

Asian Regional Reanalysis

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Executive Summary

A retrospective analysis (reanalysis) of circulation and thermodynamic fields over Asia is proposed to advance characterization, understanding, modeling, and prediction of regional climate variability and change over this vastly populated continent of complex orography, land-surface types, and land-ocean boundaries. The strongest seasonally-reversing (monsoon) circulation on the planet occurs in the Asian longitudes, with the attendant rainfall nurturing the agricultural economies of the region.

Interest in regional climate variability and change, specially, hydroclimate (precipitation, surface temperature, evaporation, soil wetness, stream flow, drought indices) is intense and growing, since it is the component that is “felt”. Precipitation is very influential and among the best measured hydroclimate fields, but model forecasts of precipitation remain inaccurate; reflecting challenges in modeling of convection and cloud processes, and assimilation of precipitation.

The canonical assimilation of circulation and temperature – as in current global reanalyses – is thus insufficient in yielding a reliable estimate of the hydroclimate state. Additional assimilation of precipitation, radiance, and aerosol observations will lead to more accurate state representation, including greater consistency between its circulation and hydroclimate components. The resulting high-resolution reanalysis over Asia and the adjoining regions should reveal the scope and impact of regional-scale dynamic and thermodynamic interactions; which mediate the forcing (e.g., anthropogenic) and the response.

The recent precipitation-assimilating North American regional reanalysis offers some guidance on assimilation strategy, but several intellectual challenges remain. The foremost among them being the relative emphasis placed on minimization of short-term circulation forecast errors (the guiding principle in current global reanalyses) and reduction of longer-term imbalances in atmospheric and terrestrial water and energy budgets (a desirable constraint from the hydroclimate perspective) during data assimilation.

The Asian Regional Reanalysis project will exploit the high spatio-temporal resolution of satellite observations; generate unique synthesis of conventional and remotely sensed data using state-of-the-art atmosphere/land-surface models while being mindful of regional water and energy budgets; develop comprehensive summer and winter monsoon phenomenologies from closer interaction of the modeling and observational communities; provide a framework for diagnosing the influence of regional anthropogenic aerosols/pollutants on circulation and hydroclimate; permit a more rigorous analysis of water resource management and agricultural practices; and above all, forge stronger links between climate programs of Asian countries (e.g., India, China, Japan, Korea, and Taiwan).

Some defining attributes

- The Asian Regional Reanalysis project should have both research and operational elements. The goal is to produce a high-quality data set using innovative assimilating techniques, many of which may not be adequately developed at the present time. The project is thus envisioned to begin (and not end) with the production of a North American Regional Reanalysis type data set for the Asian region.
- Should use as much of the remotely sensed data as possible, given vast stretches of difficult terrain in the region. Data stream should include observations from NASA, NOAA, Indian, Japanese, Chinese and Taiwanese satellites; consistent with regional focus and geopolitics.
- Should plan on using COSMIC data (Constellation Observing System for Meteorology, Ionosphere & Climate: <http://www.cosmic.ucar.edu>), as it becomes available. This unique record of remotely sensed upper-air temperature and humidity soundings over land and ocean should prove valuable given the sparse upper-air sampling over much of the Asian continent and most of the adjoining ocean basins. Use of COSMIC data will also engage the considerable US-NSF and Taiwan's investments in COSMIC (Bill Kuo, UCAR/NCAR).
- The reanalysis data stream should include SSTs from the recently deployed ARGO floats in the Indian ocean (and western Pacific) basins.
- Pilot-phase efforts to focus on South Asia to facilitate design and refinement of strategies for assimilation of aerosols and for reducing atmospheric and terrestrial water/energy imbalances during data assimilation.
- WRF is an interesting candidate model for this effort, for various reasons, including in-place UCAR cooperative agreements with India and other Asian countries on mesoscale modeling and data assimilation. The WRF model comes with several built-in choices, including ability to ingest COSMIC data (?), which will likely become important in the out years.
- Investigate ways to execute the regional reanalysis on an ongoing basis (5-year repeat frequency). Asians countries will be more involved/vested if the first/future versions of Asian Reanalysis is produced in an Asian country.
- Connections with related US initiatives/programs (e.g., NASA's MERRA; Dole's Integrated Earth System Analysis initiative)
- Links with international initiatives/programs: WCRP/COPE's Observational and Assimilation Panel (WOAP, Trenberth); UNEP's ABC activities (Ram); WCRP's CLIVAR and GEWEX programs.
- Links with regional international programs (e.g., AMY08, Japan's MAHASRI, India's CTCZ, China's AIPO and MAIRS, and CLIVAR's AAMP activities; among others).

Planning activities

- **AGU Fall Meeting 2006 (San Francisco, CA): Session # A34B (December 13th, 4PM):**
*Hydroclimate Variability and Change Over the South Asian Monsoon Region:
The Need for Regional Reanalysis*
- A workshop will be organized in 2007 to discuss data streams, assimilation and execution strategies, and the project's scope, in order to advance prospectus development.