

A91-23838 The relationship between variations in total ozone and nitrogen dioxide concentrations in the atmosphere (Vzaimosv'iaz' variatsii obshchego soderzhaniiya ozona i dvoukisi azota v atmosfere). N. E. KAMENOGRAVSKII, V. K. SEMENOV, V. P. SINIAKOV, and L. A. SPEKTOROV, *Meteorologiya i Gidrologiya* (ISSN 0130-2906), May 1990, pp. 27-32. 7 Refs.

Simultaneous observations of the total ozone and nitrogen dioxide concentrations were carried out on the northern shore of Lake Issyk Kul in 1983-1988. On the basis of these data, an analysis is made of trend, seasonal, and irregular variations in the mean monthly values. An attempt is made to relate the observed ozone and nitrogen dioxide anomalies with transport processed and zonal circulation in the stratosphere.

A91-23804 The effect of Space Shuttle and Energiia launches on the earth's ozone layer (Vliianie zapuskov raket 'Shattl' i 'Energiia' na ozonnyi sloi zemli). VALERII P. BURDAKOV, NIKOLAI F. ELANSKII, and VIACHESLAV M. FILIN, *Akademiia Nauk SSSR, Vestnik* (ISSN 0002-3442), No. 12, 1990, pp. 72-81. 13 Refs.

The character and magnitude of the effect of Space Shuttle and Buran-Energiia launches on the ozone layer are evaluated. Attention is given to the effects of a single launch and to the projected cumulative effect of regular launches. It is concluded that regular launches of the Shuttle and the Buran-Energiia over a 15-year period will lead to a 2.5-percent average reduction in the mass of stratospheric ozone in the Northern Hemisphere.

A91-23796 Aerosol characteristics in the Martian atmosphere according to data from the KRFM experiment (Kharakteristiki aerologii v atmosfere Marsa po dannym eksperimenta KRFM). V. I. MOROZ, E. V. PETROVA, L. V. KSNFOMALITI, L. ESPOZITO, ZH.-P. BIBRING et al., *Kosmicheskie Issledovaniia* (ISSN 0023-4206), Vol. 28, Nov.-Dec. 1990, pp. 936-942. 15 Refs.

Photometric limb-to-limb profiles of Mars were obtained in eight narrow bands between 320 and 550 nm with the Phobos-2 KRFM instrument. The imaginary part of the refractive index between 0.02 and 0.04 for 320 nm and less than 0.01 for 550 nm was estimated for a 'constant' dust haze with a nearly wavelength-independent optical depth of about 0.3. The absorbing properties of the material can be explained as due to basaltic rocks with a small fraction of goethite (2-3 percent). Particles with a relatively narrow size distribution with $n = 1.31$, $\kappa = 0$, and $\tau = 0.15$ can explain the bright spot above Arsia Mons.

A91-13564 Spectroscopic measurements of CO, CH₄, and N₂O contents throughout the atmosphere over the central Arctic (The SP-28 station) (Spektroskopicheskie izmereniia soderzhaniiya CO, CH₄, N₂O v tolshche atmosfery tsentral'noi Arktiki /Stantsiia SP-28/). E. I. GRECHKO and A. V. DZHOLA, *Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana* (ISSN 0002-3515), Vol. 26, May 1990, pp. 547-550. 9 Refs.

The CO, CH₄, and N₂O concentration profiles were obtained from measurements of spectroscopic absorption at 4.67, 3.3, and 3.9 microns, respectively, carried out on board the SP-28 drifting station, using models of 'synthetic' absorption spectra of the atmosphere at these wavelengths to find correlations between integral absorption and the content of gas in a vertical air column. Results of measurements indicated that, between 45 deg N and 85 deg N, the concentrations of CO remain uniform. No significant spatial or seasonal variations were found for CH₄ and N₂O.

A91-11903 Diurnal variations of the vertical profile of ozone concentration in the upper atmosphere according to radiometer measurements (Sutochnye variatsii vertikal'nogo profil'ia kontsentratsii ozona v verkhnei atmosfere po dannym radiometricheskikh izmerenii). K. IA. KONDRAT'EV, N. I. MOSKALENKO, IU. I. FEDOROV, and F. S. IAKUPOVA, *Akademiia Nauk SSSR, Doklady* (ISSN 0002-3264), Vol. 313, No. 4, 1990, pp. 840-842. 8 Refs.

