Catchment-based Hydrological Model Data Assimilation (CAHMDA-VI)

Recap of Session 2 "Extreme Events: modeling."

- Wayne Tshirhart: "Watershed Engineering."
- Bart Forman: "Towards Multisensor Snow Assimilation: A Simultaneous Radiometric and Gravimetric Framework"
- David Maidment: "National Flood Interoperability Experiment"
- Zhicong Yin: "Numerical Simulation of Urban Ponding and its Application in Beijing."
- Li Dan: "Hydrological Projections over the 3H Region of China Using Climate Change Scenarios."
- Yong-Fei Zhang: "Assimilation of MODIS Snow Cover and GRACE Terrestrial Water Storage Data through DART/CLM4"
- Peirong Lin: "Implementing a vector-based river routing scheme within the WRF-Hydro modeling system."

Overall Impression

Session had a nice balance between modeling the ***effects*** of the extreme events and modeling the ***precursors*** or ***conditions*** that are required to produce an extreme event.

Not much discussion of catchment-scale conditions … snowpack, soil moisture, precip … but lots of discussion of catchment-scale effects.

As a global community, probably woefully unprepared for urban flood modeling. The data requirements: 1m vertical resolution for urban corridors/drainages, real-time monitoring of drainages and existing soil saturation, rapid delivery of precipitation nowcasts and forecasts … make this a very expensive proposition.

large cities have the resources to make this happen – despite the fact the losses from flooding may greatly outweigh the cost.

There is a phenomenal diversity in the models, data, and observations.

Quick recap of presentation highlights (as I saw them):

#1) Lunchtime speaker … Wayne Tshirhart …

San Antonio contracted its own flood monitoring system. The nature of the urban flooding required a new high-res mapping of the watershed – to 1m precision, much higher than current DEMs.

Rain events are convective in nature – very short, if any, lead time to useful precipitation data. NWS forecasts are too infrequent. Rain "bomb" may have come and gone between forecasts.

Can run scenarios – but it sounds like a very manual process.

Political boundaries and watersheds may not line up. Presents a management problem.

Quick recap of presentation highlights (as I saw them):

#2) Bart Forman … "Water. It's about Water." – *Wallace Stegner*

Snowmelt drives 1/3 of all agriculture and is the primary water supply for more than 1 *billion* people yet we have pretty poor models of snow supply – Hard to measure, hard to model.

Focused mostly on drought forecasting – but knowing snowpack is important for flood forecasting too.

No one instrument can provide the observations we need. Observations (SNOTEL, CMC) known to be biased – verification a problem.

Physically-based radiative transfer models require information that we may never know at the scales we need – statistical method works just as well (maybe even better) …

Quick recap of presentation highlights (as I saw them):

#3) David Maidment …

Creation of the ***National Water Center*** and the *Integrated Water Resources Science and Services (IWRSS)* provides an opportunity for '*transformative*' research.

National Flood Interoperability Experiment (NFIE) with the goal: Connect National Scale Flood Modeling with Local emergency planning and response

Integrate existing federal, state agencies and local response teams.

The flood preparedness in Iowa demonstrates what is possible.

Quick recap of presentation highlights (as I saw them):

#4) Zhicong Yin …

The Beijing Urban Waterlogging model is a 1km grid with 14000+ channels to model ponding depth in Beijing.

For given rainfall rates and durations, it is possible to simulate the ponding and mitigation strategies such as larger drainage pipes.

There is also a risk warning classification scheme for vehicle type.

Can estimate risk for different return-year conditions – 2year, 10year, 50year, 100year.

The operator interface is important and must be easy to visualize and understand and provide the right information.

Quick recap of presentation highlights (as I saw them):

#5) Li Dan …

Used VIC model at 10km resolution to focus on an area that produces 40% of the food (in all of China?) an area with 400 Million people. Important agricultural area.

Need to know what will happen to this area as temperatures and rainfall amounts change. Will irrigation be enough?

Focus on Precip, EvapoTranspiration, Runoff, and Soil Moisture.

The precipitation anomalies for 1980-2000 are crazy.

Looked at Surface Water Resources using a 2degree warming and +/- 15% precip scenarios. If precip goes down, explore mitigation strategies.

Quick recap of presentation highlights (as I saw them):

#6) Yong-Fei Zhang…

Trying to improve snow water estimates. MODIS snow cover fraction (SCF) alone does not do much once the snow is on the ground. Can help during the melt season, that's about it. Once the SCF approaches 1.0, more SCF observations do not help.

Use GRACE estimates of monthly total water storage (TWS) anomaly. Must create model-based background to create observations of total water storage. Can then assimilate the TWS observations. However, serious loss of ensemble spread occurs almost immediately.

In general, the SWE estimates compare favorably to CMC data, but not universally.

Quick recap of presentation highlights (as I saw them):

#7) Peirong Lin … runoff

Implemented a vector-based river routing scheme (RAPID) in WRF-Hydro system as opposed to the existing grid based scheme.

Will aid water managers – can run efficiently at very high resolution because of the “pour-point”, reach, and coupling file mechanism.

The efficiency enables the use of ensembles – can quantify uncertainty!

Still assessing the accuracy, but the vector channel output may better match the observations and should facilitate data assimilation.

Talking Points from an outsiders' point of view (finally):

What kind of information do we need for drought management?

- soil moisture at what scale?
- precip?
- soil texture/property maps – yes or no – at what resolution?
- are anomalies more informative than absolute soil moisture?

What kind of information for flood management?

- High rez topo … GIS not good enough?
- The list goes on and on …

How do we collect and disseminate this information?

How do we visualize and convey risk?

Soil texture maps are one thing – would soil parameter maps be more useful? – textures are pretty coarse definitions.

Talking Points

Downscaling problems were everywhere. There was some discussion of using covariates (primarily elevation).

We are relying on the land models to do the spatial downscaling for us – in my opinion, this is why people are using data assimilation. In some sense, they become a very clever interpolant. Thoughts? Riots?

Integration of efforts. At some level, lots of resources exist and the best use of the National Water Center might be consolidate resources to facilitate the transformative science that will really serve the public.

Personally, I love the notion of consolidates services. I've been frustrated for years that the data is so federated. It is hard to find if you don't know where to look.

I feel as though I am always using 'yesterdays' model/data/method/observations.