Appendix 2. Inventory of Level-2 Data of continuously monitored variables and automatically filtered bottle samples (B&F). B&F* denotes insufficient data quality.

Departure Port and Date Pusan	Kobe	Level-2 Data File Name	Bottle & Filter Sampling	Manned Investigation
< 91/Mar/25			B&F*	Plankton Taxon., LPC
91/Mar/27 >			B&F*	Plankton Taxon., LPC
**********		Reconfiguration of the system		
< 91/Jun/16			B&F*	Plankton Taxon., LPC
91/Jun/18 >			B&F*	Plankton Taxon., LPC
< 91/Jun/21		JK910621.DAT		
91/Jun/22 >		JK910622.DAT		
< 91/Jun/24		JK910624.DAT		
91/Jun/26 >		JK910626.DAT		
< 91/Jun/28		JK910628.DAT		
91/Jun/29 >		JK910629.DAT		
< 91/Jul/01		JK910701.DAT		
91/Jul/03 >		JK910703.DAT	B&F	
< 91/Jul/05		JK910705.DAT		
91/Jul/06 >		JK910706.DAT		
< 91/Jul/07		JK910707.DAT		
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91/Jul/13 >		JK910713.DAT		
< 91/Jul/15		JK910715.DAT		
91/Jul/17 >		JK910717.DAT	B&F	
< 91/Jul/19		JK910719.DAT		
91/Jul/20 >		JK910720.DAT		
**********		Malfunction of data recorder		
< 91/Aug/05		JK910805.DAT		
91/Aug/07 >		JK910807.DAT		
< 91/Aug/09		JK910809.DAT		
91/Aug/10 >		JK910810.DAT		
< 91/Aug/12		JK910812.DAT		
91/Aug/14 ->		JK910814.DAT	B&F	
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91/Aug/17 >		JK910817.DAT		
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< 91/Aug/23		JK910823.DAT		

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91/Aug/24 >             JK910824.DAT
         < 91/Aug/26    JK910826.DAT       Manned Investigation for System Check
91/Aug/28 >             JK910828.DAT  B&F  Manned Investigation for System Check
         < 91/Aug/30    JK910830.DAT       Calibration method was changed
91/Aug/31 >             JK910831.DAT
         < 91/Sep/02    JK910902.DAT
91/Sep/04 >             JK910904.DAT
         < 91/Sep/06    JK910906.DAT
91/Sep/07 >             JK910907.DAT
         < 91/Sep/09    JK910909.DAT
91/Sep/11 >             JK910911.DAT
********************    Cruise canceled due to typhoon storm
         < 91/Sep/16    JK910916.DAT
91/Sep/18 >             JK910918.DAT
         < 91/Sep/20    JK910920.DAT
91/Sep/21 >             JK910921.DAT
         < 91/Sep/23    JK910923.DAT
91/Sep/25 >             JK910925.DAT
********************    Cruise canceled due to typhoon storm
         < 91/Sep/30    JK910930.DAT
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         < 91/Oct/11    JK911011.DAT
91/Oct/12 >             JK911012.DAT
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         < 91/Oct/18    JK911018.DAT
91/Oct/19 >             JK911019.DAT
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91/Oct/23 >             JK911023.DAT
         < 91/Oct/25    JK911025.DAT
91/Oct/26 >             JK911026.DAT
         < 91/Oct/28    JK911028.DAT
91/Oct/30 >             JK911030.DAT  B&F

********************    Malfunction of the system

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          < 91/Nov/29    JK911129.DAT
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          < 91/Dec/02    JK911202.DAT  B&F       Plankton Taxon., LPC
91/Dec/04 >              JK911204.DAT  B&F       Plankton Taxon., LPC
          < 91/Dec/06    JK911206.DAT
*******************Anchoring at Kanmon Strait due to an obstacle on the route
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          < 92/Feb/07    JK920207.DAT
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          < 92/Feb/10    JK920210.DAT  Malfunction of fluorometer
92/Feb/12 >              JK920212.DAT
          < 92/Feb/14    JK920214.DAT
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92/Feb/22 >		JK920222.DAT			
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92/Feb/26 >		JK920226.DAT	B&F		
**********		Yearly Docking			
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93/Jan/30 >                JK930130.DAT
          < 93/Feb/01      JK930201.DAT   B&F  Manned Investigation
                                           pCO2, LPC, Plankton Taxon.

********************Transfer of the Monitoring Program to two other ferry lines

Beppu(Kyushu) Osaka
          < 94/Feb/01          Ship:'Sunflower2'

Naha(Okinawa) Osaka
          < 94/Mar/11          Ship:'Ferry Kuroshio'
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Global Environmental Monitoring Programme

The Center for Global Environmental Research (CGER), an organ of the Environment Agency of Japan, was established in October 1990 to contribute to the scientific understanding of global change. One of the functions of the center is to generate monitoring data on a long term basis. In addition, CGER makes its data available to interested parties both directly through the publication of data reports and also by inclusion of our data into international data networks. The following ten projects are presently being coordinated by the center.

