

December 2022 Weather Summary for UVic

The Month in a Minute video is on the You Tube (that's a link to click back there). This video summarises the month of December 2022 with a grid of daily time-lapse videos of the view looking north from UVic.

Typical December temperatures are around 5 °C and that's how the month began. The end of November was a bit cold but that changed to normal temperatures in the first week of this month. Figure 2 shows the daily average temperatures and the extremes for the month.

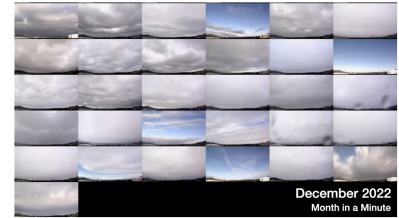


Figure 1: December time-lapse video from UVic.

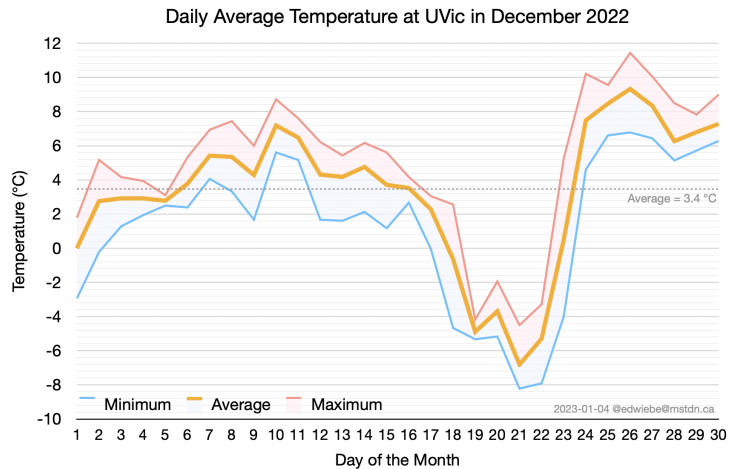


Figure 2: December temperatures at UVic.

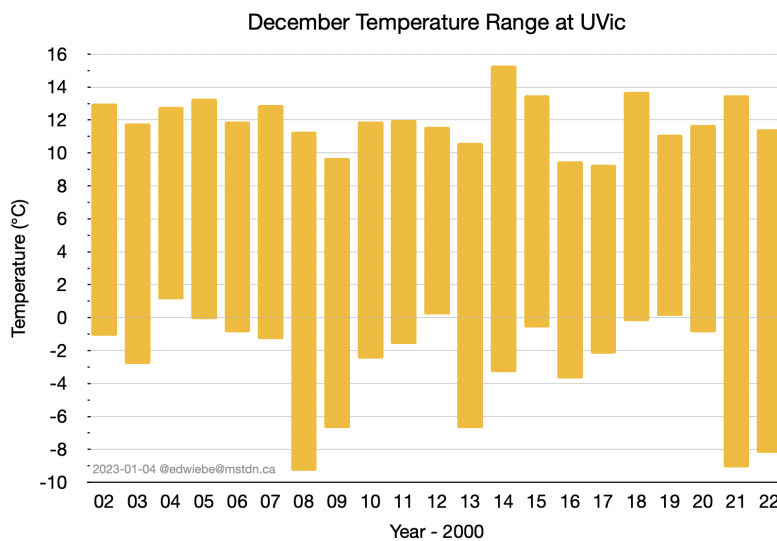


Figure 3: December temperature ranges at UVic.

Daily lows stayed above freezing for the first half of the month. We say a high of a bit more than 8 °C on the 10th. The December temperature range at UVic is mostly strongly affected by low temperature

events (Fig. 3). Warm events are much more unlikely in Winter for a variety of reasons. Cold events though, have a straightforward cause, cold continental and polar air masses that can extend west and south over UVic.

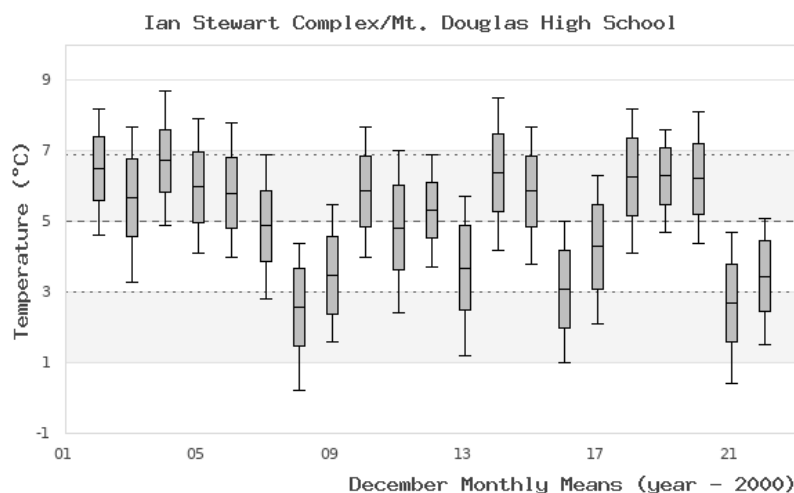


Figure 4: Monthly mean temperatures at UVic.