Vertical profiles of ozone concentration were retrieved from measurements of spectral radiation brightness of the atmospheric ozone in the 9.6-micron band in the horizon zone. The data on diurnal variations of ozone concentration in the upper atmosphere are shown to correspond well to diurnal variations of the spectral brightness in the horizon zone and point to the necessity of taking into account diurnal variations of the ozone concentration field in studying radiative heat transfer in the middle and upper atmosphere.

A90-45072 Molecular hydrogen in the Jupiter Red Spot (Molekuliarnyi vodorod v bol'shom krasnom piate luptera). A. A. ATAI, *Astronomicheskii Vestnik* (ISSN 0320-930X), Vol. 24, Apr.-June 1990, pp. 121-126. 12 Refs.

The quadrupole hydrogen lines S(1) at 6376.76 Å in the spectra of the Jupiter Red Spot, (RS), equatorial zone (EZ), and south equatorial belt (SEB) were investigated. The H₂ pressure at the S(1) line formation level, the hydrogen content in the above-cloud atmosphere, the amount of absorbing gas along a mean free path between scattering events within the cloud layer, and the specific gas content per unit free path were determined in the framework of a two-layer model. It is shown that physical conditions in the RS, EZ, and SEB differ considerably at the depth of S(1) line formation.

A90-43006 Effect of atmospheric pollution on measurements of total ozone (Vliianie zagriazneniia atmosfery na izmerenie obshchego soderzhaniiya ozona). A. G. POPOV and T. D. ZHUKOVSKAIA, *Meteorologiya i Gidrologiya* (ISSN 0130-2906), Feb. 1990, pp. 58-64. 23 Refs.

The effects of various atmospheric gas pollutants on the measurement accuracy of total ozone by the broadband filter instruments used at USSR ozonometric stations were assessed, and the results were used to construct nomograms correlating the total ozone concentration with various concentrations of SO₂, NO₂, N₂O₂, HNO₃, and other pollutants. It was found that the increased concentrations of SO₂ and NO₂ as well as of the photochemically produced near-surface ozone can significantly affect the determination of total ozone, with errors produced by the SO₂ and NO₂ reaching levels as high as 100 and 40 percent, respectively.

A90-32666 Sulfuric acid in the Venus atmosphere according to radio-occultation data (Sernaia kislota v atmosfere Venery po dannym radioprosvechivaniia). S. S. MATIUGOV, O. I. IAKOVLEV, and V. N. GUBENKO, *Kosmicheskie Issledovaniia* (ISSN 0023-4206), Vol. 28, Mar.-Apr. 1990, pp. 277-281. 12 Refs.

An analysis is made of Pioneer-Venus and Venera 15 and 16 data on radio-wave absorption at wavelengths of 5 and 13 cm in the Venus atmosphere at heights from 40 to 70 km. It is shown that this absorption is due to sulfuric acid vapor. At 39-44 km, the sulfuric acid concentration (amounting to 37 + or - 7 ppm) is shown to depend weakly on height. At 54 to 53 km, the H₂SO₄ concentration decreases with height; at 47 km, it amounts to 20 + or - 5 ppm.

Japanese Aerospace Literature This month: Planetary Atmospheres

A92-17933 Sea-salt particles in the middle troposphere over the tropical Pacific Ocean. MIWAKO IKEGAMI, KIKUO OKADA, and YUJI ZAIZEN, *Papers in Meteorology and Geophysics* (ISSN 0031-126X), Vol. 42, March 1991, pp. 31-41. 17 Refs.

During the INSTAC-I flight tests, aerosol number-size distribution was measured in the middle troposphere at four to five km altitude from 0 deg N to 34 deg N by utilizing an optical counter. The upward transport of sea-salt particles through convective clouds is considered to be responsible for high particle concentrations in the midtropical troposphere.