1. Atmosphere monitoring stations in Japan (Hateruma and Cape Ochi-ishi)

The potential for global warming due to the increasing atmospheric concentrations of greenhouse gases (GHGs) such as carbon dioxide (CO_2), methane (CH_4), chlorofluorocarbons (CFCs), and nitrous oxide (N_2O) is of great concern. The GHGs are continuously monitored to determine the trends in background concentrations in Japan. Hateruma Island in Okinawa is the southern-most inhabited island in Japan. Concentration data for atmospheric gases sampled at Monitoring Station -Hateruma- should be representative of background conditions in the southern Japan region. The continuous monitoring of GHGs at Hateruma Island commenced in Oct 1993 although it remains in the test stage. To obtain atmospheric background data for the northern region of Japan, a monitoring station was constructed at Cape Ochi-ichi, Hokkaido in June 1994. The data collected at both stations will be submitted to the Background Air Pollution Monitoring Network (BAPMoN) and the Carbon Dioxide Information Analysis Center (CDIAC).

2. Ozone Monitoring (Ozone Laser Radar)

Over a past decade, a significant decrease in total column ozone has been observed in both hemispheres. However, the change in vertical profiles of ozone has not been well determined. We are measuring the vertical profile of ozone in the stratosphere above Tsukuba with lidar. This instrument was installed in 1988 and routine monitoring of the ozone layer commenced in October 1990. These measurements have been made more than 50 days each year under usual weather conditions and the data will be submitted to the international Network for the Detection of Stratospheric Change (NDSC).

A millimeter-wave radiometer is being developed to measure ozone profiles more frequently to higher altitude.

3. Monitoring of GHGs in Siberian Wetlands by Chartered Airplane

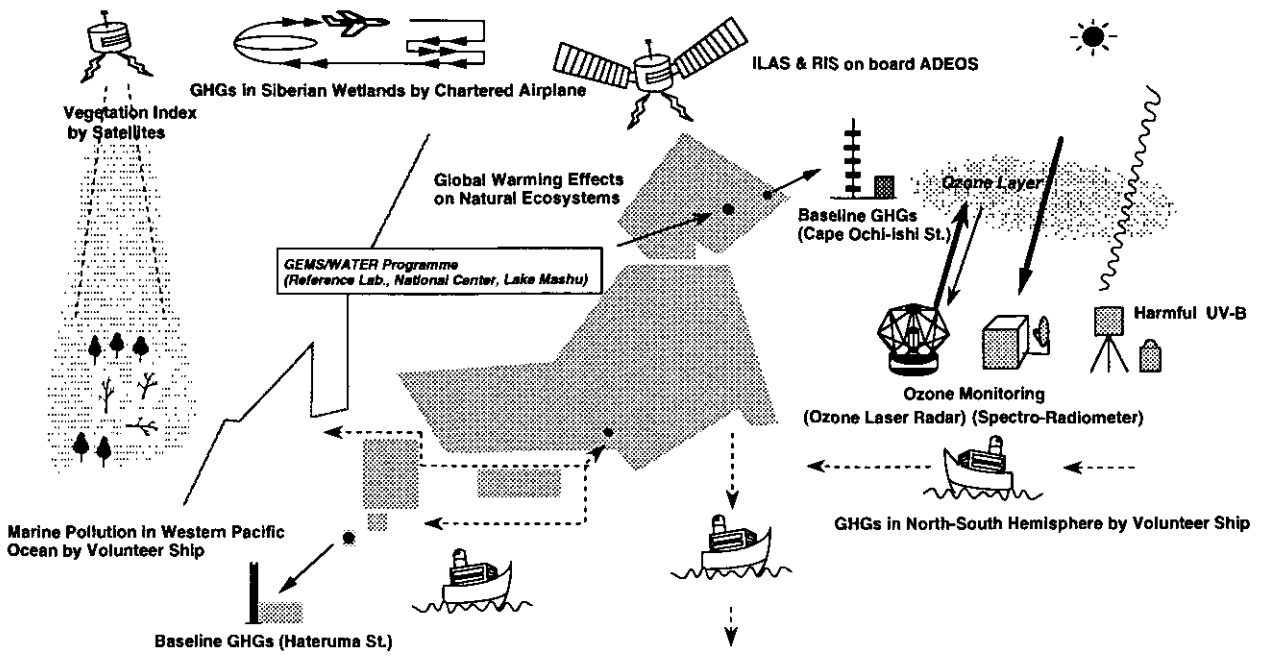
Large portions of the frozen Siberian wetlands are now or may soon be melting due to both rapid development and atmospheric warming. Will a large amount of methane be released from melting wetlands, thereby accelerating the global warming problem further? We are using an airplane to evaluate the methane flux from Siberian wetlands as a part of cooperative research projects between Russia and Japan. Aircraft can sample broad areas quickly and thus have some unique advantages for environmental monitoring. This sampling will be conducted every summer for three years (1992-1994).

