Remarks by John T. Snow – 14 March 2016

Two recent events of which you should be aware and take into account in your planning, personal and professional, for the future

* the Earth is warming and seemingly doing so at a rate that is unexpectedly rapid

> 2015 was the warmest year on record, 0.9C above long term normal (since 1880); surpassing 2014, which was 0.74C above normal - NASA GISS
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> February 2016 was the warmest month in a sequence of warmest-ever months (December 15, January 16). It was 1.35C above the long-term global average, 0.2C above January 16, the previous record holder - NASA GISS

* An international panel convened by the NAS/NRC has published this past week a report, ***Attribution of Extreme Weather Events in the Context of Climate Change***. This report is free for download from National Academy Press. It offers carefully vetted techniques for sorting out where unusual weather events. Some of the examples where there is a clear climate connection are cause for concern.

Without question, we live in a world with a changing climate, where the magnitude of the changes are now well

beyond normal variability. The seeming increase in the rate of change is particularly worrisome, since the pace of change may exceed the ability of parts of the world to adapt to these changes.

The changing climate manifests itself in many ways. Long term trends are towards warmer, dryer, dustier/smokier conditions (or in few places, the opposite, towards cooler, wetter conditions). Almost out sight for most of us, the Arctic appears to be on a track to a near-ice free state. This may have as yet unknown consequences for the large scale weather patterns across the North Hemisphere. What is happening to the Antarctic is less clear, but again, one should expect that large scale weather patterns in the Southern Hemisphere will undergo changes from what we have known in the past.

Of particular interest to this group: Change in large scale weather patterns likely means more frequent, more intense severe/hazardous/unusual weather.

This brings us to the growing need for much enhanced Early Warnings (EW) to ensure public safety, economic prosperity, and sustainable development.

To provide effective EW, one must have a solid base of technology (hardware and software) + a professional staff that can quickly and smoothly **monitor, process, forecast, and communicate** when a weather hazard occurs. My role and the role of several others on the

CIRDA technical team is to help you develop this end-to-end system.

Much of our emphasis in the first two years of the CIRDA program has been on monitoring the atmosphere. In past workshops, we have talked about monitoring technology, especially surface weather and hydrology technology, a good bit. Surface data are good but not sufficient - one also needs access to satellite data, lightning data, radar data, aircraft obs, etc... to develop a full 4-D picture of what is happening in the atmosphere.

Point: collecting and archiving surface data is good but in and of itself, not enough. It is only a first step in building **an end-to-end system that converts data into information that decision-makers can use, then effectively communicates that information to those users. It is this effective communication that constitutes the "last mile".** Given the diversity and breadth of the users and the nature of the communication means, this is very complex process.

This meeting focuses on communication across the last mile to users, another major/essential element of the end-to-end system. As the "lead technical guy" on the CIRDA team, I would like for this workshop to trigger some **backwards planning** on your part -- after we have an in-depth look at communicating across the last mile, what tech/operational procedures/organizational change are necessary for processing and forecasting within your NHMS to effectively provide EW your users?

Let me close by noting that producing and communicating EW will likely lead to significant institutional change. It will almost certainly change the pace of work, make the work more exciting, and help build the credibility and reputation of the NHMS, aspects essential if the NHMS is to survive in the 21st century.

Thank you very much