Predicting Flash Flooding in Namibia

Around the world, flash floods devastate crops, homes, and lives with unfortunate regularity. A 2008 World Meteorological Organization (WMO) survey of 139 countries found that, in 105 of those, flash flooding ranked as one of the top two natural hazards of greatest concern. More than five thousand people are lost every year to flash floods around the world – more than those killed by high winds, tornadoes, lightning, or any other storm-related hazard. Research from the United States Agency for International Development (USAID) indicates that nearly all the nations of the world are susceptible to these tragic events. Flash floods are difficult to forecast and monitor because they require multi-disciplinary understanding from the forecaster, who must be knowledgeable about both the meteorological and hydrological factors leading to these events. Additionally, because flash floods occur over small temporal and spatial scales, the number of observations required to successfully forecast flash floods is high and represents a significant economic barrier in not only developing but also developed nations.

When run at high temporal and spatial resolution, distributed hydrologic models are capable of predicting small-scale, rapid rises in water level. Over the United States, the Flooded Locations and Simulated Hydrographs (FLASH) project currently produces real-time forecasts of flash flooding six hours into the future running at a resolution of 1-km/5-min. The current standard used for forecasting flash flooding in the US and around the world is flash flood guidance, which, put simply, consists of a single number for a given location. This number represents the amount of rain required over a given period of time in that location to produce bankfull (e.g., flooding) conditions on small streams and rivers. Preliminary results from FLASH suggest that it is currently as skillful as FFG and with continued calibration and improvement will eventually become more skillful than FFG.

The advent of modern computing systems and a better understanding of how to apply parallel processing to distributed hydrological models has made projects like FLASH technically possible. The main input needed for systems like FLASH is regular gridded rainfall estimation. In the US and other developed nations, these rainfall estimations are derived from Doppler weather radar networks. Rainfall estimates from space-borne instruments (combined with a smattering of ground-based rain gauges) make running distributed hydrologic models a worldwide possibility. Calibration of distributed hydrologic models is a computationally intensive task well suited to modern cloud techniques. Additionally, as the resolution of these models increases, their skill at forecasting flash flooding tends to improve, with a concomitant increase in required computing power. The requested travel to Namibia will allow knowledge to flow in two directions: the Namibian hydrological community will be trained in how to use the Coupled Routing and Excess Storage (CREST) model that underlies FLASH, while the FLASH research team will learn about the needs of the Namibians and the opportunities for improving flood forecasts in their region. It is anticipated that when CREST is expanded to Namibia its outputs will be added to the Namibia Flood Dashboard and run on the Open Cloud Consortium system, for use by interested parties in Namibia, sub-Saharan Africa, and around the world.

References

FLASH project website:
http://blog.nssl.noaa.gov/flash

Report of the 13th WMO Commission for Hydrology:
http://www.wmo.int/pages/prog/hwrp/chy/chy13/CHy-XIIIreport.php