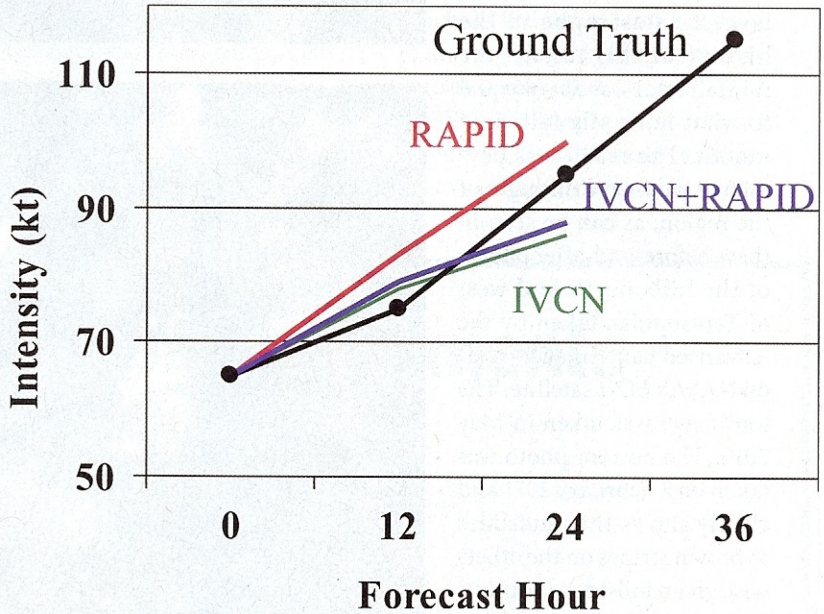
gional Climate Center at Cornell University, five cities that have at least 70 years of temperature data sweated through the warmest year in their history in 2010: Boston, Massachusetts (average temperature of 53.8°F); Providence, Rhode Island (53.7°F); Hartford, Connecticut (52.9°F); Concord, New Hampshire (48.725°F); and Caribou, Maine (44.2°F). The previous records were 53.6°F in 1949 for Boston, 53.5°F in 2006 for Providence, 52.8°F in 1990 for Hartford, 48.7°F in 1998 for Concord, and 42.4°F in 2006 for Caribou.

Four other places—Atlantic City, New Jersey; Bridgeport, Connecticut; Portland, Maine; and JFK Airport in New York City—had their second-warmest year on record. Other northeastern locations that experienced top-20 warmth in 2010 include Washington, D.C. (4th warmest); Philadelphia, Pennsylvania (4th); Burlington, Vermont (4th); New York City's Central Park (7th); Wilmington, Delaware (7th); Worcester, Massachusetts (10th); Scranton, Pennsylvania (14th); Albany, New York (14th); and Buffalo, New York (18th). For Boston, Atlantic City, Portland, Washington, Philadelphia, Central Park, Albany, and Buffalo, temperature records go back at least 130 years.

PAPERS OF NOTE

A Deterministic Rapid Intensification Aid

While rapid intensification (RI) in tropical cyclones (TCs) remains difficult to forecast, progress over the last decade has been made in developing probabilistic guidance for predicting these events. One such method is the RI Index—a probabilistic text product available to National Hurricane Center (NHC) forecasters. Instead of providing a quantitative prediction of TC intensity change, the RI Index incorporates a number of atmospheric variables linked to TC intensity changes to estimate the probabilities that maximum winds will increase by 25, 30, and 35 kn for the 24-h period commencing at the initial forecast time. To turn those probabilities for RI back into a quantitative prediction that forecasters can easily consider in real time, we developed a deterministic intensity forecast aid from the RI Index that looks for probabilities only above predetermined thresholds before applying one of the rates. We then implemented this new deterministic RI aid (RAPID) as part of a consensus intensity forecast (an average of several deterministic intensity forecasts), and immediately realized improvement in the new consensus forecast.



Intensity forecasts for OMAR on 15 Oct 2008 at 0000 UTC. The deterministic rapid intensity (RI) forecast aid (RAPID) and the NHC variable intensity consensus (IVCN) are shown along with the post-season analyzed verifying intensity (Ground Truth). A consensus intensity forecast that combines RAPID and IVCN (IVCN+RAPID) is a slightly closer fit to the actual verified intensity than IVCN.

RAPID is constructed using the highest RI index intensification rate available for probabilities at or above a given threshold probability. For example, if the RI index determined probabilities of 45%, 55%, and 60% for its three intensification rates (25, 30, 35 kn), respectively, and the threshold probability set by RAPID was 50%, RAPID would choose 35 kn as the 24-h quantitative intensification forecast. Its quantitative prediction is then presented to forecasters along with the other intensity prediction aids. Results indicate that the higher the probability threshold is, the better RAPID performs. It appears to outperform the consensus aids (averages for various combinations of deterministic intensity forecasts) at about the 50% probability threshold. When included in the consensus aids, RAPID improves consensus aid forecast errors starting at a probability threshold of 30%, and it reduces undesirable negative biases.

