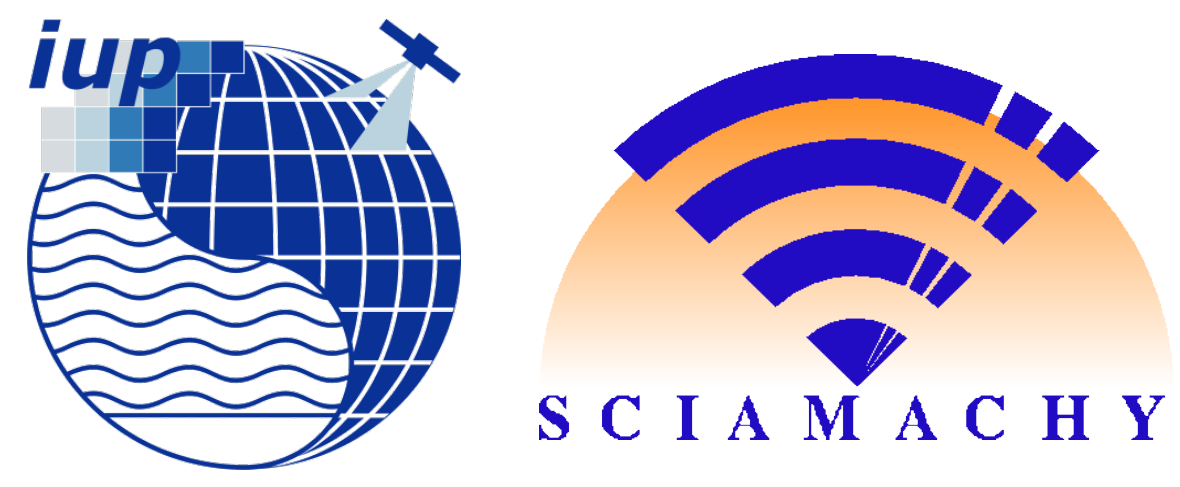


# Sonde validation of improved SCIAMACHY ozone limb data on global scale



Jia Jia, A. Rozanov, A. Ladstätter-Weissenmayer and J. P. Burrows

Institute of Environmental Physics/Remote Sensing, University of Bremen, Germany

Email: jia@iup.physik.uni-bremen.de



## 1. Introduction

SCIAMACHY limb ozone scientific data sets, namely the current V2.9 and the new V3.0, were extensively compared with ozonesonde measurements for the time period of 2003–2011, from 61 sonde stations.

The two versions use different retrieval processors (Rozanov, Wed-10:00):

- In visible spectral region
  - V2.9: reference tangent height + triplet method
  - V3.0: solar spectrum as the reference + DOAS type fit
- In the UV band
  - these however do not provide information at altitudes less than 30 km.

