The Impact of Global Warming on the Pacific Northwest: A Movie

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Objectives

- obtain climatological mean of simulated snow cover for each julian day under both normal and double carbon dioxide conditions
- create a movie using images obtained from the regional climate model.
- study effect that global warming has on snow cover in the Pacific Northwest.

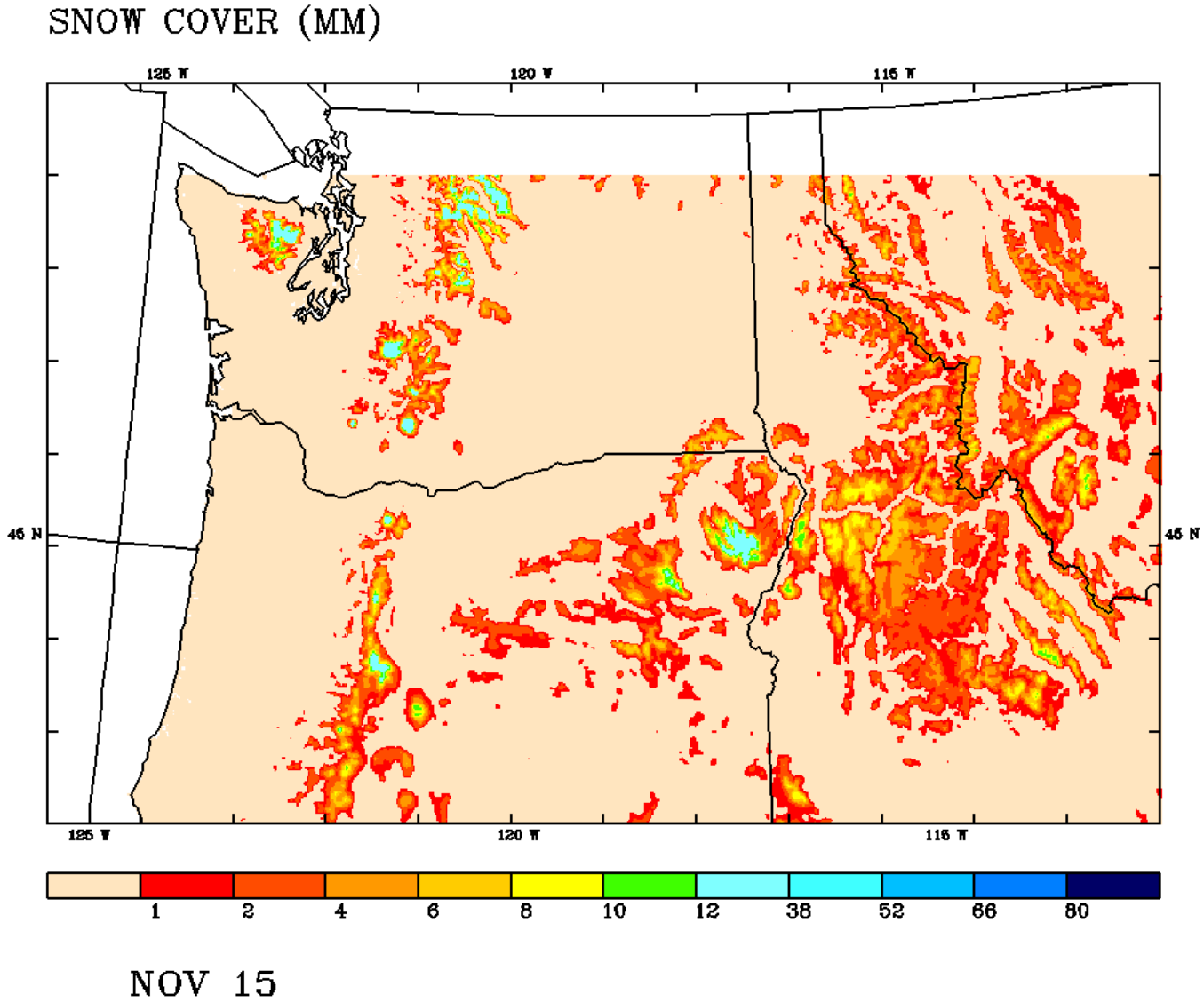
Results

- The product is a Quicktime movie that starts on September 1 and runs through August 31. It shows how the snow accumulates and then melts off during the year. This movie can be found at

http://www.pnl.gov/atmos_sciences/as_clim2.html#Regional Climate Modeling.