A92-17930 Atmospheric CO₂ and CH₄ observed during the flight of International Strato/Tropospheric Air Chemistry I. HISAYUKI Y. INOUE, HIDEKAZU MATSUEDA, TAKASHI MIDORIKAWA, and YUKIO SUGIMURA, *Papers in Meteorology and Geophysics* (ISSN 0031-126X), Vol. 42, March 1991, pp. 3-10. 22 Refs.

Air samples were collected during the test flight of International Strato/Tropospheric Air Chemistry I from Tokyo, Japan to Biak, Indonesia in March 1989. The samples collected at four to five km were subjected to CH₄ and CO₂ measurement initially, then CO₂ was extracted to measure the carbon isotope ratio. The relationship between carbon isotope ratio and the concentration of atmospheric CO₂ shows that the high concentration over and near the Japan Islands and a hump at 13 deg N are created by the fossil fuel consumption and/or land plant respiration.

A90-24567 Equivalent widths and band intensities of CO₂. MIKIHICO HIRONO and TSUYOSHI SUDA, *Applied Optics* (ISSN 0003-6935), Vol. 29, Feb. 1, 1990, pp. 608-614. 25 Refs.

Equivalent widths of the 2.7- and 4.3-micron CO₂ bands have been measured at high pressures up to 50 atm. The line-by-line calculations for the equivalent width showed that the empirical values of Winters et al. (1964) are also applicable to the high pressure experiments for the 4.3-micron CO₂ band. Using the curve-of-growth method, the band intensities of the 5.2-, 9.4-, and 10.4-micron CO₂ bands were estimated to be 0.0199/sq cm atm STP, 0.0340/sq cm atm STP and 0.0208/sq cm atm STP, respectively.

A90-21514 Large stratospheric sudden warming in Antarctic late winter and shallow ozone hole in 1988. HIROSHI KANZAWA and SADAOKAWAGUCHI, *Geophysical Research Letters* (ISSN 0094-8276), Vol. 17, Jan. 1990, pp. 77-80. 21 Refs.

There occurred a large stratospheric sudden warming in the Southern Hemisphere in late winter of 1988 which competes in suddenness and size with major mid-winter warmings in the Northern Hemisphere. Associated with the dynamical phenomenon of the sudden warming, total ozone increased over the eastern hemispheric part of Antarctica. The sudden warming as well as other warmings which followed it made the 1988 Antarctic ozone hole shallow in depth and small in area.

A92-26873 Lidar measurements of stratospheric and tropospheric aerosols at 1064 nm using a new and low-noise photomultiplier. OSAMU UCHINO, HIDEYUKI TAKASHIMA, and ISAO TABATA, *Meteorological Society of Japan Journal* (ISSN 0026-1165), Vol. 69, Dec. 1991, pp. 709-713. Research supported by Special Coordination Funds for Promoting Science and Technology of Japan. 18 Refs.

Using a new type of photomultiplier (PMT) tube R3236 cooled to -30°C , and a photon counting method, lidar measurements of stratospheric aerosols and tropospheric aerosols above an altitude of 2.25 km were made at the fundamental wavelength of 1064 nm of a Nd:YAG laser which is sensitive to aerosol scattering. The PMT R3236 was found to be useful even for measurements of stratospheric aerosols near the background level. The average of the integrated backscattering coefficient above tropopause was $3.3 \times 10 \exp -5/\text{sr}$ at Tsukuba (36.1°N , 140.1°E) during November through December 1988. Tropospheric aerosol layers in the free atmosphere were frequently observed, and the altitude of the maximum scattering ratio of the aerosol layer varied for every measurement, compared with the stable stratospheric aerosol layer. Some tropospheric aerosol layers were confined by two inversion layers.

A92-26868 Multiple thin film method for simultaneous detection of sulfate and nitrate ions in individual particles and its application to atmospheric aerosols. GONG W. QIAN, HIROSHI TANAKA, MASAHIKO YAMATO, and YUTAKA ISHIZAKA, *Meteorological Society of Japan Journal* (ISSN 0026-1165), Vol. 69, Dec. 1991, pp. 629-640. 36 Refs.

