

size calculation is that reasonable chunk sizes must be decided on based only on information from the compressed data available at a given point in the process. Similarly, from previous data, it must be possible to evaluate when to switch from the parallel chunk compression to the

serial process that completes compression of each piece.

A more general technique accommodates pieces that are not compressed independently, allowing compressors such as the Fast Lossless (FL) to more fully exploit dependencies between spectral

bands, which generally allows a higher compression factor to be achieved.

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Temperature Dependences of Mechanisms Responsible for the Water-Vapor Continuum Absorption

Results can be used to develop better empirical models.

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The water-vapor continuum absorption plays an important role in the radiative balance in the Earth's atmosphere. It has been experimentally shown that for ambient atmospheric conditions, the continuum absorption scales quadratically with the H₂O number density and has a strong, negative temperature dependence (T dependence). Over the years, there have been three different theoretical mechanisms postulated: far-wings of allowed transition lines, water dimers, and collision-induced absorption. The first mechanism proposed was the accumulation of absorptions from the far-wings of the strong allowed transition lines. Later, absorption by water dimers was proposed, and this mechanism provides a qualitative explanation for the continuum characters mentioned above. Despite the improvements in experimental data, at present there is no consensus on which mechanism is primarily responsible for the continuum absorption.

Because all three mechanisms scale as the square of the H₂O monomer number density, one way to discriminate between the mechanisms is by their T dependences. This work involved a

detailed study of the T dependence of the continuum absorption based on the far-wing theory. Because the calculated absorption coefficients, especially their T dependences, match the new NIST measurements very well, one can conclude that in the 800 to 1,150 cm⁻¹ region, contributions from far-wings of allowed H₂O lines are the dominant source responsible for the continuum.

Although all three mechanisms have a negative T dependence, their T dependences would be characterized by individual features. To analyze the characteristics of the latter will enable one to assess their roles with more certainty. The dimer spectra exhibit a very strong negative T dependence, the far-wing theory exhibits a moderately strong negative one, and the collision-induced absorption has a weak and mainly negative T dependence. In addition, these three have quite different T dependence patterns, i.e., the strength of its T dependence varies differently as the frequency of interest varies.

The far-wing theory exhibits the most complex T dependence pattern and it could vary significantly as the frequency

of interest varies. On the other hand, the collision-induced absorption spectra exhibit a systematic T dependence with frequency. Finally, the pattern of the T dependence of the dimer absorption is rather simpler. By comparing theoretical calculations from the far-wing theory with the most recent and accurate experimental data at different temperatures ranging from 310.8 to 363.6 K in the infrared windows, it was found that theoretical results agree very well with measurements in the 800 to 1,200 cm⁻¹ region. Meanwhile, the new measurements show that at room temperature, the continuum data are in reasonable agreement with the widely used semi-empirical MT_CKD continuum model, but at higher temperatures, the MT_CKD model provides very low values, up to 50% less than those experimentally measured. This indicates that the T dependence exhibited in the current MT_CKD model is not correct, and this model has to be modified.

This work was done by Qiancheng Ma of Goddard Space Flight Center. Further information is contained in a TSP (see page 1). GSC-16075-1