Snowpack in the Pacific Northwest: What are the Controls?
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BACKGROUND:
Snowpack – both its extent and duration – is of central importance to resource managers. Prior studies have investigated trends and sensitivities of spring snowpack, of particular interest to water managers (e.g., Hamlet et al., 2000; Etner et al., 2009; Casola et al., 2009; Stedinger et al., 2010).
Water availability in cool and high-mountain ecosystems is often strongly sensitive to the ability of snowpack to persist into late spring and even summer. An improved understanding of the controls on late-season snowpack would allow resource managers to make more informed decisions regarding the vulnerabilities of forested lands.

GOALS:
1. Identify primary controls on late-season snowpack, both on regional scales and through case studies. Develop simple snow-sensitivity metrics for snow extent and duration.
2. Develop a high-resolution snow dataset for use with NetMaps* mapping software.

*NetMaps is a community-based watershed science mapping utility that can be used for analysis and decision-support in resource management (http://www.netmaptools.org)

FOCUS REGIONS:
USFS lands in Oregon and Washington
Specific attention paid to: Olympics, Wenatchee-Okanogan, Willamette, Deschutes, and Malheur National Forests

DATA:
1. VIC: Variable Infiltration Capacity Hydrologic model, run over the Columbia River basin and coastal drainages of the Pacific Northwest. Simulations were performed using historical data for 1916-2006 and future climate scenarios for the 2040s and 2080s. Resolution: 1/16th degree (~6 km), and 30 arc-seconds (~800 m).

REGIONAL-SCALE SENSITIVITIES:

Comparison with SNOTEL:

CONCLUSIONS:
The broad-scale sensitivities of late-season snowpack do not appear to be very different from those for April 1st. Furthermore, as confirmed by prior studies, VIC appears to faithfully capture the dynamics of snow cover at these scales, and is therefore suitable for assessing sensitivities at regional to smaller scales.

It is likely that snowpack is also sensitive to more localized processes related to landscape features and vegetation. However, attempts to associate snowpack persistence with landscape features (e.g., slope, aspect) have not yet not yielded any clear associations in either the VIC or the SNODAS data. (note: this appears to be true for both the 1/16th degree and 30 arc-second VIC simulations, the latter of which do account for the influence of slope and aspect). Possible explanations include the limited horizontal resolution, an incomplete radiative scheme, or confounding influences due to soil and/or vegetation type.

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