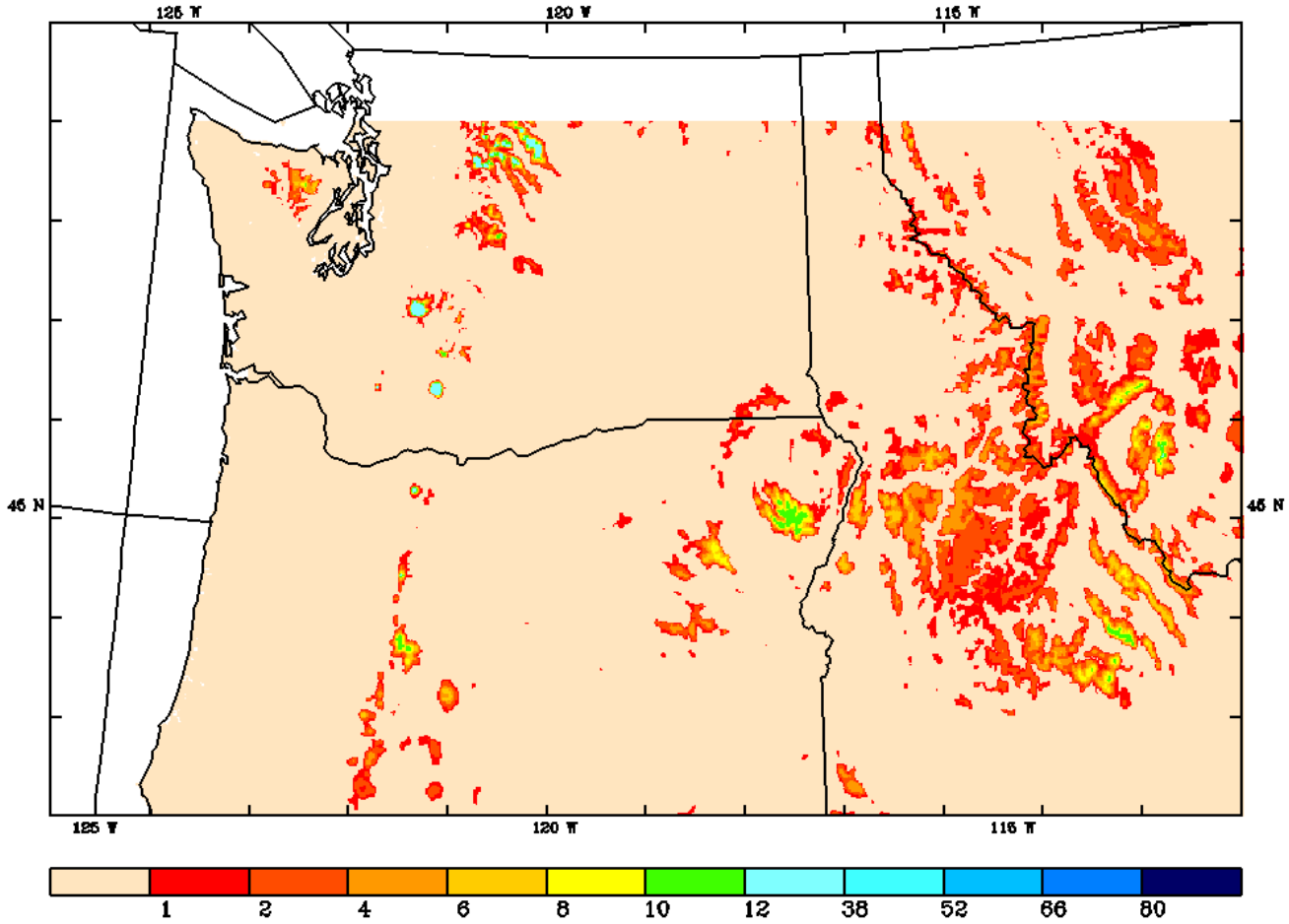
The following frames show the control and double carbon dioxide simulated snow cover for four select days: November 15, March 1, June 1 and August 31.