A new thin film chemical method has been developed for the simultaneous detection of individual sulfate-containing and nitrate-containing aerosols. It is based on the reactions of the sulfate ion with barium chloride and of the nitrate ion with nitron. Multiple thin films are prepared by successive depositions of nitron and barium chloride. Both reactions of sulfate with barium chloride and of nitrate with nitron proceed in the octanol saturated atmosphere. Under this reaction condition, existence of sulfate and nitrate in individual particles is indicated by the appearance of the Liesegang rings and of a bundle of needle-like crystals, respectively. These reactions are reproducible and not interfered with carbonate and chloride ions. The method is specific for sulfate and nitrate ions and can be applied to soluble sulfate and nitrate. Examples of the method applied to atmospheric aerosols are shown. Particular interest is concerned with the observation of the mixed salt of sulfate-nitrate in the atmosphere.

A92-22682 Wind and temperature regime in Mizuho Plateau, East Antarctica. T. KIKUCHI, K. SATOW, T. OHATA, T. YAMANOCHI, and F. NISHIO, F. Selected Papers A92-22676 08-47, presented at the 5th IAMAP, Scientific Assembly, Symposium, Remote sensing in the polar regions, Reading, England, Aug. 8, 1989, *International Journal of Remote Sensing* (ISSN 0143-1161), Vol. 13, Jan. 10, 1992, pp. 67-79. 22 Refs.

Data from a ground-based study of the Antarctic plateau region are employed to assess the accuracy of remotely sensed climatological and geographical data. Snow temperatures at 10-m depths and snow-surface topologies are employed to assess annual mean temperatures and prevailing wind directions respectively. Remotely sensed data are incorporated into these data, and the results are compared to NOAA channel-5 brightness temperatures and wind data. The 12-micron NOAA-derived temperatures are found to agree with the snow temperatures, and an identifiable distinction is noted between the katabatic wind system and the system of synoptic disturbances. The ridges and the troughs of the plateau are examined, and a noticeable climatic distinction is found which relates to the different katabatic-wind effects in the two types of area.

A92-17932 Measurements of nitric oxide and ozone in the troposphere from mid-latitudes to equator. YUTAKA KONDO, YASUNOBU IWASAKA, AKIRA IWATA, TOSHIHIRO OGAWA, YUKIO SUGIMURA, and YUKIO MAKINO, *Papers in Meteorology and Geophysics* (ISSN 0031-126X), Vol. 42, March 1991, pp. 21-29. Research supported by Science and Technology Agency of Japan. 2 Refs.

Mixing ratio of nitric oxide (NO) and ozone were measured on board an aircraft over the western Pacific ocean between 7th and 10th of March, 1989. The latitude range covered was from 35°N to 1°S . NO mixing ratio at 4.5 km varied between 10 and 45 pptv at latitudes between 32° and 15°N and the average NO mixing ratio was about 20 pptv. A peak in NO mixing ratio reaching 45 pptv was encountered near 20°N during both southbound and northbound flights. The average NO mixing ratio at latitudes between 10°N and the equator was about 10 pptv. The latitudinal variation in the ozone mixing ratio was basically similar to that of NO, suggesting larger sources of NO and ozone at midlatitudes than at lower latitudes.

A90-29813 Random modulation CW lidar using new random sequence. CHIKAO NAGASAWA, MAKOTO ABO, HIDEKI YAMAMOTO, and OSAMU UCHINO, *Applied Optics* (ISSN 0003-6935), Vol. 29, April 1, 1990, pp. 1466-1470.

New modulation codes are presented for a random-modulation CW lidar. One characteristic of these modulation codes is that, for very noisy background conditions, the signal-to-noise ratio is improved by using these new sequences and is better than for the maximum-length sequence (the M-sequence) which is commonly used as the modulation code. Another characteristic of these modulation codes is that there is no correlation between them. This fact will be useful for the simultaneous multitransmitter of the differential absorption lidar. These two characteristics of the new modulation codes were confirmed experimentally.

A92-17931 Measurement of light nonmethane hydrocarbons (C₂-C₅) over the western Pacific during the INSTAC-I flight campaign (1989.3). FUMIO SAKAMAKI and HAJIME AKIMOTO, *Papers in Meteorology and Geophysics* (ISSN 0031-126X), Vol. 42, March 1991, pp. 11-19. 27 Refs.