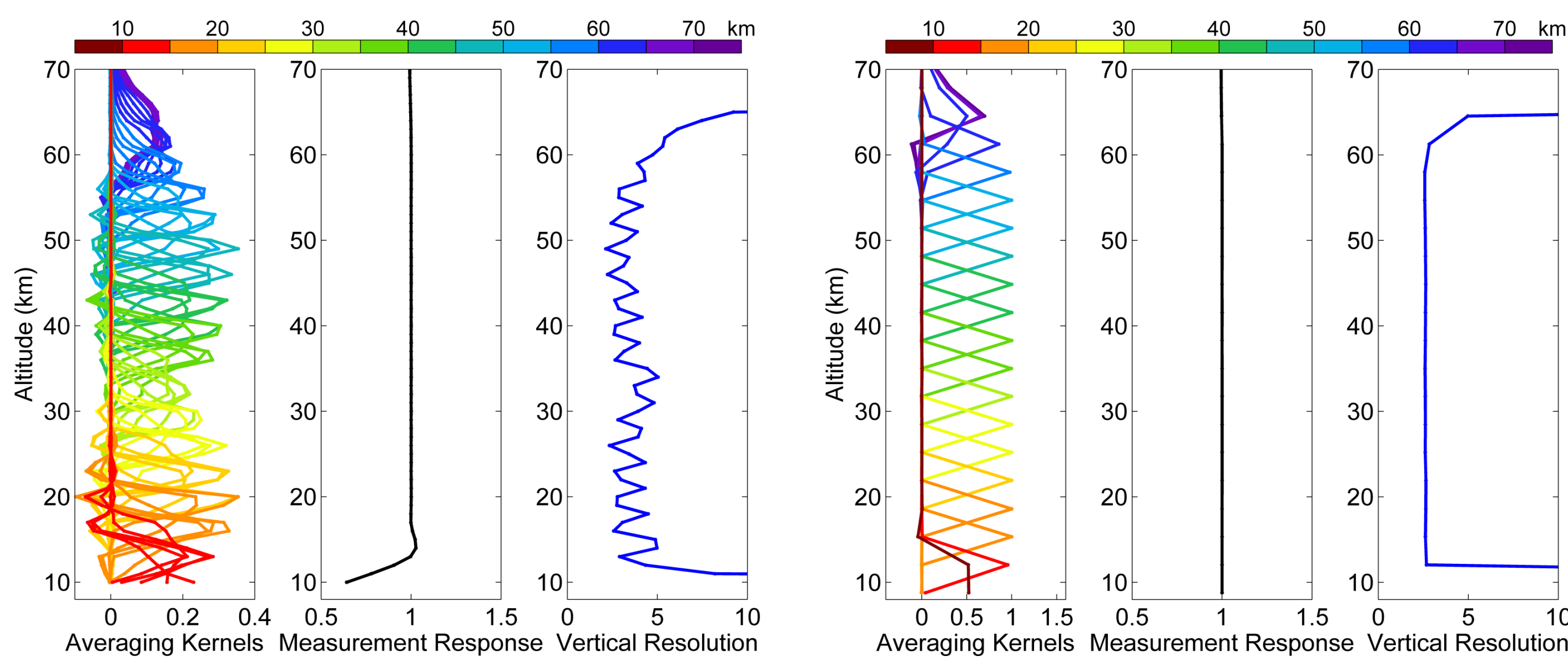


Figure 1. Averaging kernels, measurement response and vertical resolution from SCIAMACHY V2.9 (left panel) and V3.0 (right panel). Note that the x axis range is different between the two panels. The example is calculated for orbit 21223; measured at 17:36 UTC on 22 March 2006; solar zenith angle of 74.95; at 75.44° N and 93.58° W.

## 3. Partial column comparison results

Apart from vertical information, the limb partial columns are used as an important input for tropospheric ozone retrieval using the residual method. Therefore, in addition to the vertical profile comparison, the results of partial-column comparisons are presented.

