Geophysical Research Abstracts
Vol. 12, EGU2010-537, 2010
EGU General Assembly 2010

ESA's STSE WACMOS Project: Towards a Water Cycle Multimission Observation Strategy

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Understanding the role of the global water cycle in the Earth system it is essential to be able to measure from space hydro-climatic variables, such as radiation, precipitation, evapotranspiration, soil moisture, clouds, water vapour, surface water and runoff, vegetation state, albedo and surface temperature, etc. Such measurements are required to further increase not only our understanding of the different components of the water cycle and its variability, both spatially and temporally, but also to characterise the processes and interactions between the terrestrial and atmospheric branches of the water cycle, and how this coupling may influence climate variability and predictability.

Moreover, enhancing the observational capacity and the model capabilities to predict in a reliable manner the variations in the global water cycle will be a key contribution to the improvement of water governance, the mitigation of water-related damages and the sustainable human development.

In the last few years, EO has demonstrated the capacity to provide reliable measurements over oceans, land and atmosphere representing an unique tool for scientist to observe and monitor the earth system. Now, the earth observation panorama is getting into a new era where the increasing number of missions and sensors available for scientific and operational applications, besides the advances in computer science, modelling and data assimilation, open unprecedented opportunities to enhance human capacities to observe, understand and predict the water cycle and its variability in time.

However, in order to fully exploit this increasing potential and bring this newly available capacity to practical operational levels, significant scientific efforts are required in order to:

• Develop novel and enhanced geo-physical products exploiting available synergies among different observational system;
• Consolidate the development of consistent long-term data sets integrating different EO systems in a synergic manner;
• Develop robust methodologies to integrate and assimilate space observations and in situ measurements into advance coupled models being able to describe biophysical processes and interactions between ocean, land and atmosphere describing the water cycle and hydrological processes;

In this context, the European Space Agency (ESA) in collaboration with the Global Energy and Water Experiment (GEWEX) of the World Climate Research Program (WCRP) launched the project Water Cycle Multi-mission Observation Strategy (WACMOS) early in 2009.

The project, funded under the ESA's Support To Science Element, address the first of the above objectives.

In particular, the project objective is twofold:

• On the one hand, developing and validating a Product Portfolio of novel geo-information products responding to the GEWEX scientific priorities and exploiting the synergic capabilities between ESA EO data and other non-ESA missions.
• Exploring and assessing different methodologies to exploit in a synergic manner different observations towards the development of long-term consistent datasets of key (essential) variables describing the water cycle.

In this context, WACMOS is focused on four components of the above cycle that are also thematic priorities identified in close collaboration with the GEWEX scientific community: Evapotranspiration, soil moisture, clouds and water vapour. The product portfolio comprises:

1) AATSR-MERIS based evapotranspiration modelling approach;
2) Merged passive and active microwave first multi-decade soil moisture data set;
3) Novel MSG SEVIRI-SCIAMACHY cloud products and
4) Synergic SEVIRI-IASI and SEVIRI-MERIS water vapour products.

In this paper, the methodologies and preliminary results of WACMOS are introduced. In the next phase of the project, consolidated methods, data products and validation results will be generated, so that a global water cycle product of evapotranpiration, soil moisture, clouds and water vapour with quantified uncertainties can be produced for climate research and water resources management uses.