During the INSTAC-I flight campaign in March 1989, 21 air samples were collected and 8 light nonmethane hydrocarbons were measured with an FID-gas chromatograph. The mean concentrations of the hydrocarbons measured were 1.30 ppb (ethane), 0.372 ppb (propane), 0.175 ppb (n-butane), 0.075 ppb (isobutane), 0.139 ppb (n-pentane), 0.039 ppb (iso-pentane), 0.006 ppb (neopentane), and 0.179 ppb (acetylene). All hydrocarbons showed a slight tendency to increase over the tropics. No marked difference was recognized between the samples obtained during the southbound and northbound flights. The sum of relative reactivities of these light hydrocarbons to methane was estimated to be about 26 percent of methane, which signifies that the effect of light hydrocarbons on atmospheric chemistry in the unpolluted troposphere cannot be ignored.

A92-11014 Hunting phenomena of the balloon motions observed over Antarctica. JUN ISHIMURA, Technical Papers (A92-11001 01-01) presented at the AIAA International Balloon Technology Conference, Albuquerque, NM, Oct. 8-10, 1991, Washington, DC, American Institute of Aeronautics and Astronautics, 1991, pp. 83-88. 4 Refs. (AIAA Paper 91-3667).

It was reported that strong hunting motions were observed just after reaching the ceiling altitude for the balloons launched in Antarctica in the daytime. Such hunting motions have been observed over midlatitudes only for night time launching. In this paper, the thermal analysis of the balloon motions is performed by considering the atmospheric temperature and environmental radiation conditions at balloon altitudes. It is found that the hunting phenomena in summer season are caused by the fact that the balloons over Antarctica encounter similar thermal conditions to those flights at night over the midlatitudes.

A92-10741 Nitric acid trihydrate particle formation in the polar stratosphere and its effect on nitric acid transport to the troposphere. YASUNOBU IWASAKA and MASAHIKO HAYASHI, *Journal of Geomagnetism and Geoelectricity* (ISSN 0022-1392), Vol. 43, No. 8, 1991, pp. 667-675. 17 Refs.

Growth and sedimentation of type-I polar stratospheric clouds (type-I PSCs) particles including nitric acid are examined using a numerical model. The PSCs particles which grow in the upper particle layer have a large enough size (of about 10 microns) to descend rapidly to the tropopause within several days. In the lower part of PSCs layer, evaporation of HNO₃ from particulate matter occurs and acts as source of HNO₃ vapor. From the viewpoint of stratospheric HNO₃ distribution, the particle sedimentation effectively functions as a vertical transport mechanism of HNO₃ vapor from the upper PSCs layer to the lower layer and/or to the troposphere.

A91-54410 Spectral analysis of temperature and Brunt-Vaisala frequency fluctuations observed by radiosondes. TOSHITAKA TSUDA, MASAHIRO MIZUMOTO, SUSUMU KATO, SHOICHIRO FUKAO, and THOMAS E. VANZANDT, *Journal of Geophysical Research* (ISSN 0148-0227), Vol. 96, Sept. 20, 1991, pp. 17,265-17,278. Research supported by Kokusai Denshin Denwa Co., Ltd. 13 Refs.

The characteristics of temperature fluctuations in the troposphere and lower stratosphere are studied using radiosonde observations. Model vertical wavenumber spectra are developed for the normalized temperature perturbation $T\text{-prime}/T$ and $N\text{-squared}$, and the models are compared with the mean spectra observed in the troposphere and lower stratosphere height ranges in three winter and two summer seasons. Seasonal differences in the behavior of the stratospheric spectra indicate that saturated gravity waves are dominant in the winter stratosphere, while the amplitudes of temperature fluctuations in the summer stratosphere are much smaller than predicted, suggesting that gravity waves at large scales are not necessarily saturated there. Vertical profiles of T variance integrated over vertical scales from 150 to 900 m are derived and their characteristics are interpreted in terms of the saturated gravity wave theory.