4. High Temporal-Spatial Resolution Biogeochemical Monitoring of Western Pacific by Volunteer Ships

The cycles of elements such as C, N, and P have been perturbed from the pre-industrial or pre-agricultural conditions. These perturbations are thought to have impacted the ocean through the areas called marginal seas. A monitoring system was developed using the continuous intake of the ferry boat and deployed on the ferry line between Pusan, Korea and Kobe, Japan (June, 1991 - February, 1993) as a cooperative program between NIES and KORDI (Korea Ocean Research & Development Institute). Since March, 1994, the project has been shifted to the two other ferry lines (Line A. Osaka - Kuroshio - Okinawa; Line B. Osaka - Seto Inland Sea - Kyushu). The frequency of cruises of A. and B. are one round-trip per week and daily, respectively. In both lines, water temperature, salinity, pH, and fluorometeric chlorophyll-a are monitored at every 10 seconds. (equivalent to around 100 m in distance). On Line B., dissolved Si, PO_4-P, NH_4-N, NO_2-N, NO_3-N and chlorophyll-a and pheopigments in particulate matters are measured by the automated filtration sampling apparatus for every other week. The data are archived in CD-ROM and will be offered to the World Data Center (WDC) through the Japan Ocean Data Center (JODC).

5. Monitoring of the atmosphere-ocean carbon dioxide exchange rate by Volunteer Ship

Despite active study, the global carbon budget can not yet be balanced. One of the most important sinks for atmospheric carbon dioxide is invasion from the atmosphere to the ocean, and this process plays an important role in the regulation of the global carbon cycle. An estimate of the net rate of carbon dioxide air-sea gas exchange can be calculated from measurements of the partial pressures of CO_2 in air and surface seawater. An instrument will be installed on a cargo vessel in 1994 to automatically measure the carbon dioxide partial pressures while sailing between Japan and Canada. This project will help define the magnitude of the net oceanic carbon dioxide sink as well as the temporal and spatial variations in CO_2 distribution in the North Pacific.



The Global Environmental Monitoring Programme by NIES/CGER

Center for Global Environmental Research

6. Monitoring of GHGs in North-South Hemisphere by Volunteer Ship

It is possible to routinely sample air along a north-south transect from a freighter (the NYK Line) which makes frequent crossings between Japan and Australia. Such samples are now being gathered and sent to a laboratory for high precision determination of greenhouse gases such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). The resulting data will be useful in general circulation models. This freighter will also be used as a platform for monitoring the carbon dioxide partial pressures in air and surface seawater following the completion of project No. 5.

7. Monitoring of Harmful UV-B

The increase in ultra-violet-B (UV-B) solar irradiation resulting from stratospheric ozone depletion may damage human health. However, quantitative measurements of UV-B in a large city have not previously been carried out. We will install a Brewer Spectrometer at the top of a building in Tokyo. UV-B spectra will be recorded hourly from 4 a.m. to 7 p.m. every day. More than ten years of monitoring will be conducted to reveal the trend in urban UV-B irradiance.

8. GEMS/WATER Programme (Reference Lab., National Center, Lake Mashu)

High quality fresh water is essential to maintenance of human health. Water quality is also an indicator of environmental change. However, water quality management is rather heterogeneous. Therefore, a strong global network is indispensable to efforts to improve the consistency of global water quality monitoring. GEMS/WATER, jointly organized under the United Nations Environment Programme (UNEP) and the World Health Organization (WHO), is such a network. A network of 20 stations in Japan has been established for phase two of GEMS/WATER. In particular, Lake Mashu with more than 30 meter of transparency in secchi disk reading has been registered as a base line station. CGER of NIES has assumed the responsibilities as Japanese national centre (forcal point) for coodinating data, transmission etc. CGER also participate in an AQC programme by providing certified reference materials (CRMs) of river sediments for laboratories with global flux stations.

9.Vegetation Index by Satellite

The rapid destruction of tropical forests in South-East Asia and elsewhere is a serious problem. Our vegetation index project uses data from the NOAA satellite to produce 1 km resolution vegetation maps of the South-East Asia region twice yearly (winter and summer). The resulting maps will be distributed throughout the world by the UNEP/GRID - Tsukuba center, a CGER unit.

10. ILAS & RIS on board ADEOS

The National Space Development Agency of Japan (NASDA) is scheduled to launch the "Advanced Earth Observing Satellite (ADEOS)" in early 1996. The Environment Agency of Japan is developing two instruments for this mission. The Improved Limb Atmospheric Spectrometer (ILAS) will detect solar infrared radiation absorption in the earth's atmospheric layers. From this data, vertical profiles of ozone and related species in the stratosphere will be calculated for both north and south polar regions twenty-eight times a day. The second instrument is the Retroreflector In Space (RIS), which will reflect laser light from a ground station back to earth. The reflected light will be detected in Tokyo, providing once daily vertical profiles of ozone and related species in the air above the city when the satellite overpasses the region visible from the ground station. The data obtained using both instruments will be processed and disseminated to interested parties by the center.