

MEASUREMENTS OF CARBON DIOXIDE PARTIAL
PRESSURE IN THE AIR AND SURFACE SEA
WATER ON BOARD THE ICEBREAKER
"SHIRASE" (ABSTRACT)

Gen HASHIDA¹, Takakiyo NAKAZAWA¹, Shohei MURAYAMA¹,
Masayuki TANAKA¹, Shuhji AOKI²,
Takashi YAMANOUCHI² and Sadao KAWAGUCHI²

¹*Upper Atmosphere and Space Research Laboratory, Faculty of Science,
Tohoku University, Aramaki Aoba, Aoba-ku, Sendai 980*

²*National Institute of Polar Research, 9-10, Kaga 1-chome,
Itabashi-ku, Tokyo 173*

Continuous measurements of the CO₂ partial pressure in the air and surface sea water were made on board the icebreaker "SHIRASE" between Japan and Antarctica for the periods from November 1987 to April 1988 and from November 1988 to May 1989. The atmospheric CO₂ concentration was high in the mid-northern hemisphere, decreased rapidly southward to a minimum in the mid-southern hemisphere, and increased slightly in the Antarctic region. Irregular variations of the CO₂ concentration were clearly observable, especially in the mid-northern hemisphere, mainly due to alternation and mixing of the continental and maritime air. The CO₂ partial pressure in surface seawater (pCO₂) showed high values in the equatorial region, decreased poleward, and increased again in the Antarctic region. By comparing pCO₂ with the salinity and surface sea temperature measured concurrently, it was found that pCO₂ variations were closely related to upwelling of the deep seawater which is rich in CO₂. The difference of the CO₂ partial pressure between the air and surface seawater ($\Delta p\text{CO}_2$) showed negative values in mid-latitudes of both hemispheres and positive values in the equatorial region. This fact implies that the mid-latitude and equatorial oceans act as a sink and source for atmospheric CO₂, respectively. The Antarctic Ocean was generally a source, but $\Delta p\text{CO}_2$ was highly variable there, due to local ocean conditions.

(Received November 6, 1989; Revised manuscript received April 11, 1990)

RADIATION BUDGET OBSERVATION AT ASUKA CAMP,
ANTARCTICA, IN 1988
—CLOUD RADIATIVE FORCING—(ABSTRACT)

Teruo AOKI¹ and Takashi YAMANOUCHI²

¹*Meteorological Research Institute, 1-1, Nagamine, Tsukuba 305*

²*National Institute of Polar Research, 9-10, Kaga 1-chome,
Itabashi-ku, Tokyo 173*

Upward and downward radiation on the snow surface were observed at Asuka Camp (72°31'S, 24°08'E, 930 m a.s.l.), Antarctica, from January to December 1988. We have studied the effect of clouds on the surface radiation budget and have found that the long wave (LW) greenhouse effect of clouds exceeded the short wave (SW) albedo effect of clouds, so that net (SW+LW) cloud-radiative forcing on the snow surface was heating. The heating mechanism is explained