CONTROL


SNOW COVER (MM)
125 W
120 W
115 W
45 N
45 N
125 W
120 W
115 W
1
2
4
6
8
10
12
38
52
66
80
NOV 15

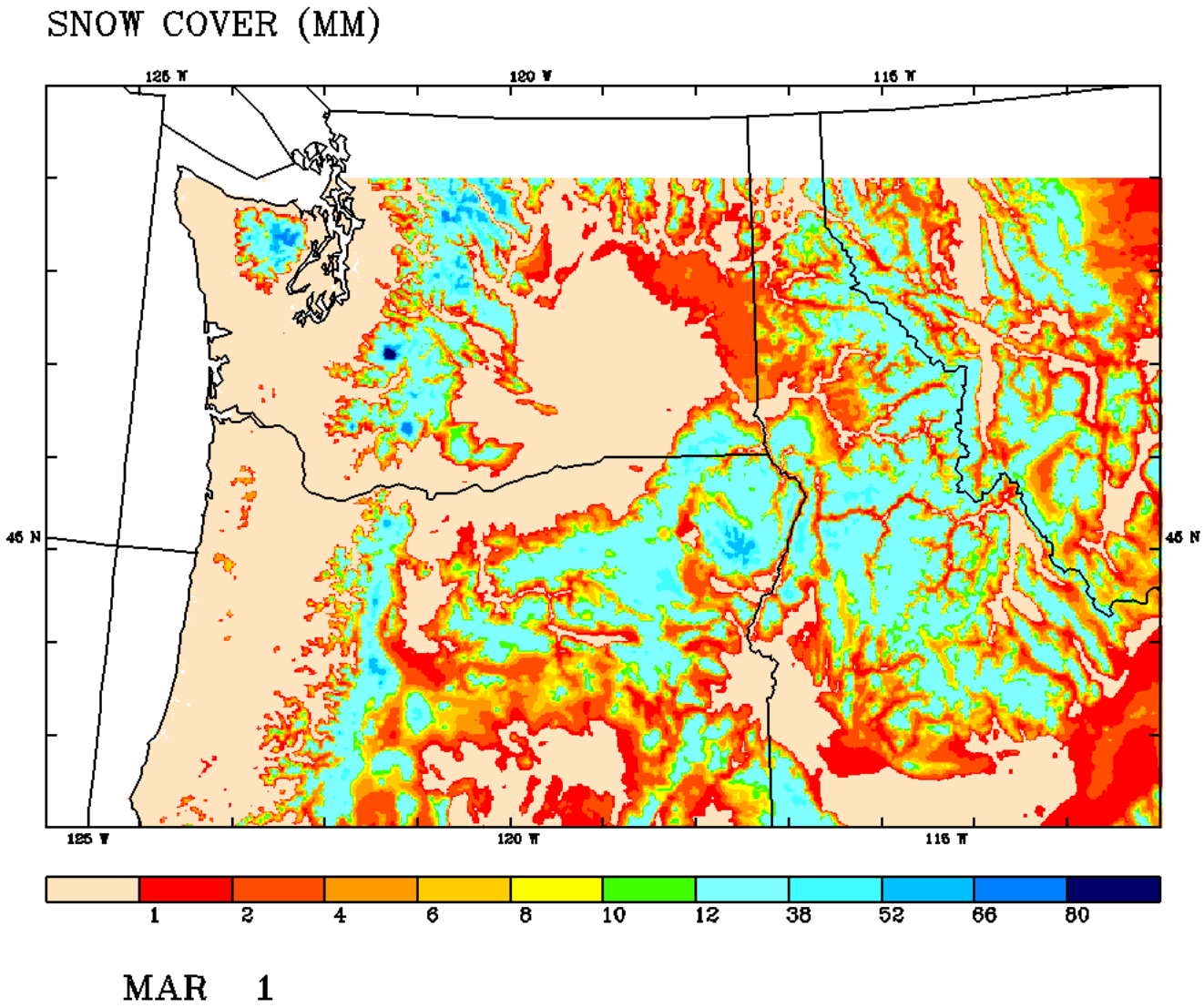
DOUBLE

SNOW COVER (MM)