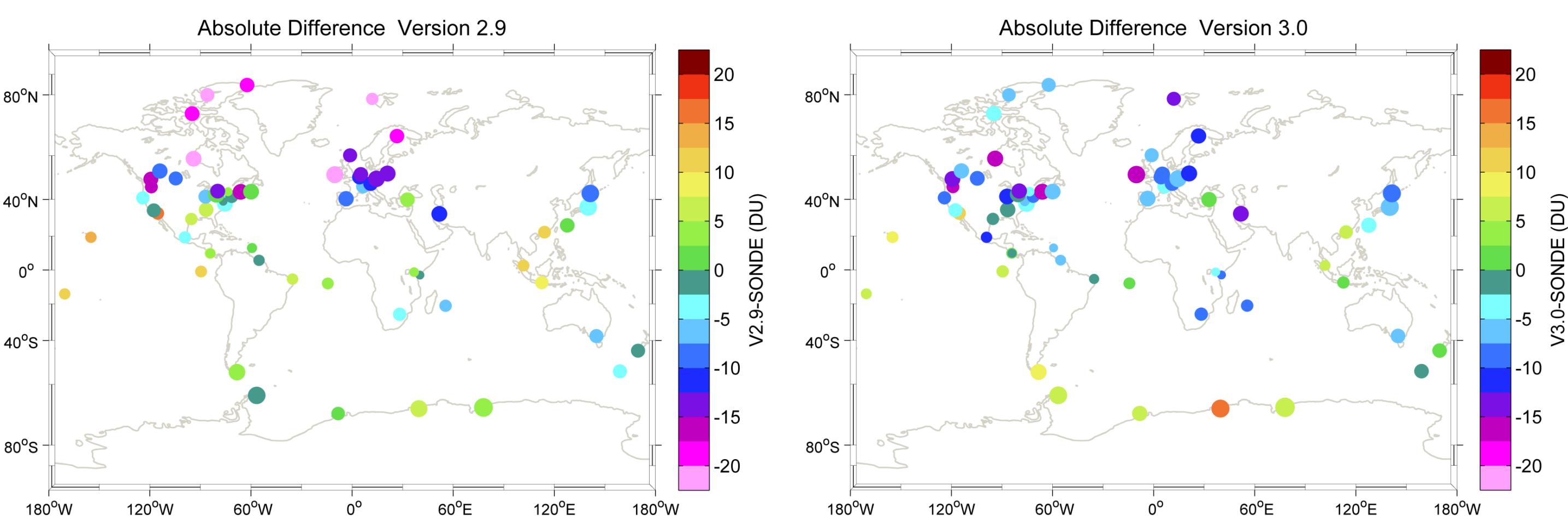


Figure 4. Comparison with all considered ozonesonde station data for the averaged daily absolute differences in partial columns over the entire time period. In each panel, the color of the dots depicts the mean difference, while the size of the dots represents 1 standard deviation.

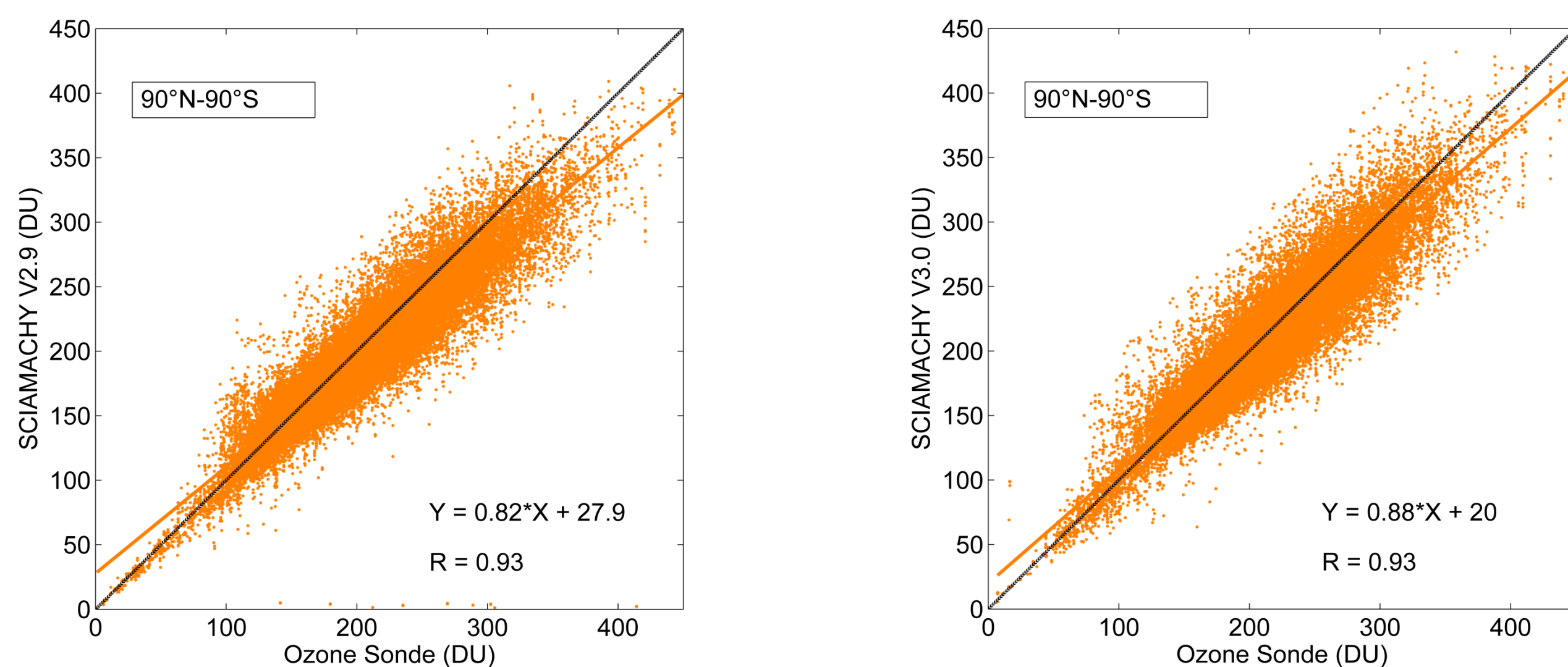


Figure 5. Scatter plots of the partial columns from SCIAMACHY and ozonesonde data.

## 5. Outlook

The Huggins band is believed to improve ozone retrieval accuracy between 30 and 45 km and will be included in the retrieval. Cloud influence on albedo will be considered for improving the retrieval at below 15 km.

