A Roundtable Discussion of the Climate Outlook for the Intermountain West

The winter and spring seasonal forecasts issued by the National Oceanic and Atmospheric Administration (NOAA) Climate Prediction Center (CPC) show the Southwest as having "equal chances" of above-average, near-normal or below-average precipitation (i.e., there's no forecast). Given this, WWA and CLIMAS sought the input of experts to contribute their insight to a roundtable discussion on how the region's snowpack and water supply might fare this winter and spring. The following is an abbreviated version of the discussion that took place on November 18th, 2005, focused on the Intermountain West. The order of some topics in that discussion has been changed and minor edits were made for clarity. For a version focusing on Arizona and New Mexico, see the December issue of the Southwest Climate Outlook (http://www.ispe.arizona.edu/climas/).

Roundtable Participants:
Klaus Wolter, PhD, Meteorologist, NOAA-CIRES Climate Diagnostic Center, Boulder, and research associate, WWA
David Brandon, Hydrologist in Charge, NOAA Colorado Basin River Forecast Center
Jeff Smith, Senior Hydrologist, NOAA Colorado Basin River Forecast Center
Holly Hartmann, PhD, assistant research scientist, Department of Hydrology and Water Resources, and investigator, CLIMAS, University of Arizona
Melanie Lenart, PhD, roundtable moderator and research associate, CLIMAS, University of Arizona

LENART: With the Climate Prediction Center seasonal forecasts that are coming out for winter precipitation, there's not much to say for the Southwest. From the CPC prognostic discussion, they feel that El Niño signal and the Madden-Julian Oscillation are both neutral as is the

North Atlantic Oscillation. (The MJO is a fluctuation characterized by a 30- to 60-day cycle in tropical Pacific precipitation. This in turn affects global circulation patterns, including the jet stream over North America, which influences precipitation patterns and amounts in the Southwest over short time periods). Klaus, why do you see a potential La Niña?

WOLTER: I'm not saying that I'm expecting a La Niña event. However, the whole Pacific behavior in terms of what has happened with sea surface temperatures and precipitation patterns over Indonesia, the initial strong track into the Pacific Northwest, the coolness over Alaska-- they all point to more of a La Nina type setup than we've seen in about four years. The NOAA definition of a La Niña is a three-month running average of -.5^{o}C or lower sea surface temperatures, so it would be three months at least before we could definitely say we had a La Niña, although the atmosphere over the western hemisphere is acting like it's feeling one.

LENART: I noticed that CPC has Florida projected as dry, and the Southwest and Florida tend to have the same precipitation direction. They're both dry during La Niña years. Does that dryness have anything to do with the ENSO conditions you're describing?

WOLTER: No, I think that prediction came from a variety of factors other than ENSO status. The dry Arizona signal didn't come from La Niña-- it was from the warm tropical Atlantic, especially the Caribbean. The very active hurricane season, anchored low pressure over the Caribbean and promoted high pressure upstream in Arizona. The experimental forecast guidance I issued last month for January-March is a very simple dipole, with wetness in Utah and western Colorado and dryness in New Mexico and eastern Colorado (http://www.cdc.noaa.gov/people/klaus.wolter/SWcasts/index.html). Interestingly, I have a neutral condition for Arizona, which does reflect the current state of ENSO being almost neutral. If we

had a full-blown La Niña, I would definitely go dry in Arizona. Right now, it's too close to neutral to call.

LENART: Dave, given the forecasts for winter precipitation, what do you see in terms of streamflows?

BRANDON: We put out more of an "outlook" than a "forecast" this time of year (http://www.cbrfc.noaa.gov), since this early there's a lot of error involved. Before the '98 El Niño, our forecast would start on January 1st , but lately we've been looking earlier, e.g. in October or November to see if there are climate signals we can pick up. One of the things we look at is the antecedent streamflow of the system, or in other words what are the flows of the river in the fall compared to normal. We also have a soil moisture model which is probably the most important factor. Finally, although there's not much snowpack this early, we have 116 NRCS SNOTEL (Natural Resources Conservation Service snowpack telemetry) sites above Lake Powell that we look at. We combine all three of these factors and compare them to last year and other years' averages.

Obviously, it's very early in the season, but our outlook is slightly below average right now, and last year at this time we were a little bit above average. When we run these outlooks, the main thing we find is that we can be about 10 to 16 percent more accurate when averaged over many predictions than we would be just using the climatological averages for the last 30 years. A lot of that increased accuracy comes from the soil moisture model. If you've been in a very dry or wet period, the models reflect that well.

