer scale (time T) of about 20-30 days (depending somewhat on the atmospheric field), after which the climate regime begins. We bolster this interpretation by empirically constructing space-time ("Stommel") diagrammes; we obtain near linear relations between time and (horizontal) space and theoretically predicted power law relations between the vertical and time up until the end of the weather regime ($\approx$10000 km in the horizontal, $\approx$ 10 km in the vertical, $\approx$10 days in time).
Going beyond the weather regime to time scales >T, we see that the spectra flatten out into a "spectral plateau". Using multiplicative space-time cascade models over scales much longer than T, we find that the flattening is nearly as expected and is caused by the transition from a full space-time weather process at scales below T to an increasingly time only type process at larger scales. Further evidence for this "dimensional transition" is the empirical finding that the same type of statistical variability (i.e. probability distributions) persists up to about a year in in situ temperature, humidity and wind statistics and up to tens of years in the 20th Century reanalyses.
For long enough periods however we find that new scaling climate processes begin to dominate.