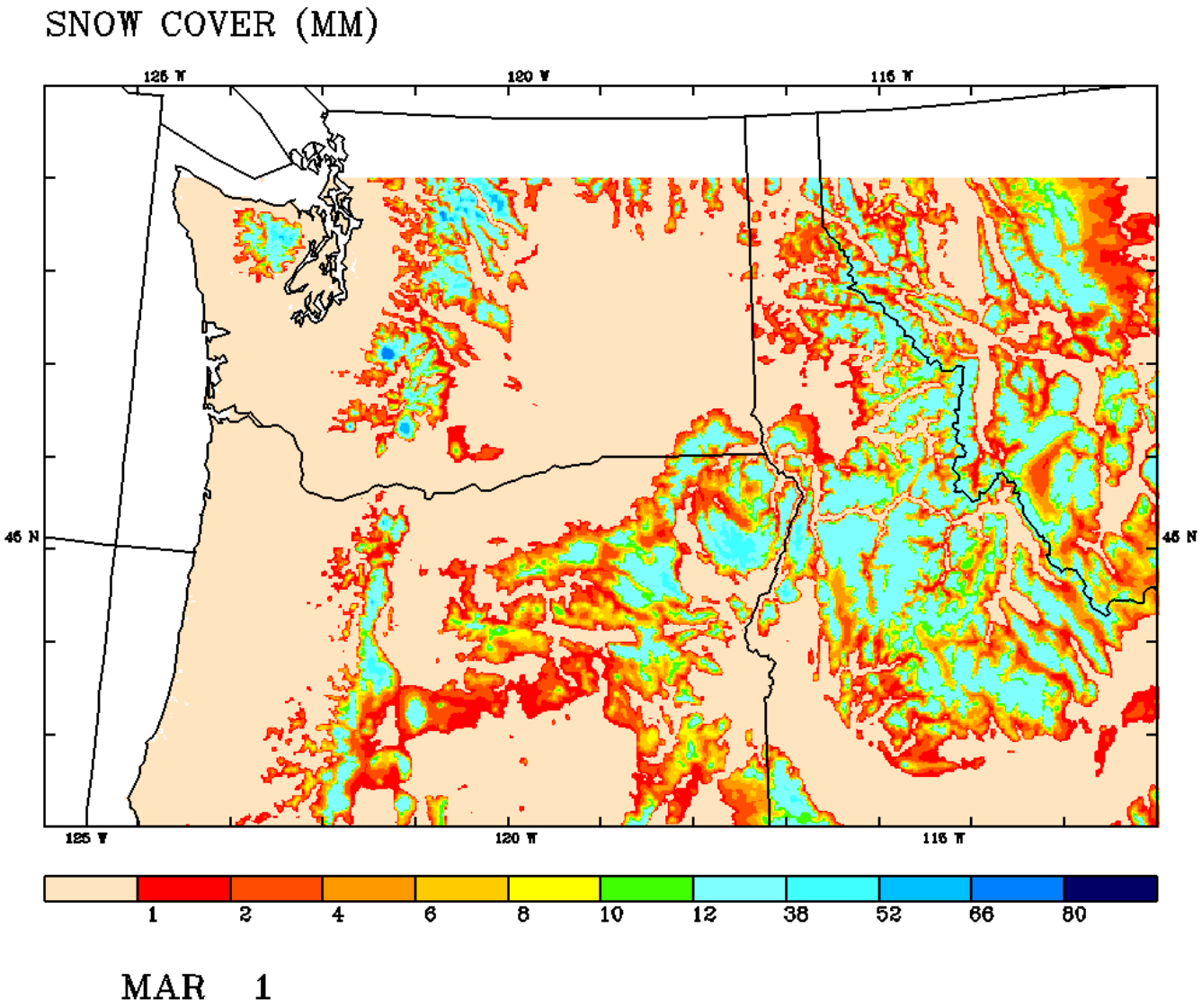


NOV 15

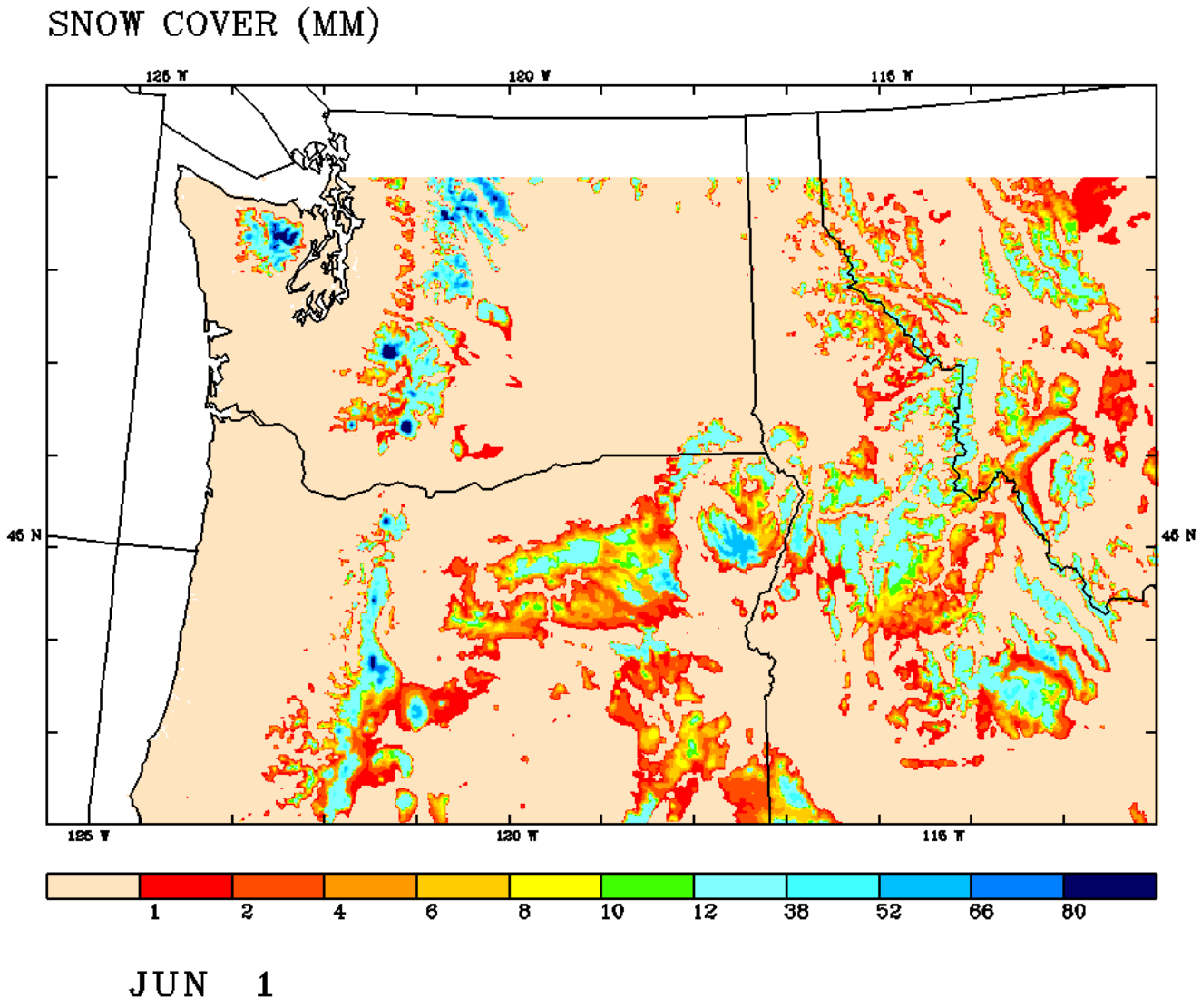
CONTROL



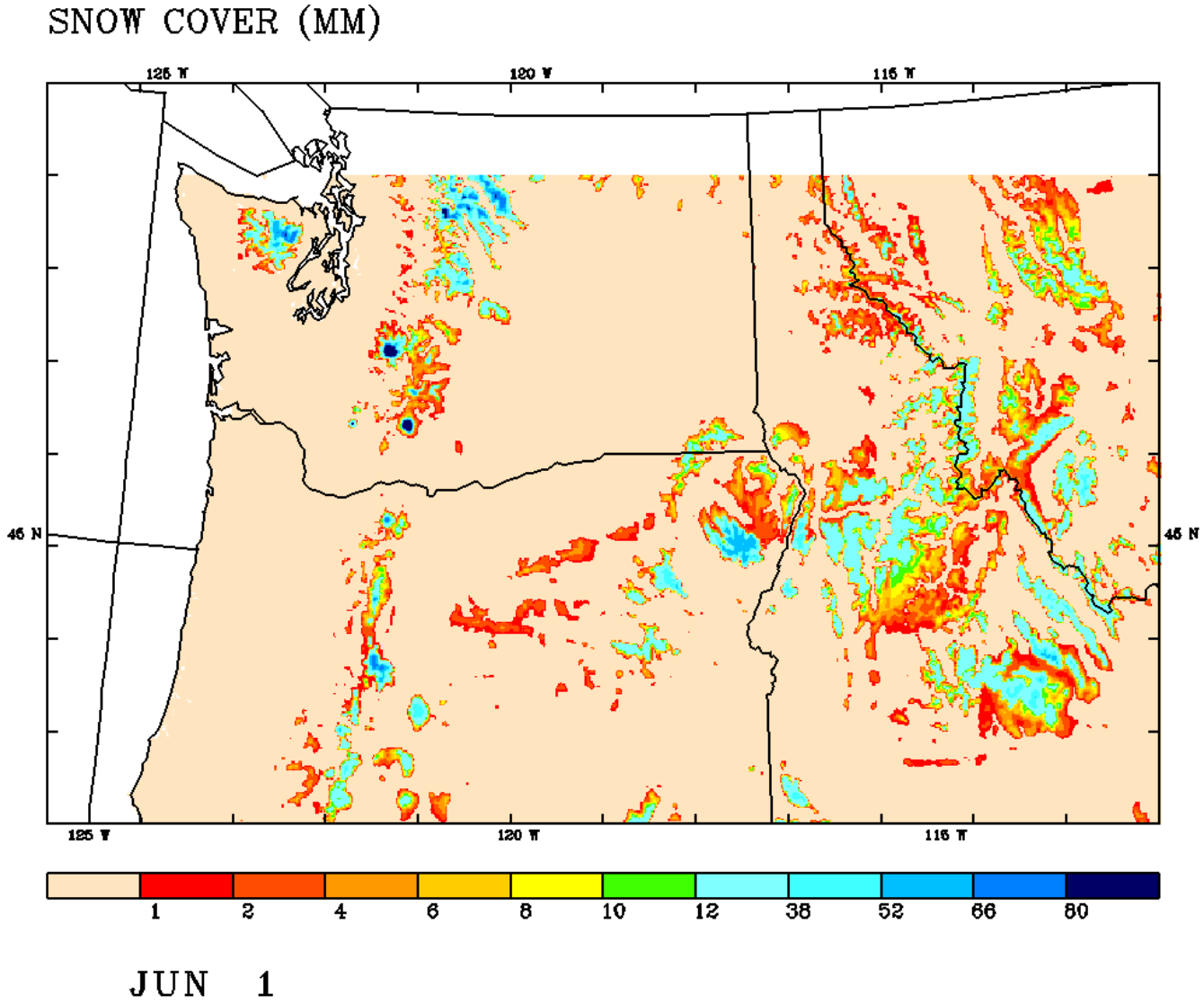
DOUBLE



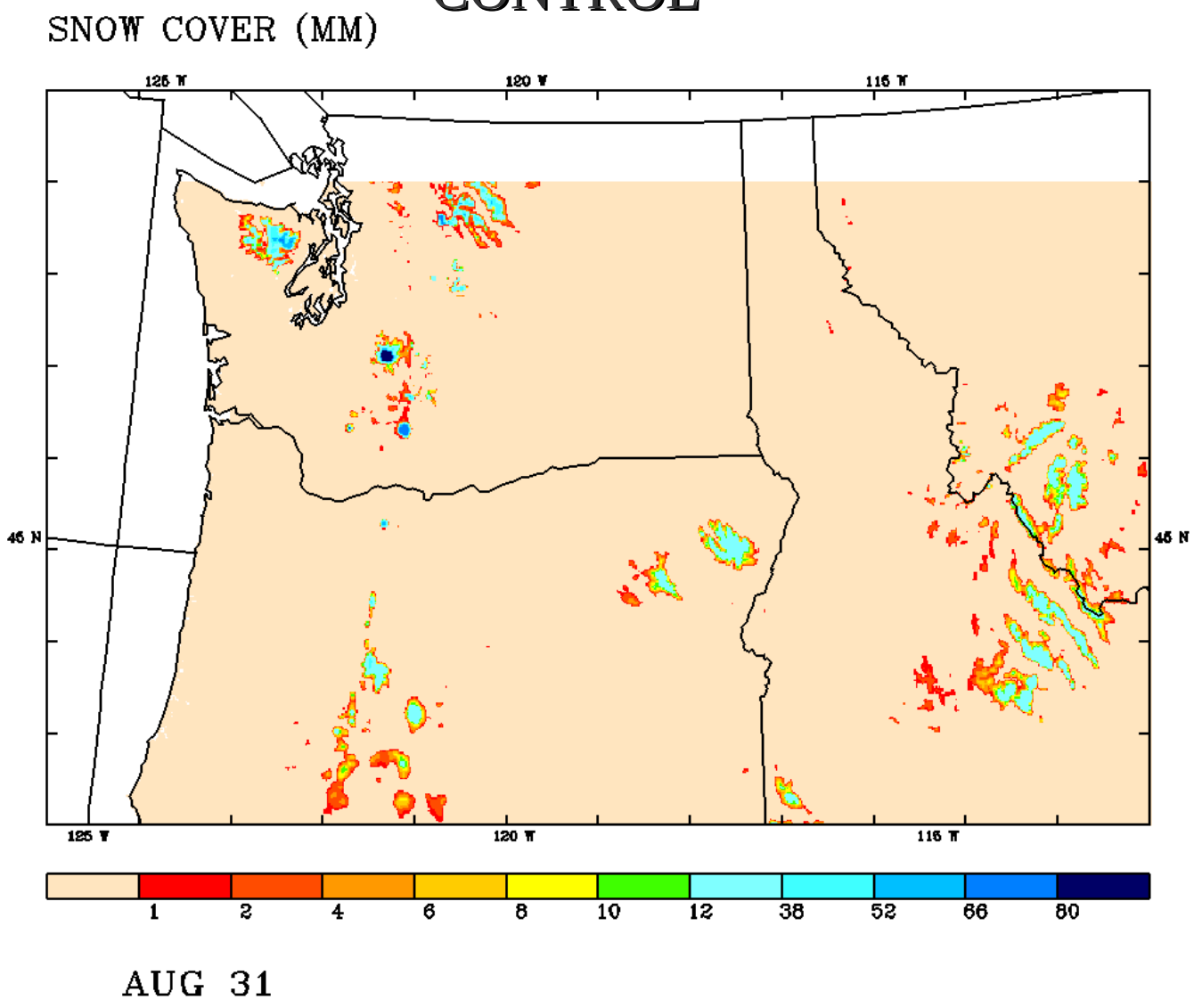
CONTROL


SNOW COVER (MM)
125 W
120 W
115 W
45 N
45 N
125 W
120 W
115 W
1
2
4
6
8
10
12
38
52
66
80
JUN 1

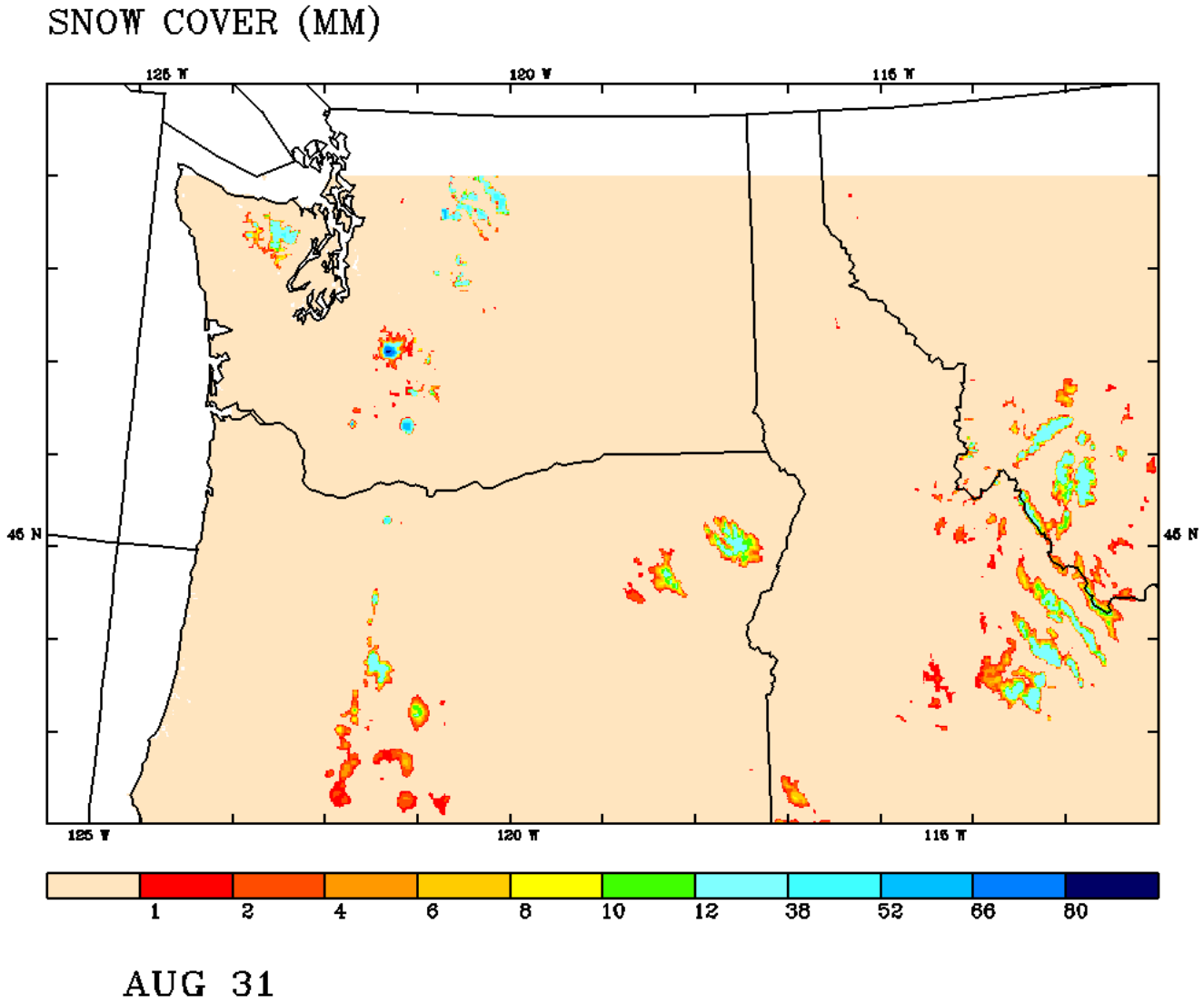
DOUBLE


SNOW COVER (MM)
125 W
120 W
115 W
45 N
45 N
125 W
120 W
115 W
1
2
4
6
8
10
12
38
52
66
80
JUN 1

CONTROL


SNOW COVER (MM)
125 W
