Investigation Title: Calibration & Validation of Priroda Microwave Sensors (IKAR)

Principal Investigator(s): James C. Shiue, NASA/Goddard Space Flight Center

Additional Investigator(s): Neon A. Armand; Eni G. Njoku; William Wilson

INVESTIGATION OBJECTIVES

The objective of this experiment was to document sensor characteristics and validate sensor retrieval algorithms.

PHASE 1 MISSIONS

This experiment was canceled after a soyuz craft collided with the Mir Space Station. Sufficient power was not available to activate the Priroda sensors.

RESULTS

None expected from PI

CONCLUSIONS

None expected from PI

PUBLICATIONS

None expected from PI

Investigation Title: Comparison of Atmospheric Chemistry Sensors on Priroda & American Satellites (Chemistry)

Principal Investigator(s): Jack A. Kaye, NASA/Headquarters

Additional Investigator(s): Not provided by PI

INVESTIGATION OBJECTIVES

The objective of the experiment was to make a comparison of contemporaneous data from multiple sensors.

PHASE 1 MISSIONS

This experiment was canceled after a soyuz craft collided with the Mir Space Station. Sufficient power was not available to activate the Priroda sensors.

RESULTS

None expected from PI

CONCLUSIONS

None expected from PI

PUBLICATIONS

None expected from PI

Investigation Title: Mir Window Survey

Principal Investigators: Kamlesh P. Lulla, Ph.D. and Premkumar B. Saganti, Ph.D., NASA/Johnson Space Center; Stainslav Savachinko, Ph.D. and Ivan Firsov, Ph.D., RSC/Energia

Additional Investigators: Gregory J. Byrne, Ph.D., Jon Disler, and Cindy Evans, Ph.D.

INVESTIGATION OBJECTIVES

1. To collect photographic and video data of the optical windows on the Mir Complex.

2. To analyze the collected data for estimating the optical degradation and for documenting the existing condition of the window surfaces.

Mir Window Survey was a first of its kind to photo document the condition of optical windows. Mir Complex has a total of 30 different windows in various modules. Some windows have been exposed to the space environment for about 12 years and some windows have been exposed to the space environment for about three years.

PHASE 1 MISSIONS

NASA 5 - NASA 7

OPERATIONAL ACTIVITIES

Acquisition of photographic data with a 35 mm Nikon-F3 film camera using various zoom lenses. Acquisition of video survey data of the window panes and window housing.

RESULTS

Data for a total of eight different windows were collected during three different missions (NASA 5, 6, and 7) as a specific NASA-Mir Mission Science objective. Final analysis of the window data was completed and presented at the Phase 1 Mission Science Symposium in November 1998. Most exterior window panes showed contamination deposits, Micrometeoroid and Orbital Debris (MMOD) impacts, and other degradations (scuff marks and scratches). Qualitative descriptions of most features and quantitative measurements of most impacts were presented as part of the results.

CONCLUSIONS

Most interior window panes and interior window housing were found to be in remarkably good condition. Most exterior window panes showed significant damage due to MMOD impacts, external contamination deposits, and other degradations (scuff marks) some could have been EVA related.

PUBLICATIONS

Mission Science Reports - 1997, 1998, and 1999

Mission Science Symposia - 1997, 1998

JSC Technical Report - 1999

Invited Paper - GeoCarto International Special Edition - 1999

Investigation Title: Regional & Temporal Variability of Primary Productivity in Ocean Shelf Waters (Color)

Principal Investigator(s): Frank E. Muller-Karger, University of South Florida

Additional Investigator(s): O. Kopelevich

INVESTIGATION OBJECTIVES

The objectives of this experiment were: to quantify the role of continental margins in global BGC, to investigate physical & chemical factors controlling production, to investigate trajectory of materials supplied by upwelling & river discharge, to compare MOZ-Obzur & SeaWiFS data, to investigate use of MOZ-Obzur to correct SeaWiFS data for aerosol distribution, and to assure data comparability between Priroda and SeaWiFS.

PHASE 1 MISSIONS

This experiment was canceled after a soyuz craft collided with the Mir Space Station. Sufficient power was not available to activate the Priroda sensors.