A90-47570 Seasonal variations of spectra of wind speed and air temperature in the mesoscale frequency range. HIROSHI ISHIDA, *Boundary-Layer Meteorology* (ISSN 0006-8314), Vol. 52, No. 4, Sept. 1990, pp. 335-348. 21 Refs.

Seasonal variations of wind speed spectra and air temperature have been studied in the mesoscale frequency range from 0.00013 to 0.0015 Hz based on a year of observations at a land station near the shore. Spectrograms of wind speed and air temperature in the mesoscale frequency range are characterized by peaks seen from time to time that can be attributed to the existence of short-lived mesoscale atmospheric activity with narrow frequency bands. Mesopeaks of wind speed are found in 19 percent of the total time during winter and 15-16 percent of the time in the other seasons. The mesopeaks occurred more often over land than over the ocean. Air temperature mesopeaks were found in 12 percent of the time in autumn and 16-19 percent of the time in other seasons. Mesopeaks of wind speed and air temperature were often found simultaneously. Usually wind speed and air temperature mesopeaks were highly correlated with each other, with a 90-180 deg phase difference and with air temperature leading wind speed.

A91-44411 A general circulation model study of the solar and QBO modulation of the stratospheric circulation during the Northern Hemisphere winter. KUNIHICO KODERA, MASARU CHIBA, and KIY-OTAKA SHIBATA, *Geophysical Research Letters* (ISSN 0094-8276), Vol. 18, July 1991, pp. 1209-1212. 11 Refs.

A general circulation model has been used to study the modulation of north-polar temperatures during winter by both solar activity and the equatorial quasi-biennial oscillation (QBO). The variation of solar activity was simulated by changing the heating rate due to the absorption of UV radiation by ozone, while the QBO zonal wind fields were reproduced by incorporating zonal-momentum sources in the equatorial stratosphere. A total of 10 experiments were conducted by changing the heating rate from 70 to 110 percent for each of the simulated QBO easterly and westerly cases. The results of the numerical experiments show modulation effects similar to those found by Labitzke (1987) in the 30-mb temperatures at the North Pole.

A91-43766 Kelvin waves near the equatorial stratopause as seen in SBUV ozone data. ISAMU HIROTA, MASATO SHIOTANI, TAKAHIRO SAKURAI, and JOHN C. GILLE, *Meteorological Society of Japan Journal* (ISSN 0026-1165), Vol. 69, April 1991, pp. 179-186. Research supported by MOESC and Institute of Space and Astronautical Science. 23 Refs.

Data on ozone mixing ratios derived for the time period 1979-1986 from measurements of the solar backscatter UV instrument on board Nimbus-7 were used to investigate space-time variations of atmospheric ozone in the equatorial middle atmosphere during this period. Evidence is presented for the appearance of equatorially trapped 'ozone Kelvin waves' above the 10-mb level, having a zonal wavenumber-one component and an eastward migration period of about 7 days. It is shown that Kelvin wave amplitudes are closely related to the semiannual oscillation of the zonal mean wind around the stratopause level.

A91-39872 Mobile lidar for simultaneous measurements of ozone, aerosols, and temperature in the stratosphere. OSAMU UCHINO and ISAO TABATA, *Applied Optics* (ISSN 0003-6935), Vol. 30, May 20, 1991, pp. 2005-2012. 26 Refs.

A Meteorological Research Institute Mark II mobile lidar was developed for simultaneous measurements of ozone, temperature, and aerosols in the stratosphere. The lidar consists of an XeCl laser, a Nd:YAG laser, and an 80-cm diam receiving telescope. The laser beams at three wavelengths (308, 355, and 532 nm) can be almost simultaneously transmitted. The purpose of this lidar is to study, for example, the aerosol impact on the ozone layer through radiative and photochemical processes, the aerosol impact on the Umkehr measurements after violent volcanic eruptions, and the interaction between temperature and ozone. The performance of the lidar system and some data about ozone, aerosols, and temperature are described.

