across a meridional plane in the Pacific, and an 'influence potential', the percentage of a tracer emitted from a region that enters into the boundary layer or free troposphere over the United States. These 'potentials' permit a quantification of the seasonal and inter-annual variability in transport of each regional tracer and their relative contribution to the composition of downwind air masses due to the variability of meteorology. Maximum trans-Pacific transport occurs in winter and spring. The East Asian and former Soviet Union regions have the largest transport potential across the Pacific and have the largest influence potential on the U.S. boundary layer composition while the European region is of secondary importance. East Asian and Indian tracers have the largest trans-Pacific transport potential and influence potential in the U.S. free troposphere. Transport and influence potentials are both larger in the free troposphere than in the boundary layer. Vertical subsidence over the continental U.S. is an important entry route for foreign tracers, particularly in winter. Focusing on the East Asian tracer we find that maximum transport occurs at approximately 40°N in the lower to mid-troposphere. Although significant inter-annual variability in transport exists, we find that neither the North Pacific Index nor the Southern Oscillation Index is adequate for predicting the inter-annual variability in trans-Pacific transport. However, using a combination of area weighted indices of surface pressure over the Pacific we are able to accurately predict the seasonal and inter-annual variability in trans-Pacific transport of the East Asian tracer.

A23B CC: 520 F Tuesday 1330h

Stratospheric Composition and Dynamics I

Presiding: **D F Rault,** NASA Langley Research Center**; S M Melo,** University of Toronto

A23B-01 1330h

Chemistry-Climate Modelling of Ozone Throughout the Middle Atmosphere

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To address issues associated with stratospheric ozone changes and their coupling to climate requires the use of comprehensive models that can properly represent all the relevant physical processes and interactions. The Canadian Middle Atmosphere Model (CMAM) is based on the state-of-the-art CCCma GCM, and includes a comprehensive on-line stratospheric photochemistry that is fully interactive with the radiation. Thus, CMAM is ideally suited for representing the climate coupling between troposphere and stratosphere and its interaction with stratospheric ozone changes. The model is run at T32L65 resolution, with no degradation of tropospheric resolution compared to that of the host tropospheric GCM, and with a lid at ∼95km to avoid contamination from upper boundary effects. A key requirement is to validate CMAM in terms of its ability to properly represent the key physical processes and interactions. To that end, results from multi-decade simulations will be presented and compared with observations to show the model's capability to give a comprehensive representation of the current state of the overall climate system from the surface to the mesopause region. The analysis will focus on various aspects of the general circulation and the ozone distribution, including coupled chemical-dynamical variability, and highlight the role of the ozone radiative feedback on the circulation in the polar vortex region.

A23B-02 1345h

Polar Stratospheric Cloud Properties Observed in the Arctic

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Polar stratospheric clouds (PSCs) were observed in the Arctic with an airborne lidar during the recent SAGE-III (Stratospheric Aerosol and Gas Experiment) Ozone Loss and Validation Experiments (SOLVE-I in 1999-2000 and SOLVE-II in 2003) and the earlier Airborne Arctic Stratospheric Experiment in 1989 (AASE-I). In all campaigns the airborne lidar operated from the NASA DC-8 aircraft and used multiple laser wavelengths to obtain aerosol scattering ratio (ASR) measurements at 1064, 610, and 311 nm and aerosol depolarization measurements at 610 and 1064 nm (note that in SOLVE-II the 1064 nm depolarization channel was unavailable due to additional requirements for simultaneous nadir measurements). Optical properties and spatial extent of the background stratospheric aerosols and PSCs were measured during all the campaigns with the results from the AASE-I campaign leading to the discovery of two sub-types of nitric acid trihydrate (Type-1) PSCs. The Type-1a PSCs were found to contain large solids with high depolarization, low wavelength dependence of backscattering (WDB), and low ASR, which reflects low number densities, and the Type-1b PSCs were found to contain small liquid aerosols with very low/zero depolarization, moderate WDB, and moderate ASR. Also, the ASR of the Type-1a PSCs is not much greater than the ASR of the background sulfate aerosols, particularly at 610 nm, and this will modify the average optical characteristics of the PSCs if not properly accounted for. There are similarities in the average optical characteristics of the Type-1a and 1b PSCs observed during these campaigns; however, there are many PSC observations whose properties fall in between the characteristics of the Type-1a and 1b PSCs. In situ measurements have indicated that many PSCs may be mixtures of Type-1a and Type-1b aerosols. An analysis of the airborne lidar depolarization and WDB data shows that the optical properties of these PSCs are consistent with a mixture of the Type-1a and 1b aerosols, and the relative amounts of their contribution to the average optical properties of the mixture can be estimated. Results on Type-1a, Type-1b, and Type-1a/b mixtures observed during the SOLVE campaigns are discussed and compared with results from the AASE-I campaign, and a self-consistent interpretation of the Type-1 PSC characteristics is presented.