120 W
115 W
46 N
45 N
1
2
4
6
8
10
12
38
52
66
80
AUG 31

DOUBLE



Discussion

- On November 15 the snow has begun to accumulate much more quickly under normal conditions than under the double carbon dioxide conditions. This is because increased levels of carbon dioxide in the atmosphere cause the surface temperature to rise. About the same amount of precipitation is expected to fall under both situations, but it will fall mainly as rain in the warmer climate.

- On March 1, a difference in sensitivity between the Cascades and the Rockies is apparent. Since the Cascades are lower and their temperature is only slightly above freezing, a small change in temperature affects them more by changing much of the precipitation from snow to rain. The Rocky Mountains, which are much higher, are affected only at the lowest elevations by these same temperature increases.

- On June 1 it is apparent that the snow has melted off more in the double carbon dioxide simulation than in the normal simulation. The higher temperatures and smaller snowfall totals cause the snow to melt away about two months earlier when there is global warming. This shift in the runoff period will decrease the amount of water available for irrigation during the summer months

- On August 31, the final day of the water year, there is not much of a difference between the simulations. It may seem surprising, though, that there is so much snow cover on the surface at this time. The higher peaks have lower temperatures year round, so they are expected to keep their snow. Some of this late-summer snow cover, though, can be explained by an error in the model.

Future Work

- Assimilate Canadian topographic data so that northern Washington can also be part of the climate simulation.
- Fix the error in the regional climate model snow balance that caused excessive snow cover during the summer months.

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