## 2. Vertical profile comparison results

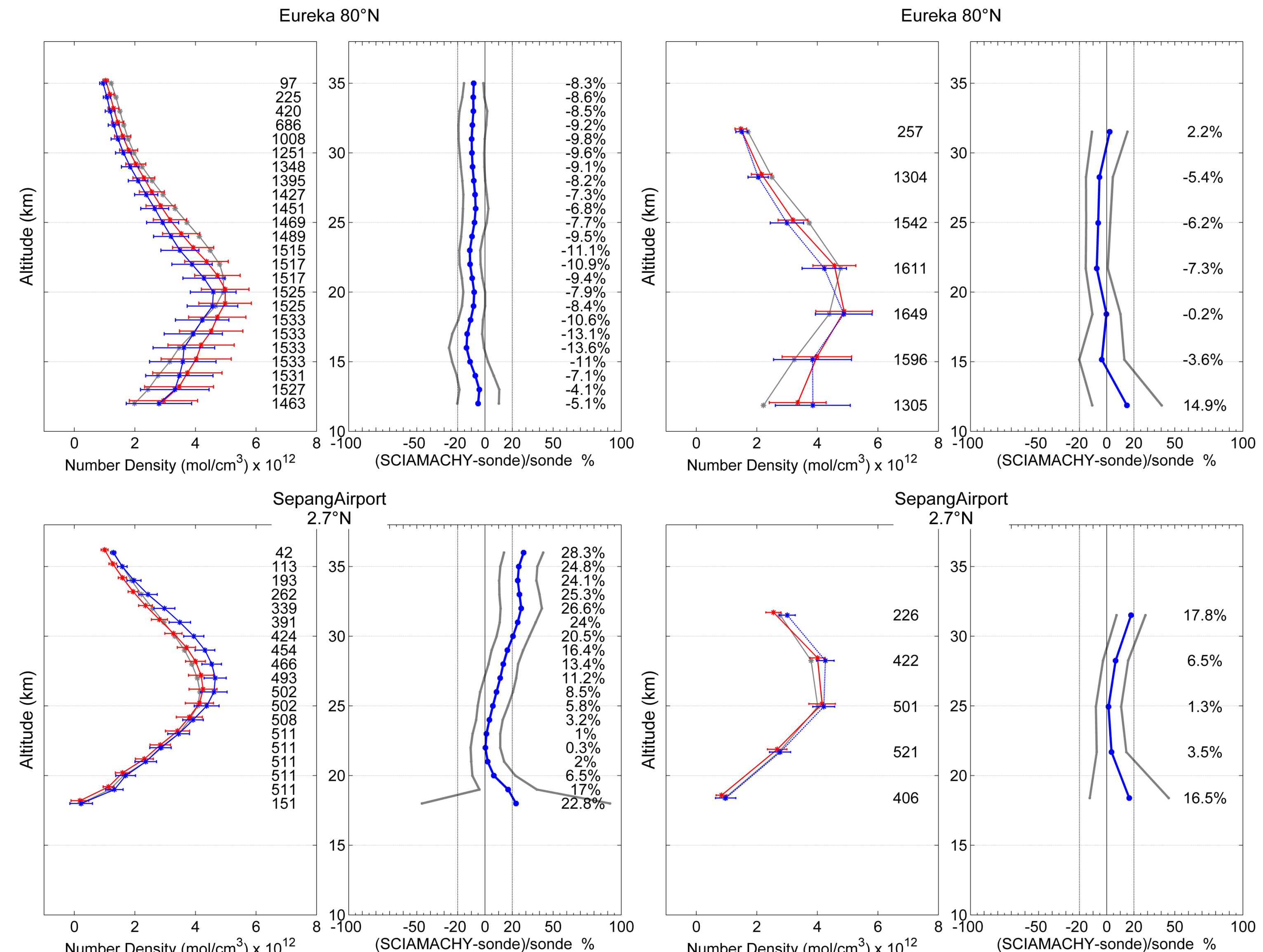


Figure 2. Vertical profile comparisons at Eureka (80.0° N, 85.9° W) and Sepang Airport (2.7° N, 101.7° E) averaged from January 2003 to December 2012. The four panels show the results for the ozone profiles for V2.9 on the left-hand side and for V3.0 on the right-hand side. In the left subpanels, the red and blue curves represent the ozone number densities with 1 standard deviations for ozonesonde and SCIAMACHY limb data, respectively. The gray lines show a priori information used in the SCIAMACHY retrieval. In the right subpanels, the blue lines represent the relative mean differences of the ozone concentrations. The gray solid lines depict 1 standard deviations. The numbers on the right denote the number of SCIAMACHY limb profiles used in the comparisons and the relative differences for each layer.