We also look at ENSO (El Niño Southern Oscillation) signals. We now have an operational procedure in which we look at CPC forecasts for the season and translate those into a shift in precipitation or temperature based on ENSO predictions. For example, we've found that in the last 15

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La Niñas, 14 were dry in Arizona. There isn't a strong ENSO signal right now, but that's something we're starting to look at: a trend towards a La Niña. Using these variables, we come up with an ensemble streamflow prediction and then run previous years through our model to check it.

LENART: From what you're saying, it sounds like you have some bad news for us in terms of your streamflow outlook this year.

BRANDON: Well, bad news is in the eyes of the beholder. There's a lot of error this early, but the current outlook for Lake Powell inflow indicates that it's going to be around 80 percent.

SMITH: That's around 6.5-6.7 million acre-feet from April to July. The average inflow into Lake Powell is about 7.9 million acre-feet.

BRANDON: In 2002, we had 1.1 million acre-feet, so it's relatively much better. When we ran the model last year at this time (November 2004),

the prediction was a little higher, but we'd had a wet fall and early snow in the San Juan Mountains. Last year we were coming off a very dry period, and we were still predicting a little below normal. For water year 2005, we ended up just a bit above normal for the whole basin. So what you end up with is another story. There's a lot of weather between now and August. Even in April, we can still be 20% off from what the actual runoff will be between April and July.

SMITH: The weather between April and July can have huge swings. And the other issue is, frankly, we don't have the greatest data network in the world. There's certainly error between what we think the snow and soil moisture distribution is and what it really is.

BRANDON: So even on April 1, we can still have error in the streamflow forecasts.

LENART: I know that the CPC forecast for temperature showed that the West has a higher probability of being warm. Holly, how reliable are those for this area?

HARTMANN: Temperature forecasts in general are much more skillful than precipitation forecasts although precipitation forecasts, when available, are fairly good in Arizona and New Mexico for the winter season. By and large, the temperature forecasts are excellent for the entire Southwest's winter season. The CPC's forecast is calling for a temperature like that of the warmest 10 years out of the last 30. When you think about what those ten warm years have done to the snowpack, you get an appreciation of the implications for the water supply next spring and summer.

LENART: Wasn't temperature an issue in 2002, where temperatures took some of the snow and sublimated, or evaporated, it?

WOLTER: That was the wind more than anything-- it was warm, but it was also very windy.

HARTMANN: And wind is not something in the CPC's forecast—the focus is on temperature.

BRANDON: I think that March 2002 was one of the warmest and driest on record and nobody's going to forecast that this early. That really was an oddball month, when the wind knocked 20% off the snowpack. Temperature really becomes important in that transition time between March and May where you can have large temperature fluctuations. It's not so much the temperature as it is how fast the temperature changes, and hence how fast the snowpack melts. Obviously, we put temperature in our model.

LENART: So if the temperature increases and melts the snow quickly, that can cause more streamflow.

BRANDON: Right- it causes more runoff rather than letting it soak slowly into the soil.

LENART: So it must be difficult to work out what temperature is going to do and whether its effect will be positive or negative?

BRANDON: When you get into the dynamic situation of trying to forecast, say, next week, we can get a better handle on that now than we could 15 years ago.

LENART: When trying to assess now what the temperatures are going to be in that key March-May period, is that based more on trend, or are other things involved?

HARTMAN: Trend is a large component of that, especially in the longer range forecast. The trend is based on what's called an optimal climate normal (OCN) derived from data from the last 10-15 years. That's an ideal period for looking at long-term trends. Although in a particular region there may be other periods that would work better, nationwide they've decided on 10-15 years.

WOLTER: The OCN seems to work really well for temperatures and often shows global change. The spring CPC temperature forecast is driven by trend, period. It is by far the strongest component- nothing else goes that far. A lot of the tools used latch onto the same temperature signal so you can get a trend-based prediction several different ways.

BRANDON: I have a final comment, which is this is why it's very difficult to take all this information and put it into streamflow numbers. Klaus has good information and a lot of people are looking at it, but it's difficult to turn into numbers.

LENART: So despite the CPC forecast for equal chances, there's a general feeling here that things might be a little bit drier and we might not get as much streamflow at least compared to last year if not the average.

BRANDON: Yes, especially in the Upper Colorado.

HARTMAN: In the face of uncertain seasonal forecasts, you can't expect to have a forecast all the time this far in advance. It's only really when you get strong signals from ENSO that you have something to utilize. Since the seasonal forecast is more of a forecast of opportunity, people who need to make decisions would be well advised to think about conditions that cause them problems and prepare for those rather than relying on a forecast to tell them what to do.

LENART: Thank you all very much.