Satellite trace gas sensing modeling for missions such as ASCENDS

**Requirements and approach**
- **ASCENDS** is a mission that monitors trace gases in the atmosphere from space.
- **Passive observations** are advantageous for climate modeling and atmospheric sensing.
- **Applicable to other sensing missions such as ASCENDS** and a variety of molecules including CO2, CH4, N2O, etc.
- **Projected space oxygen distributions**

**Benefits for climate science**
- **Quantify global spatial distribution of CO2** on a time scale of months.
- **Quantify the seasonal cycle** of CO2 and other trace gases.
- **Quantify the sensitivity of the Earth system** to changes in atmospheric CO2.

**NASA LCLC ASCENDS approach**
- **1.5% accuracy** (coefficient on CO2), mixing ratio calculation is required NASA Langley Research Center (LaRC) is developing an intensity mixing ratio instrument called a LCLC that uses a combination of terrestrial and solar radiation to quantify the mixing ratios of CO2, CH4, and N2O.

**Pre-analyzed atmospheric data for error analysis**

Analysis and processing of the MERRA dataset

**Combining individual layer error estimates**

**Global annual temperature sensitivity analysis for CO2 and O2 bands**

**Global annual temperature sensitivity analysis for alternative CO2 bands**

**Global annual temperature sensitivity analysis for alternative O2 bands**

**Wavelength instability effects**

**Fig 2.3** Pre-averaged annual temperature sensitivity analysis for CO2 bands.

**Fig 2.5** Pre-averaged annual temperature sensitivity analysis for O2 bands.

**Fig 2.7** Pre-averaged annual temperature sensitivity analysis for alternative CO2 bands.

**Fig 2.9** Pre-averaged annual temperature sensitivity analysis for alternative O2 bands.

**Conclusions and further work**

- **Future observations** will be required for improved accuracy.

**References**

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