The Scale of surface layer convection cells in red giant stars

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The scale of photospheric convection in red giants is generally associated, by analogy with the Sun, with the atmospheric pressure scale height and the thickness of the superadiabatic transition layer(SAL). As pointed out by Schwarzschild(1975), both of these quantities are relatively much larger in terms of the stellar radius in a red giant then in the Sun. On these grounds, Schwarzschild concluded that only a few cells must be present on the surface of a supergiant, in contrast with two million cells observed on the solar surface. Observations of brightness variations in the TiO band on Betelgeuse (Gaustad 1986) and direct imaging of Betelgeuse (Gilliland & Depree 1996) with HST, have yielded results that are compatible with giant cells, although other interpretations (e.g. pulsation) are possible. 2D numerical simulations (Freytag 2001) also claim compatibility with the giant cell interpretation. On the other hand, Gray(2001) has pointed out that his extensive spectroscopic observations of Betelgeuse are more easily interpreted in terms of hundreds of convection cells per hemisphere. We present preliminary results of 3D radiative hydrodynamical simulations which are closer to Gray's interpretation. Rather than use the pressure scale height or the thickness of the SAL to estimate the convective eddy size, we compute the Full Width at Half Maximum (FWHM) of the 2-point vertical correlation of the turbulent vertical velocity.