A91-34249 Particulate fluxes of carbonate and organic carbon in the ocean. Is the marine biological activity working as a sink of the atmospheric carbon? SHIZUO TSUNOGAI and SHINICHIRO NORIKI, *Proceedings of the 3rd International Conference on Analysis and Evaluation of Atmospheric CO₂ Data, Present and Past*, (Vol. 43B), Hinterzarten, Federal Republic of Germany, Oct. 16-20, 1989, A91-34232 13-46, *Tellus, Series B—Chemical and Physical Meteorology* (ISSN 0280-6509), April 1991, pp. 256-266. MOESC-supported research. 48 Refs.

The particulate fluxes of carbonate carbon and organic carbon observed in various oceans have been summarized in this paper and discussed with special reference to the fate of the atmospheric carbon dioxide. The organic carbon fluxes, which act as a sink of atmospheric carbon dioxide, are generally larger than the carbonate carbon fluxes working as a source, but are comparable in the deep subtropical oceans. The areal and vertical variations of the carbonate carbon fluxes are much smaller than those of the organic carbon fluxes, indicating that organisms producing carbonate particles exist rather evenly in the world ocean and that a substantial part of carbonate produced is transported to the ocean bottom. The particulate fluxes are much larger in the coastal and hemipelagic seas. Although the productivity of shallow seas holds a key role in the fate of anthropogenic carbon, the marine biota may not be a large sink when longer time scales are considered. The carbonate carbon fluxes in the productive northern Pacific are larger in the northeast Pacific than in the northwest Pacific, reflecting a difference in the ecosystems. This suggests that the eutrophication of marine environments may not necessarily act as a sink for the atmospheric carbon dioxide.

A91-34238 The concentration of atmospheric carbon dioxide at the Japanese Antarctic station, Syowa. T. NAKAZAWA, S. MURAYAMA, S. AOKI, T. YAMANOCHI, M. FUKABORI et al., *Proceedings of the 3rd International Conference on Analysis and Evaluation of Atmospheric CO₂ Data, Present and Past*, (Vol. 43B), Hinterzarten, Federal Republic of Germany, Oct. 16-20, 1989, A91-34232 13-46, *Tellus, Series B—Chemical and Physical Meteorology* (ISSN 0280-6509), April 1991, pp. 126-135. 23 Refs.

Precise and continuous measurements of the atmospheric CO₂ concentration have been made at Syowa Station, Antarctica since February 1984. The diurnal CO₂ variation was hardly observable throughout the year. The secular CO₂ trend was variable with time, showing slow increase in 1984, 1986 and 1988 and rapid increase in 1985 and 1987. The annual CO₂ increase was especially large in 1987, which may be related to the 1986/1987 ENSO event. The average rate of annual CO₂ increase over the last 5 years was about 1.6 ppmv/yr.

A91-36967 Two different stages in polar stratospheric cloud events - Lidar backscatter of particulate matter and temperature in the Antarctic stratosphere. YASUNOBU IWASAKA and MASAHICO HAYASHI, *Meteorological Society of Japan Journal* (ISSN 0026-1165), Vol. 69, Jan. 1991, pp. 71-81. 37 Refs.

A lidar was utilized to observe two distinct aerosols during polar stratospheric clouds (PSCs) events in Antarctica. The two aerosols are analyzed theoretically by means of a thermodynamical consideration of particle forms in the Antarctic winter stratosphere. The aerosols are suggested to be nitric acid trihydrated (NAT) crystal, which is dominant in the early stage of a PSC event, and ice crystals, the major component in the fully developed stage of the PSCs. An ice crystal particle layer was discovered at times in the lower layer of the PSCs; it is suggested that this is due to water vapor influx from the troposphere, and the ice particles do not exhibit characteristics of nucleation on the NAT particles. In fully developed PSCs, the PSC particles could form in an expanded region which approached the tropopause. It is proposed that active particle descent from the stratosphere to the troposphere, which sinks stratospheric particulate matter, causes denitrification of the stratosphere. This is theorized to be an important process for disturbing Antarctic ozone.

