DOE/ER/62600-1

FINAL REPORT ON THE PROJECT: " DIAGNOSTIC STUDIES OF CLIMATIC VARIATIONS IN MODELS AND IN OBSERVATIONS "

DOE ID No: DEFG0298ER62600

The work completed under this project falls in two areas related to climate change:

(1) We showed that that secular changes in the strengths of three semi-permanent atmospheric pressure systems, the North Pacific High, the Icelandic Low, and the Azores high, are related to secular changes in global climate, that is, changes in the globally averaged surface temperature. The strengths of all three systems diminish with increasing temperatures. It was also found that the climate induced change in cloud cover for certain regions are related in the strengths of adjacent atmospheric pressure systems, and plausible physical explanations exist for the three regions that have been studied. This suggests that the regional climate change at certain locations might be related to the atmospheric pressure systems, and given the importance of understanding regional climate change, it would seem that the role of the major atmospheric high and low pressure systems should be studied further. These results are reported in the following paper:
Croke, M.S., R.D. Cess and S. Hameed, 1999, Regional Cloud Cover Change Associated with Global Climate Change: Case Studies for Three Regions of the United States, Journal of Climate, 12, 2128-2134.

(2) There is considerable interest in understanding the influence of climate on the biosphere, and there is increasing evidence that zooplankton interannual variability is related to changes in climate variables. We analyzed the interannual variations of zooplankton biomass and two climate related variables, the sea surface temperature and surface salinity at Station P in the Gulf of Alaska (50N, 145W). This 1956-1980 data set was gathered by Canadian weather ships with a frequency of approximately one month. Spectral analysis shows that most of the interannual variability in all three properties is contained in frequency bands corresponding to periods near 12-24 years, near 6 years, near 29 months, and near 14 months. These frequencies correspond to those found in well known oscillations of the atmosphere-ocean system, and the results illustrate that coupling between climate and marine ecosystem of the Gulf of Alaska occurs in these frequency bands. These results are reported in the paper:
Conversi, A. and S. Hameed, 1998, Common Signals between physical and atmospheric variables and zooplankton biomass in the Sub arctic Pacific, ICES Journal of Marine Sciences, 55, 739-747.

In another study of the influence of climate on marine biology, we examined changes in the zooplankton species *Calanus finmarchicus* in the Gulf of Maine over a 30-year period. Three major components of temporal dynamics were analyzed: seasonal, interannual and interdacadal variability. Seasonal cycles of *Calanus finmarchicus* abundance were different in high versus low years of the North Atlantic Oscillation

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(NAO), with higher mean abundance and a more pronounced annual signal during the high NAO years. Interannual fluctuations of *Calanus finmarchicus* and the NAO index were also positively correlated with the abundance responding to NAO changes with a lag of 4 years. Over the thirty year period, the *C.f.* abundance in the Gulf of Maine had an increasing trend, a phenomenon also seen the sea surface temperatures of the Gulf of Maine. These results are consistent with the hypothesis that in the Gulf of Maine changes in the water column are related to changes in the atmosphere and climate. These results are reported in the following paper:
Conversi, A., S. Piontkovski and S. Hameed, 2001, Seasonal and interannual dynamics of *Calanus finmarchicus in* the Gulf of Maine with reference to the North Atlantic Oscillation, Deep Sea Research, II 48, 519-530.

Thus the results produced in the research carried out in this grant have contributed to important new pathways to understanding regional climate change and in the interaction of climate with the marine biosphere.