RESULTS

None expected from PI

CONCLUSIONS

None expected from PI

PUBLICATIONS

None expected from PI

Investigation Title: Test Site Monitoring (TEST)

Principal Investigator(s): Cynthia Evans, Lockheed Martin

Additional Investigator(s): Kamlesh Lulla; Lev Desinov

INVESTIGATION OBJECTIVES

The objective of this experiment was to monitor changes in land cover and condition, lake levels, etc., at selected test sites in support of the US Earth Observations System Program and global change research.

PHASE 1 MISSIONS

NASA 2 - NASA 7

OPERATIONAL ACTIVITIES

This experiment was merged with the Visual Earth Observations (Obs) experiment.

Investigation Title: Validation of Biosphere-Atmosphere Interchange Model for Northern Prairies (Prairies)

Principal Investigator(s): Anthony W. England, University of Michigan

Additional Investigator(s): A. M. Shutko

INVESTIGATION OBJECTIVES

The objective of the experiment was to validate biosphere-atmosphere interchange model of northern prairies.

PHASE 1 MISSIONS

This experiment was canceled after a soyuz craft collided with the Mir Space Station. Sufficient power was not available to activate the Priroda sensors.

RESULTS

None expected from PI

CONCLUSIONS

None expected from PI

PUBLICATIONS

None expected from PI

Investigation Title: Validation of Priroda Rain Observations (Rain)

Principal Investigator(s): Otto W. Thiele, NASA/Marshall Space Flight Center

Additional Investigator(s): Not provided by PI

INVESTIGATION OBJECTIVES

The objective of the experiment was to validate rain rate estimations from Priroda sensors.

PHASE 1 MISSIONS

This experiment was canceled after a soyuz craft collided with the Mir Space Station. Sufficient power was not available to activate the Priroda sensors.

RESULTS

None expected from PI

CONCLUSIONS

None expected from PI

PUBLICATIONS

None expected from PI

Investigation Title: Visual Earth Observations

Principal Investigators: Kamlesh Lulla, Ph.D, NASA/Johnson Space Center; Cynthia Evans, Ph.D, and Lev Desinov, Ph.D

Additional Investigators: David L. Amsbury, Ph.D, M. Justin Wilkinson, Ph.D., Julie Robinson, Ph.D., Patricia Dickerson, Ph.D., Joe Caruana, and Kim Willis

INVESTIGATION OBJECTIVES

1. Document environmental changes and dynamic processes on the Earth's surface like flooding and droughts, urban growth and landuse changes around the world, events related to El Niño, and transient features like tropical storms, large fires and volcanic eruptions. Assimilated imagery into the larger database of Earth photographs taken by astronauts and cosmonauts.
2. Use an operational environment to develop approach and tools for ISS-based Earth observations.

PHASE 1 MISSIONS

NASA 2 - NASA 7

OPERATIONAL ACTIVITIES

Use handheld cameras (Hasselblad 70 mm film format with 50, 100 and 250 mm lenses) to photograph Earth's surface over designated regions or over targets-of-opportunity selected by crew or ground-based scientists.

RESULTS

The NASA-Mir missions returned more than 22,000 images of the Earth's surface, taken between March, 1996 and June, 1998. They images have been fully catalogued and added to the Ofiice of Earth Sciences database (http://eol.jsc.nasa.gov).

Specific Mission Results/Highlights

NASA 2: Photos of out-of-control forest fires on the Mongolian Steppes in April 1996; drying reservoirs in the southwest U.S. and northern Mexico during sever drought in western North America; baseline conditions before 1997-98 El Niño

NASA 3: Massive flooding in the lower Nile, continued drought in southern Africa, spring thaw in the southern Andes; baseline conditions before 1997-98 El Niño.

NASA 4: Snow and ice cover over the northern U.S. and Canada, sea ice breakup in Great Lakes and St. Lawrence Seaway. Ohio-Mississippi River floods (March 1997), widespread forest fires in far-eastern Asia (Mongolia, China and Russia) in late April and early May, and detailed imagery of western European river systems (Garonne, Loire, Rhone, Rhine, Danube).

NASA 5: Key atmospheric dynamics related to the developing 1997 El Niño event (thick smoke and haze over South America and Africa).

NASA 6: Continued El Niño observations from September, 1997 through January, 1998, including smoke and haze over Sumatra and New Guinea, dropping lake levels in the high Andes, and key photographs of the unusually lush coast of Somalia after floods.

