Use of Satellite and In-Situ Data to Improve Sustainability

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PREFACE

The Advanced Research Workshop (ARW) "Using Satellite and In situ Data to Improve Sustainability" was held in Kyiv, UKRAINE during June 9–12, 2009. The ARW was sponsored by the North Atlantic Treaty Organization (NATO) and organized by the National Space Agency of Ukraine (NSAU) in cooperation with the Center for Satellite Application and Research (STAR) of the National Environmental Satellite Data and Information Services (NESDIS), National Oceanic and Atmospheric Administration (NOAA) http://www.star.nesdis.noaa.gov/smcd/emb/vci/VH. Drs. Powell (NOAA) and Fedorov (NSAU) served as ARW Directors.

The ARW was focused on the current issues of changing climate and providing services for sustainable economy, healthy environment and better human life and had the following sessions

- Early warning of natural disasters
- Weather and food security
- Climate services to enhance national security
- Land cover/land change and anthropogenic activities
- Human health and the environment
- Satellite and in situ data records for trend analysis

Eighty five scientists from North America, Europe and Asia, attended the Workshop, participated in the discussions and gave 53 presentations. The brain-storming discussions at the end of each day session resulted in the ARW Summary. The following important issues were emphasized at the Workshop

1. More than 30-year satellite data time series have already provided sufficient information to be used for monitoring land, ocean and atmosphere, improving sustainable economy, environment and human life; these activities must be expanded, advertised and widely distributed.
2. The gap between research and applications for improving sustainability should be overcome by combining satellite and in situ data for enhancing spatial and temporal coverage of the Earth and expanding the products and services quantity and quality.
3. In order to expand the applications, satellite data sets and products must be presented in a ready-to-use form, easily available and be user friendly.
4. Existing and new satellite data and products must be validated and calibrated to enhance their credibility.
5. Following the ARW goals (climate services and sustainability), the current NOAA satellite data and products can be scaled into three categories: (a) mature science/ready to use (flash-flood, drought, snow, vegetation health); (b) intermedium

maturity science (agriculture, land-water interactions, sensitivity of world ecosystem to ENSO) and (c) prospective science/need development (climate forcing, land cover/land change, anthropogenic activities, loss of bio-productivity, bio-productivity potential, wave analysis and external climate forcing).
6. In situ data must be actively collected for validation and calibration of satellite datasets and products.
7. Create regional polygon (Kherson administrative region, which combines Black Sea open water and costal ecosystems) and collect comprehensive data sub-sets (satellite, in situ, economic) with easy access for scientists in order to develop and test new methods, data, models and products.
8. Create working groups covering (a) climate science (change impacts, prediction from forcing); (b) economic effectiveness of climate services; (c) satellite/*in situ* data assimilation; (d) bio-productivity potential.
9. Implement NOAA satellite-based technique and products for monitoring droughts, flash-flood rainfall, vegetative health, and snow cover.
10. Approve the first year of Cooperation (MOU) between the National Oceanic and Atmospheric Administration and the National Space Agency of Ukraine. Considering the Cooperation success continue the MOA activities for the next 4 years.

Cooperation between National Oceanic and Atmospheric Administration (NOAA) and the National Space Agency of Ukraine (NSAU) started in June 2008 when NOAA Administrator and Director General of NSAU signed the Memorandum of Agreement (MOA) to promote the application of NOAA operational environmental satellites for climate services in order to achieve sustainability. The MOA was under the umbrella of the Global Earth Observing System of Systems (GEOSS) and Group on Earth Observations (GEO).

The most advanced thirty two papers discussing the basic science, new methods, datasets, products and applications were selected to be including in this book. Scientific and application results presented in these papers can be used today for an early detection of large-scale natural disasters, assessments of agricultural production losses, monitoring fires, climate and land surface trend analysis, application of climate forcing for lead-time predictions and others.

This book consists of the following five parts and appendix

Part I: Large-Scale Weather Disasters: Early Detection and Monitoring from Space and In Situ Data

Part II: Environment and Food Security: Diagnosis and Prediction

Part III: Climate Change, Environment and Socioeconomics

Part IV: Marine Ecosystem, Land Ccover, Atmosphere and Anthropogenic Activities

Part V: Satellite and In Situ Long Records for Trend Analysis, Modeling and Monitoring

Part I consists of six chapters discussing such large-scale disasters as drought, flood, severe weather and fires. Several methods are presented showing both satellite and in situ data used for monitoring and assessments. Part II consissts of six chapters discussing mostly food security issues in terms of monitoring large-scale

agricultural production from satellite and in situ data. The authors share their experience in Ukraine, Russia and USA. Part III consists of seven chapters discussing climate change issues and implications for a reduction of glassiers, changes in bio-climatic potential, crop yield variations under different IPCC scenarios etc. In addition, some aspects of climate change origination and climate forcing impact on land surface are also analysed and presented. Part IV consists of seven chapters discussing marine ecosystem issues such as interaction between land and coastal water. Also, some papers are devoted to desertification issue, geomagnetic activities and others. Part V consists of six chapters discussing long-term satellite-based time series records for monitoring changes in land surface, comparing the records produced from the same source but with different processing algorithms.

The appendix contains color images for several papers.

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PART IV MARINE ECOSYSTEM, LAND COVER, ATMOSPHERE & ANTHROPOGENIC ACTIVITIES

PART V SATELLITE & IN SITU LONG RECORDS FOR TREND ANALYSIS, MODELING & MONITORING