Our research, which sampled stable statistics from storm intensity forecasts during the 2006–08 Atlantic and Eastern Pacific hurricane seasons and then used 2009 season data from both basins for

DON'T EAT THE DIRTY SNOW

One might think that compared to most places, Mount Everest is a nearly pristine, unspoiled location barely tainted by human activity. Think again. While a student at the University of Southern Maine in 2006, Bill Yeo took soil and snow samples when hiking Everest. He collected soil on the Rongbuk glacier at elevations of 5,330–6,550 meters, and gathered snow along the climbing route of the northeast ridge between 6,850 and 7,750 meters. Analysis of those samples, published recently in *Soil Survey Horizons*, showed amounts of both arsenic and cadmium exceeding the U.S. Environmental Protection Agency's maximum contaminant levels. The higher Yeo went, the more polluted the soil samples were, suggesting that the toxic substances were carried there from industrialized Asian locations by high-altitude winds (the snow samples did not show any altitude patterns). There was no evidence in the research that the chemicals were seeping into local water supplies, but as both cadmium and arsenic are known carcinogens, hikers throughout the Himalayas have been advised not to consume snow at high elevations.

evaluation, suggests using a 40% threshold for producing RAPID, initially. The 40% threshold is available for approximately 8% of all verifying forecasts, and it produces approximately a 4% reduction in mean forecast errors for the intensity consensus aids. It also corrects negative biases in consensus forecasts by approximately 15%–20%. This threshold could be adjusted upward to maximize gains in skill (reducing the availability of RAPID) or downward to maximize the availability of RAPID (reducing gains in skill), depending on the desires of the operational forecasters.

We anticipate that this new deterministic RI aid, RAPID, will provide forecasters with a more realistic suite of deterministic guidance in RI situations. Additionally, we feel it is feasible to extend RAPID forecasts beyond 24 h, and that other probabilistic guidance could be leveraged to produce deterministic guidance in a similar way.—CHARLES R. SAMPSON (NAVAL RESEARCH LABORATORY), J. KAPLAN, J. A. KNAFF, M. DEMARIA, AND C. A. SISKO. *"A Deterministic Rapid Intensification Aid," in a forthcoming issue of* Weather and Forecasting.

CHAPTER CHANNEL

Delaware-Philadelphia Area's Chapter Holds Winter Weather Forum

Paul Heppner, program manager at Global Sciences & Technology, Inc., kicked off the chapter's Winter Weather Forum, which took place on 16 February 2011 at the National Weather Service Forecast Office in Mount Holly, New Jersey, with his presentation on 500-hPa anomalies and teleconnections and how they played a part in the record-setting winters of 2009–10 and 2010–11. His talk contained a review of snowfall data from Washington Dulles International Airport, Philadelphia, New York, Boston, and Portland, Maine. The data showed that the heavier snowfalls this year have been from Philadelphia northward to Boston, unlike last year, in which the heaviest axis of snowfall seemed to be from Philadelphia to Washington, while areas farther north, such as Boston to Portland, were relatively spared.

In a review of the bell curve of seasonal snowfall for Philadelphia, Heppner demonstrated that the snow that fell in the winters of 2009–10 and 2010–11 to 15 February was more than one standard deviation greater than the annual 30-year mean. In other words, Philadelphia has had two winters in a row with snowfall greater than 33 inches (for Philadelphia, mean annual snowfall is approximately 20 inches with a standard deviation of 13).

Heppner showed maps of 500-hPa circulation and height anomalies, which indicated that the persistent upper-level low located in Eastern Canada from summer 2009 to March 2010 came back in the winter of 2010–11, along with a persistent upper-level trough in the eastern half of the United States. The height anomaly data showed generally lower-than-average heights from eastern North America through much of Europe in the winters of 2009–10 and 2010–11, while at the same time there were generally higher-than-average anomalies in the polar regions of the Northern Hemisphere.

Heppner concluded with an explanation of various teleconnection indices, most notably the North Atlantic Oscillation and the Pacific/North America Oscillation and the general effects they can have on the overall weather pattern. He noted the importance of not "pinning the tail" on just one of the teleconnections to explain weather events, as there are 13 various indices that can affect global circulation.

Next up was Al Cope, NWS Forecast Office science and operations officer in Mount Holly, New Jersey, who reviewed the various winter storms that affected the region in the winters of 2009–10 and 2010–11 to date. Cope showed radar loops, surface maps, and the storms' NESIS ratings. The NESIS (Northeast Snowstorm Impact Scale) is a scale developed by Paul Kocin and Louis Uccellini that rates high-impact snowstorms based on the amount of snow that falls in a given area and the population of that area, and then assigns each storm a category from 1 to 5 according to its calculated score. The categories are: 1 (Notable): NESIS Value 1–2.49; 2 (Significant) 2.5–3.99; 3 (Major) 4–5.99; 4 (Crippling) 6–9.99; and 5 (Extreme) 10.0+. Cope noted that the storms that affected the area were generally category 2 and 3 on this scale. Among the storms he discussed:

- 19–20 December 2010—This storm brought a record December snowfall of 23.2 inches to Philadelphia International Airport (PHL), with less to the