Assessment of Trust in Expert Data Sources for Atmospheric Spectroscopy

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The expert data quality for atmospheric spectroscopy based on a test for satisfying a publishing criterion [1] is described. The spectral data quality is characterized by validity and trust. The validity of expert data must satisfy criteria established on the basis of mathematical models of molecules and criteria of alignment of expert data with primary data. The validity criteria are described by formal statements. A researcher estimates trust to select from a certain dataset the expert data source which is best suited to solving tasks at hand. Estimation of trust is based on partially formalized statements.

In this work, trust is estimated in accordance with publishing criterion. The latter classifies expert data into a trusted and a distrusted types. The two groups of data vary according to which kind of published data (measured, calculated or reference data) are compared. Estimation of trust reduces to a check of identical transitions in an expert dataset for alignment with published primary data within the required accuracy. The latter varies with the range of change of vacuum wavenumbers. A total of twelve ranges of values of vacuum wavenumbers, beginning with the radio-frequency region and ending with the x-ray frequency region, has been studied.

The amount of expert data (Hitran and GEISA) that fail to satisfy the publishing criterion is shown to vary between 0.1 (CO_2) and 75% (N_2O) for H_2O, N_2O, H_2S, and CO_2 molecules and their isotopologues. To estimate trust in expert data for the water molecule, use is made of reference wavenumbers [2-4]. Analysis of six expert datasets (Hitran 2004, 2008, and 2013 and GEISA 2005, 2008, and 2012) published in the past ten years has revealed that the percentage of trusted expert data increases, as new expert datasets for the object under study are published.

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[4] J. Tennyson, P.F. Bernath, L.R. Brown, et al., *J. Quant. Spectros. Rad. Transfer*, **2013**, *v.117*, p.29-58.