Thematic Process Session

Session T 4.3.4 - Building trust: Facilitating data and information exchange between the riparian countries in transboundary basins

Thursday 16 April, 14h40-16h40 - Daegu EXCO, room DEC_304

Round table 1: Developing Innovative monitoring
Use of the Earth Science Observations to produce useful data and information for improved transboundary /global water resources management

Mr. David TOLL
Hydrological Science Laboratory - NASA/Goddard Space Flight Center
Figure 1: Snow water equivalent (SWE) based on Terra/MODIS and Aqua/AMSR-E. Future observations will be provided by JPSS/VIIRS and DWSS/MIS.

Figure 2: Annual average precipitation from 1998 to 2009 based on TRMM satellite observations. Future observations will be provided by GPM.

Figure 3: Daily soil moisture based on Aqua/AMSR-E. Future observations will be provided by SMAP.

Figure 4: Changes in annual-average terrestrial water storage (the sum of groundwater, soil water, surface water, snow, and ice, as an equivalent height of water in cm) between 2009 and 2010, based on GRACE satellite observations. Future observations will be provided by GRACE-II.

Figure 5: Current lakes and reservoirs monitored by OSTM/Jason-2. Shown are current height variations relative to 10-year average levels. Future observations will be provided by SWOT.
Emerging Trends in Global Freshwater Storage

Trends in terrestrial water storage (cm/yr), including groundwater, soil water, lakes, snow, and ice, as observed by GRACE during 2003-12

- Greenland’s ice sheet is thinning at a rate of up to 286 km³/yr
- Russian droughts in 2010 and 2012
- Groundwater is being depleted across northern India at rate of about 54 km³/yr due to pumping for irrigation
- Alaska’s glaciers have been melting at 84 km³/yr
- Overexploitation of freshwater resources in the North China Plain
- Recent and ongoing droughts in the southeastern U.S. and Texas
- Return to normal after wet years in early 2000s
- Recovery from 2004-05 drought in the Amazon
- Drought recovery and flooding
- Drought in southern Argentina and gravity step due to 2010 Maule Chile earthquake
- Return to normal in the Okavango Delta after drought ended in 2007
- Patagonian glacier melt
- The western Antarctic ice sheet is thinning at a rate of up to 246 km³/yr
- Depletion of water resources in Middle East exacerbated by drought
- Russian droughts in 2010 and 2012
- Drought in southern Argentina

GRACE observes changes in water storage caused by natural variability, climate change, and human activities such as groundwater pumping.

From Rodell/NASA-GSFC
Satellite Data to Address Transboundary Water Issues

Transboundary Water - Satellites & Modeling
- Free and open exchange of data including improved interoperability and visualization.
- Satellite - Multi-Scale (<100m – Global)
- Near Real-time, retrospective (70’s), synoptic, with predictions (days to decades).
- Integrated data systems, including option for data assimilation.

NASA Project Lower Mekong with ‘MRC’

NASA USAID SERVIR
Flood Prediction Low Lying Deltas Himalayan

Regional Precipitation
PERSIANN (Bolten/NASA)

NASA Nile Basin Project
Zaitchik/JHU

NASA & USGS Assisting USAID with Famine Early Warning System – FEWS-NET (Verdin/USGS)

Hossain/U. Washington

NASA-USAID SERVIR
 - CREST Model Regional Water Balance and Flooding

Limaye/NASA
NASA Nile Basin Project (B. Zaitchik/JHU)

- Increasing water consumption, no sharing agreement and no consensus on basin hydrology
- Application to drought, agriculture and water balance analysis covering 11 countries & 200 million people.
- 5-km resolution, retrospective water availability estimations by country and basins, 1982-2014.
- Customized land cover and irrigation maps.
- Basin wide Evapotranspiration mapping
- Multivariate agro-ecosystem analysis for vulnerability assessment.
- Sudd wetland water balance assessment
- Hydropower optimization analysis
Ministry of Water in Kenya, Rwanda, Uganda, and Namibia did not have real time assessments of hydrologic conditions.

Spatially distributed hydrologic model ‘CREST’ using remote sensing and Earth observations developed originally for one Kenyan watershed and then extended.

Spatial resolution 1km, every 3 hours over 10 years in Amazon cloud infrastructure.

Uses near real-time satellite-derived rainfall estimates and rainfall forecasts from Kenya Meteorological Service (KMS) to produce streamflow.
Problem: Bangladesh’s severe flooding affects millions of residents every year. The Flood Forecast Warning Center (FFWC) issues flood forecasts in Bangladesh just 3 days in advance – insufficient time for families and farmers to prepare.

NASA USAID SERVIR Solution: A SERVIR AST effort led by Faisal Hossain/U. Washington linked satellite altimetry data (JASON 2) to flood forecasts. SERVIR-HKH has trained FFWC scientists to generate flood forecasts 8 days in advance using this near real time satellite data.

Results: FFWC has begun generating experimental 8-day forecasts representing river levels for the 2014 monsoon season. The satellite-derived system is being run independently by FFWC, and is expected to be adopted as the official forecasting system for the 2015 monsoon season. The 8-day forecasts will provide 160 million impacted citizens with longer lead time for disaster preparedness.