**Introduction**

Mapping quasi-conserved atmospheric constituents, such as lower stratospheric ozone, into potential vorticity (PV) - modified potential vorticity (MPV) coordinates is a common technique used to analyse sparse data sets. Ozone transformed into a flow-following dynamical coordinate system is insensitive to meteorological variability. Therefore data from a wide range of times and locations can be compiled, as long as the measurements were taken in the same air mass, as defined by the PV. The mapping approach assumes a high correlation between the ozone and PV fields. In this study, we use the comparatively high resolution of the MLS data to test the correlation between ozone and PV in the lower stratosphere. We evaluate the ability of the PV mapping technique to reproduce the MLS profile data by comparing reconstructed data to the original data as a function of latitude, altitude, and season. We use dynamical data from the NWP assimilation to represent the PV and Theta fields.

**The PV-Theta Mapping Technique**

Due to the conservation of PV and Theta along the path of an air parcel, an ozone mapping in PV-Theta space produces a climatology with greater accuracy than a simple zonal average. While this increased reliability is often achieved for steep gradients in PV, areas with little change in the PV field can be adversely affected by this technique. As a first step in evaluating the reliability of the PV-Theta technique, we examine the correlation coefficients of ozone and PV as a function of latitude, Theta, and season.

**Latitude Gradient Within PV Bins**

Ozone values are graphed as a function of latitude in each PV bin. If the ozone values within a PV bin are further sorted by latitude, a latitude-dependent ozone gradient is sometimes observed. This observation suggests that both latitude and PV are required to characterize the ozone in these cases.

**Technique Comparison**

![Technique Comparison Diagram](image-url)

- **Red**: Bias > 5% or standard deviation greater using PV than zonal mean.
- **Yellow**: PV mapping does not cause bias but does not improve standard deviation over the simple zonal mean.
- **Green**: Bias < 5% and at least 20% decrease in standard deviation.

**Conclusions**

Based on these observations, it is clear that a PV-Theta mapping does not guarantee a more accurate ozone climatology than a zonal average. While the technique works well in most areas with high PV gradients, other regions show little correlation between the ozone and PV field. It is advisable to be cautious in these cases, as a PV-Theta mapping can potentially create artificial features in the ozone map.

The following charts summarize the regions and seasons in which PV-Theta mapping works well and works poorly.

**References**