Summary of:
Inaugural Meeting of the WATER HM Science Working Group
October 29th and 30th, 2007 in Washington D.C.

Date of this document is November 1, 2007; updated November 25, 2007

While the Air France strike forced people to remain in France, our meeting still brought together a group of people from France, Germany, the U.K., and the U.S. (attendance is listed below). No official decisions were made, but recommendations were developed and are presented in this document for further discussion. The following is a summary of ideas developed and recommendations made during the meeting. I hope to develop a more extensive write-up of the meeting. -- Doug

1. **Phase A:** The SWG should request that CNES and NASA HQ communicate regarding the need to keep WATER HM moving forward. CNES would like to move into Phase A studies in March 2008 whereas NASA HQ may not have the funds to support Phase A studies. Continued dialogue between Mike Freilich, Pascal Ultre-Guerard, Eric Thouvenot, and the WATER HM SWG is needed.
2. **Meetings:** The inability of the hotel to supply effective telecom communication limited the interactions with those unable to attend the meeting. Follow-up meeting(s) including video-conferencing between JPL and CNES as well as face-to-face meetings are needed over the next one to three months. Furthermore, given the lack of full SWG participation, it may not be appropriate to call the October 29th and 30th meeting the "inaugural" meeting.
3. **Mike Freilich** indicated that he will closely follow the recommendations of the NRC Decadal Survey (DS) not only because of the scientific merits but also because the U.S. government relies heavily upon the recommendations of decadal surveys.
    a. He would like for the SWG to "close the loop" between the DS and the oceanographic and hydrologic communities, i.e., to ensure that the respective communities confirm that the mission capabilities address the important science questions. This is largely already done for WATER HM, especially given all of our previous two years work.
    b. He would like for us to continue to be "firm, objective, persuasive, and sustained advocates" of WATER HM because, while the DS may have justified the mission, the DS did not make the arguments to the necessary depth. If we fail to keep the momentum, it is possible to slip in time, but, on the other hand, activities are unlikely to move the mission forward in time ahead of Phase 1 DS missions.
    c. Before Mike Freilich arrived at our meeting, I indicated that both houses of Congress have appropriated between $60M and $100M for NASA's Earth Science Division. Freilich reiterated the above point. [Editorial note: A reading of the House bill, page 112, indicates that these moneys are for the first seven DS missions, including WATER HM and that these funds are intended to allow Phase A and pre-Phase A studies. It is has been suggested in the national media that the overall funding bill will likely be vetoed by the President].

d. WATER HM will not be an ESSP mission. ESSP is for missions outside of the DS.

e. Jason-3 appears to becoming less firm, not more firm.

4. **Science questions** are prioritized but are not as well articulated as needed. Societal questions should not drive the mission and, instead, should be a direct result of the science questions.

    a. WATER HM will produce data that should transform hydrology, much like Topex/Poseidon did for oceanography nearly 20 years ago.

    b. The topmost hydrology question should either include both storage changes and discharge, or focus on just storage changes. The implications of the word "prediction" imply something about the future whereas we should say "estimate", thus indicate an immediate result of WATER HM.

    c. The topmost oceanographic question is focused on eddy kinetic energy (i.e., measuring EKE at the fine spatial-scale necessary to understand the energy dissipation). Measurements of sea-surface heights in coastal zones are also a priority, especially given that conventional altimetry significantly under-samples the coasts. The question dealing with hurricanes is not well worded and should probably not emphasize hurricanes, instead place an emphasis on air-sea interactions.

5. **Risk reduction studies** are needed to further refine the mission and keep it on track for a launch in the 2013-2016 timeframe indicated by the DS. Studies include:

    a. WSOA was not designed as a Ka-band SAR system, thus the extensive JPL studies conducted for WSOA need to be expanded to include Ka-band and the ability to produce a synthetic aperture.

    b. Given that all early DS missions will produce large amounts of data, it is possible that additional downlink capacity will be available by launch. Nevertheless, on-board processing to reduce data volumes might be required. Such processing needs to be prototyped.

    c. Corrections for the wet and dry troposphere are needed. Regarding radiometers, what are their power requirements and what are the risks associated with newly developed ones? Conventional radiometers are viable for WATER HM over the oceans, thus what are the alternatives to advanced radiometers for making corrections over coastal and land areas?

    d. The Ka-band radar studies over three Ohio water bodies were useful for demonstrating that KaRIN will record off-nadir returns. It would be beneficial to have a more extensive study of the surface conditions, wind speeds, and resultant backscatter strength and signal correlation. Perhaps adding beamwidth and pulse size to the study would help delineate the implications of small "flat patches" along river surfaces.

6. **Mission design studies**, like the risk reduction studies, will help delineate the power, accuracy, and sampling.

    a. The orbit should be within an inclination of 66 to 90 degrees, an altitude of ~800 to ~1000 km, and non-sun-synchronous. A French development, Platform 2012, is capable of handling the expected power requirements, articulated solar panels, and

instruments for WATER HM. There is an overwhelming majority in favor of a non-sun-synchronous orbit. Thus any effort to move away from the general orbit defined above will require a study that clearly defines the benefits of an alternative orbit.

b. The hydrology virtual mission will demonstrate the time and space trade-offs (orbital sampling) for deriving water storage changes and estimating discharge. Given that every watershed around the world will be sampled every orbital repeat cycle (and most likely every half repeat cycle), data assimilation is an ideal tool to define the derived storage change and discharge accuracies and errors. Similar coastal zone and oceanographic virtual missions should also be considered. These will not alter the science questions, rather will help to carefully define the expected gains in science.

7. **A report of the SWG** is needed to enable the mission to move into Phase A studies. The report will define the motivating science questions, make a preliminary mission design, and establish a mission timeline. The report will take about a year to complete. It includes the risk reduction and mission definition studies. A preliminary version of this report could be distributed in February 2008 to enable a "pre-Phase A" description of WATER HM.

Meeting Attendees: Anthony Freeman, Bruno Lazard, C.K. Shum, Dani Esteban Fernandez, Delwyn Moller, Dennis Lettenmaier, Detlef Stammer, Diane Evans, Doug Alsdorf, Eric Lindstrom, Ernesto Rodriguez, Gregg Jacobs, Jared Entin, John Melack, Kostas Andreadis, Larry Smith, Lee-Lueng Fu, Mike Durand, Paul Bates, Richard Ray, Shannon Brown, Steve Nerem, Ted Strub, Yi Chao

Invited but unable to attend: Aaron Boone, Anny Cazenave, Bruno Cugny, Dudley Chelton, Eric Dombrowsky, Eric Thouvenot, Eric Wood, Estelle Obligis, Florent Lyard, Herve Jeanjean, Jacques Verron, Jay Famiglietti, Nelly Mognard, Pascale Ultre-Guerard, Pierre-Yves Le Traon, Pierre de May, Rosemary Morrow, Yves Menard