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Solution to the discrepancy between the seismic and photospheric solar radius

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Two methods are usually used to observationally determine the solar radius: One is the observation of the intensity profile at the limb, the other one uses f-mode frequencies to derive a 'seismic' solar radius which is then corrected to optical depth unity. The two methods are inconsistent and lead to a difference in the solar radius of approx. 0.3 Mm. Based on radiative transfer calculations we show that this discrepancy can be explained by the difference between the height at disk center where tau500=1 and the inflection point of the intensity profile on the limb. We calculate the intensity profile of the limb for the MDI continuum and the continuum at 5000 A for two atmosphere structures and compare the position of the inflection points with the radius at optical depth unity. The calculated difference between the 'seismic' radius and the inflection point is 0.347 Mm with respect to optical depth unity and 0.333 Mm with respect to the Rossland mean opacity. We conclude that the standard solar radius in evolutionary models has to be lowered by 0.333 Mm and is 695.66 Mm. This correction reconciles inflection point measurements and the seismic radius within the uncertainty. This finding is very important for the analysis of the solar diameter measurements with the SODISM instrument on PICARD.