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The Huygens Surface Science Package sound speed measurements
and the methane content of Titan's atmosphere

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The Huygens probe descended through Titan's atmosphere in January 2005. On board was the Surface Science Package (SSP), a set of nine sensors, which included a speed-of-sound sensor. We present a detailed description of the SSP speed of sound measurements and report constraints on the methane content in Titan's lower atmosphere based on these measurements. After extensive instrument calibration and subsequent Bayesian analysis of the data, the most likely result derived from our measurements in Titan's lower atmosphere is a methane fraction of approximately 2% at 10 km, increasing to 3.5% at lower altitudes. These estimates are based on a binary composition. Our data show that any large scale variation of methane within the lower 11 km of Titan's atmosphere is unlikely. Within experimental and theoretical uncertainties, our estimates are lower than, but compatible with earlier estimates obtained from the mass spectrometry experiment.