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Monitoring twenty-first century climate using GPS radio occultation bending angles

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Simulations of radio occultation bending angle profiles in transient climate experiments using a state-of-the-art global coupled climate model show a clear signal in bending angle emerging over the first half of the twenty-first century. The bending angle signal can be related to the predicted changes in the climate over this period in response to increasing greenhouse gas concentrations and is shown to be primarily a combination of three distinct effects: the changing temperature structure of the atmosphere, increased water vapor in the troposphere, and the expansion of the atmosphere due to the warming. Analysis of the predicted trends in the bending angle indicates that the climate change signal in the tropical upper troposphere and lower and middle stratosphere may become distinguishable from natural variability, i.e. “detected”, after approximately ten to sixteen years of measurements. This suggests that such observations may be one of our best prospects for monitoring the evolution of the climate over the coming decades.