A23B-03 1400h

The Interaction Between Chemistry and Dynamics in a Climate Model during Antarctic ozone depletion events

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The CMAM is a general circulation model with a top at ∼95 km with comprehensive on-line stratospheric chemistry. As part of the WMO report (Austin et al 2003) we have made several 20 year time slice runs for current and future atmospheric and ocean surface conditions. We have analysed these time slices scenarios with a view to characterizing the the variability of the timing and magnitude of ozone loss due to the of the Antarctica spring-summer stratospheric Vortex. We find that the dynamical influences are important and can alter the modelled ozone depletion in a significant fashion. Our analysis points to the need for a better characterization within all models of the actual wave forcing (planetary waves and gravity waves) for the time period of the climate being represented so that the model can reproduce the right vortex evolutionary character and hence ozone loss, for the right reasons. Thus, it is necessary to define scenario conditions in a more rigorous fashion in order to simulate the complex interactions between dynamics, chemistry and physics which produce particular ozone loss episodes.

A23B-04 1415h

SCIAMACHY on ENVISAT: Results From the First Years in Space.

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SCIAMACHY (Scanning Imnaging Absorption spectrometer for Atmospheric ChartograpHY) is a passive remote sensing instrument, and is a German, Dutch and Belgian contribution to the ESA-ENVISAT. The SCIAMACHY instrument comprises eight spectral channels and records spectra simultaneously from 220 to 2380 nm. SCIAMACHY makes measurements of the back scattered and reflected light coming form the atmosphere in nadir and limb viewing geometries, but also observes solar and lunar occultation at high latitudes. Inversion of the measurements of SCIAMACHY yields information about the amounts and distributions of atmospheric constituents (gases, aerosols and clouds). In this presentation, results about the mesospheric, stratospheric and tropospheric distributions of constituents will be reported. Case studies of relevance will be discussed.

URL: http://www.iup.physik.uni-bremen.de

A23B-05 1430h

Detecting ozone recovery: data, models and techniques

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Decline in total column ozone amounts has been observed over the past several decades throughout much of the world. Due to international legislation to limit the production of ozone depleting substances, we can now expect a recovery of the ozone layer. Looking for early signs of recovery requires a careful understanding of the data, the techniques available to identify a change and the magnitude and fingerprint of the changes we are expecting. All three issues will be briefly covered in this presentation. Data available for both total column and vertically resolved ozone leves will be reviewed. A distinction will be made between looking for positive trends, a change in previously negative trends and a return to unperturbed levels. Some insight into the signature of recovery is known from currently available models. Both the qualitative and quantitative features of these models will be discussed in light of recent data.

A23B-06 1445h

Interhemispheric differences in the trends of the stratospheric long-lived tracers during the last decade

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Long-lived chemical species were analyzed to investigate the temporal variations of mixing ratios in the stratosphere during 1992-2002 based on the data observed by HALOE. The characteristic features observed in the mixing ratios of CH_4, HF and H_2O are similar in the middle latitude region in the stratosphere. Those features include the annual, interannual as well as the secular trends. The trends observed in all three tracers show the same feature of the interhemispheric differences. It is implied that the reason of this difference is due to the change of the global-scale stratospheric circulation. To verify this implication the increase of the interhemispheric asymmetry was investigated by relating the long-term variations of observed tracers with the residual mean meridional circulation and the stratospheric wave activities. The interhemispheric differences shown in the tracer mixing ratio is in good agreement with the change in the residual circulation, which has been strengthening in the last decade in the Northern Hemisphere. This change of residual circulation is caused by the increase of the upward-propagating planetary waves in the Northern Hemisphere. The difference in the trends of the planetary waves between the Northern and Southern Hemispheres seems to be another feature of the global climate change.