NASA 7: Continued documentation of El Niño impacts: drought conditions in the central Andes and northeastern South America and Australia, photos of lush vegetation in California, fires and extensive smoke palls in Central America and diminished ice cover in the northeastern U.S.

CONCLUSIONS

Imagery taken from Mir on the joint U.S.-Russian NASA-Mir program is a rich dataset documenting the Earth's dynamic processes over a 2-year time period. It provides a global perspective on the rhythms and spatial scale of important natural and human-induced events occurring on the Earth's surface. Within the context of 35 years of imagery included in the Office of Earth Sciences database, these new observations from the NASA-Mir long-duration missions are changing our understanding of the sizes and frequencies of global processes.

PUBLICATIONS

1. Evans, C. A. , M. J. Wilkinson, J. A. Robinson, S. Runco, P. W. Dickerson, D. L. Amsbury and K. P. Lulla, 1999. NASA Pictures of Earth: The 1997-1998 El Niño: Images of Floods and Drought, Geography Review, V 12. pp 6-9.
2. Kamlesh P. Lulla and Lev Desinov, Cynthia A. Evans, Patricia W. Dickerson and Julie A. Robinson, in press, Dynamic Earth Environments: New Observations from Shuttle-*Mir* missions, Geocarto International, Hong Kong.

Contents

18. E. I. Ignatov and G. D. Solovieva, Geomorphology of Southern Azerbaijan and Coastal Responses to the Caspian Trangression

19. A. S. Shestakov Land-use Changes in the Northwest Caspian Coastal Area, 1978 through 1996--A Case Study of the Republic of Kalmykia

Investigation Title: Visual Observations (VObs)

Principal Investigator(s): Kamlesh Lulla, NASA/Johnson Space Center

Additional Investigator(s): Cythia Evans; Premkumar Saganti; Stanislav Savchenko; Ivan Firsov

INVESTIGATION OBJECTIVES

Not provided by PI

PHASE 1 MISSIONS

NASA 5, NASA 6

OPERATIONAL ACTIVITIES

This experiment was merged with the Visual Earth Observations (Obs) experiment.

Investigation Title: Watershed Hydrologic Studies

Principal Investigators: Thomas J. Jackson, U.S. Department of Agriculture

Additional Investigators: N. Armand, B. Kutuza, A. Shutko, Yu. Tishchenko, B. Petrenko, A. Evtushenko, M. Smirnov, V. Savorskij, I. Sorokin, A. Nikolaev, and A. Sidorenko

INVESTIGATION OBJECTIVES

Regional study to acquire a time series of Priroda satellite observations in conjunction with soil moisture and other important ground and meteorological observations. Results of this part of the investigation were expected to provide important information for algorithm development for future long-term missions involving the AMSR instrument.

PHASE 1 MISSIONS

After only two days of coverage in mid June 1997, the well-known docking accident involving Mir occurred. This resulted in the loss of the Priroda observing system for the duration of SGP97. We were able to acquire two data sets, June 15 and 18, 1997..

OPERATIONAL ACTIVITIES

Data collected during the June 15 and 18, 1997 missions were processed and calibrated by the Russians. The calibrated data products were provided to all cooperators.

RESULTS

A review of the data products provided indicated that many of the passive microwave instruments that we were interested in (primarily the low frequencies) had operating problems. For the channels judged as acceptable a rigorous review and testing of the calibrations was performed. This involved modeling and SSM/I satellite data comparisons over land and water targets with validation data.

CONCLUSIONS

Due to Mir platform problems during the experiment, only a very limited set of data was obtained. Based upon these data, an evaluation of the Priroda sensor performance and some analyses of soil moisture conditions were conducted. These results provide important information for utilizing Priroda data and for soil moisture algorithm development.

PUBLICATIONS

1. Jackson, T. J. , Hsu, A. Y., Armand, N., Kutuza, B., Shutko, A., Tishchenko, Yu., Petrenko, B., Evtushenko, A., Smirnov, M., Savorskij, V., Sorokin, I., Nikolaev, A., and Sidorenko, A., APriroda Passive Microwave Observations in the Southern Great Plains 1997 Hydrology Experiment,@ Proceeding of the Int. Geoscience and Remote Sensing Symposium 1998, IEEE Cat. No. 007803-4403:1568-1570, 1998.