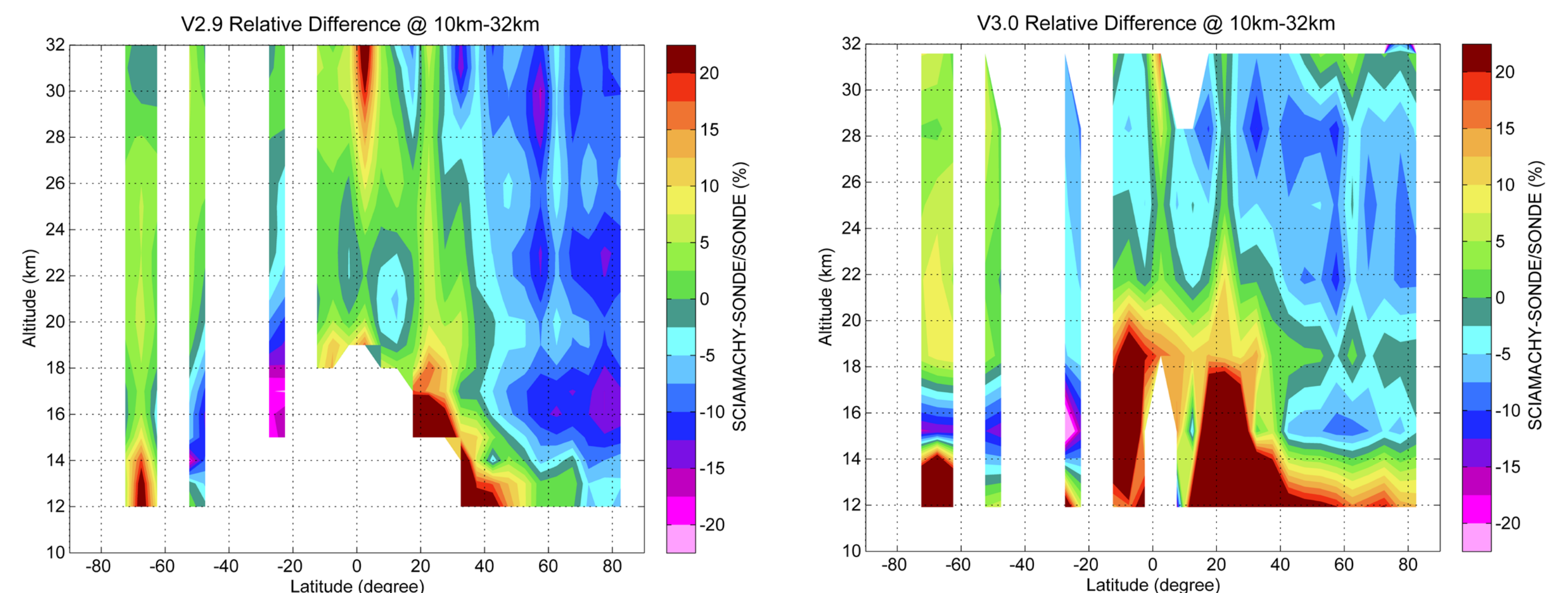


Figure 3. The altitude-versus-latitude cross section of the relative differences.

## 4. Conclusions

Compared to the ozone sonde, V2.9 has:

- < 5% (5 DU) within the latitude range of 90° S–40° N;
- Up to ~ 15% (up to over 22 DU) negative bias with observable vertical oscillations at 40° N–90° N;
- >10% (10–15 DU) overestimation at the tropic Pacific region;

Reason:

The severe underestimation over northern high latitudes is most probably caused by instrumental issues. One possible explanation is a presence of an increased external stray light when performing limb measurements at large solar zenith angles and small azimuth angles.

V3.0 has:

- Within 10% for vertical profiles and 5–10DU for partial columns northward of 40° N;
- The overestimation of the ozone profile concentrations around the tropical Pacific are eliminated;
- Slightly larger than 5% in the tropics;
- Within 10% in the southern high latitude;