A91-34236 Temporal and spatial variations of upper tropospheric and lower stratospheric carbon dioxide. TAKAKIYO NAKAZAWA, KOHJI MIYASHITA, SHUJI AOKI, and MASAYUKI TANAKA, *Proceedings of the 3rd International Conference on Analysis and Evaluation of Atmospheric CO₂ Data, Present and Past*, (Vol. 43B), Hinterzarten, Federal Republic of Germany, Oct. 16-20, 1989, A91-34232 13-46, *Tellus, Series B—Chemical and Physical Meteorology* (ISSN 0280-6509), April 1991, pp. 106-117. MOESC-supported research. 37 Refs.

Systematic collection of air samples was made using commercial jet airliners between Tokyo, Japan and Anchorage, Alaska and between Tokyo and Sydney, Australia in 1984 and 1985. The amplitude of the seasonal CO₂ cycle in the upper troposphere was found to be largest in high latitudes of the Northern Hemisphere but decreased and lagged in phase as the equator was approached. The cycle was still clearly observable in the Southern Hemisphere, due to southward transport of the Northern Hemispheric air through the upper troposphere by a monsoon circulation.

A91-17702 Rocket measurements of O₂ atmospheric (0-0) and OH Meinel bands in the night airglow. MOTOHARU TAKANO, TAKASHI WATANABE, and MASATOSHI NAKAMURA, *Journal of Geomagnetism and Geolectricity* (ISSN 0022-1392), Vol. 42, No. 10, 1990, pp. 1193-1208. 29 Refs.

O₂(0-0) atmospheric and OH Meinel bands in the night airglow have been simultaneously measured using multicolor rocketborne photometers in midlatitude. Atomic oxygen densities have been deduced from O₂ airglow intensity profiles, and the direct and two-step excitation mechanisms for the O₂ airglow have been examined. The obtained atomic oxygen densities agree with in situ measurements. The altitude profiles of the observed OH(8-3), (7-3), and (6-2) bands are reproduced by calculation using calculated atomic oxygen density profiles. It is clearly demonstrated that time-to-time variations of the altitude profile of atomic oxygen are basically important for the change of the OH altitude profile. The quenching rate of OH by O has been estimated to be small, with a best-fitted value of 5.1×10 to the -12 th cu cm/sec.

A91-10828 Echo power loss with RASS (radio acoustic sounding system) due to defocusing effects by distorted acoustic wave front. Y. MASUDA, J. AWAKA, K. OKAMOTO, T. TSUDA, S. FUKAO et al., *Radio Science* (ISSN 0048-6604), Vol. 25, Sept.-Oct. 1990, pp. 975-981. 8 Refs.

The intensity of RASS (radio acoustic sounding system) echoes scattered by refractive index fluctuations produced by acoustic waves was calculated. Because of temperature changes in the atmosphere, the sound speed decreases in the troposphere and the shape of the acoustic wave front becomes elliptical. When the shape of acoustic wave fronts is significantly distorted from that of a sphere, the backscattered radio wave does not focus on the radar. Consequently, the spot size of the RASS echo becomes large, and the peak intensity of the RASS echoes decreases. The echo power loss due to defocusing effects was estimated for an atmosphere whose sound speed decreased linearly with altitude. The loss was found to be a function of the range, radar beam width, radar wavelength, and degree of distortion of the acoustic wave front.

A90-42375 Laser heterodyne spectrometer using a liquid nitrogen cooled tunable diode laser for remote measurements of atmospheric O₃ and N₂O. H. FUKUNISHI, S. OKANO, M. TAGUCHI, and T. OHNUMA, *Applied Optics* (ISSN 0003-6935), Vol. 29, June 20, 1990, pp. 2722-2728. 14 Refs.

A laser heterodyne spectrometer with a tunable diode laser as a local oscillator has been developed for ultrahigh resolution IR spectroscopy of the absorption spectra of trace constituents in the earth's atmosphere. The spectral resolution and SNR of the developed system are 0.0013/cm and about 500, respectively. This performance is sufficient for retrieving the altitude profile of atmospheric O₃ through an inversion method. The altitude profile of atmospheric N₂O has been also obtained for the first time with this laser heterodyne technique. The high resolution and high SNR have been accomplished by adopting a tunable diode laser which operates at liquid nitrogen temperature and by developing an effective technique to eliminate the optical feedback of the local oscillator laser beam.