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Horizontal structure and dynamics of Titan's thermosphere

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The Ion Neutral Mass Spectrometer (INMS) on board the Cassini spacecraft regularly measures in situ the abundances of principal neutral and ionized gases in Titan's thermosphere down to around 950 km altitude. From a database of INMS measurements during Titan flybys since Oct 2004 we have determined horizontal variations of N_2 and CH_4 in Titan's thermosphere. We find a pronounced horizontal structure in the northern hemisphere, with total mass density increasing towards the equator. By fitting Legendre polynomials to the INMS measurements we have constructed an empirical model for Titan's thermosphere, which we have used, amongst other, to determine the thermal structure above 1000 km on Titan. Using a global fluid model with this thermal structure imposed, we have calculated global winds and the transport of Methane they cause. In this paper we will show that neutral winds on Titan are transporting Methane to the northern polar region, where densities are enhanced. The calculations of CH_4 abundances show remarkable agreement with the INMS measurements and give an independent constraint on the dynamics.