On the 18th of December this year we got a taste of winter. Arctic outflow winds reached south and west and temperatures dropped to, for Greater Victoria, extreme lows. We recorded -8 °C on December 21. This cold snap pushed the December average temperature down this year, well below the 20-year average (Fig. 4). When this sort of event happens, cold dry air rushing south jostles against warm and moist air over the Pacific Ocean. The colder air tends to push the warmer up causing it to cool and drop its load of water vapour as rain or snow. If that boundary between the warm and cold air moves over UVic we'll record rain or snow, depending on precisely how the air masses line up.

This year snow arrived on the 19th. We saw about 3 cm that day and then 17 cm more on the 20th (Fig. 7). Light and fluffy, the strong northerly winds blew it into deep drifts.

The evening of the 21st marked the end of the polar air mass' influence and temperatures rose steadily, returning to seasonal values by Christmas Day. Precipitation conditions warmed following the cold snap came in the form of freezing rain, another unusual Victoria event. Icy conditions were mitigated by the quickly rising temperatures so this wasn't as much of an ordeal as forecasters had feared. The rise back to normal temperatures was accompanied by rain, about 50 mm fell over five days.

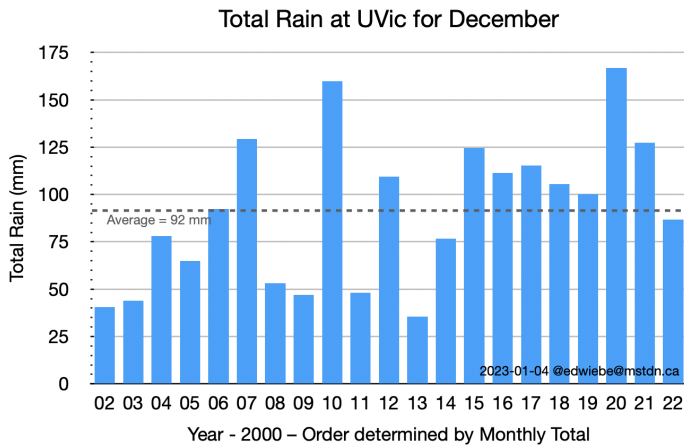


Figure 5: Total December rain at UVic.

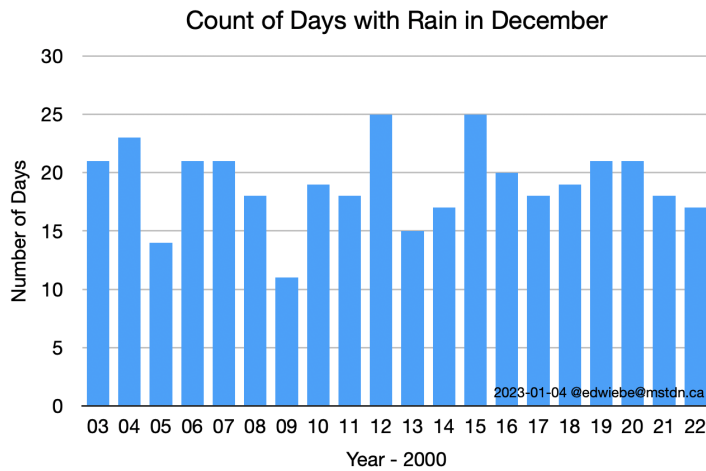


Figure 6: Number of days with rain at UVic.



Figure 7: People shovel snow in Victoria, B.C., after a heavy snowfall on Dec. 20, 2022. (Adam van der Zwan/CBC).

Overall, December 2022 saw 87 mm of rain, a few millimetres below the 20-year average at UVic (Fig. 5). The rain fell on 17 days, also a bit below the average (Fig. 6).

The late December rain and snow was the first substantial precipitation we saw this fall. Historically, November through January are the wet months at UVic (Fig. 8). We expect fall and winter rain to recharge ground water and refill the regional water reservoir. The reservoir water level is a great resource to see how our wet-dry seasonality in Victoria impacts us. The graph in Figure 9 shows that we use water at a greater rate than it is supplied by rain (and snow) during April through October. That pattern reverses in the fall, when water is added to the reservoir faster than it is removed. The rate at which we remove water doesn't change very much from year to year but the flow into the reservoir does. That's why we see such differences over the five-year period highlighted in the CRD (Capital Regional District) chart¹.

¹ <https://www.crd.bc.ca/>

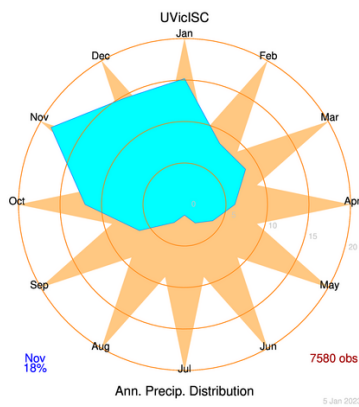


Figure 8: Seasonal rain pattern at UVic.

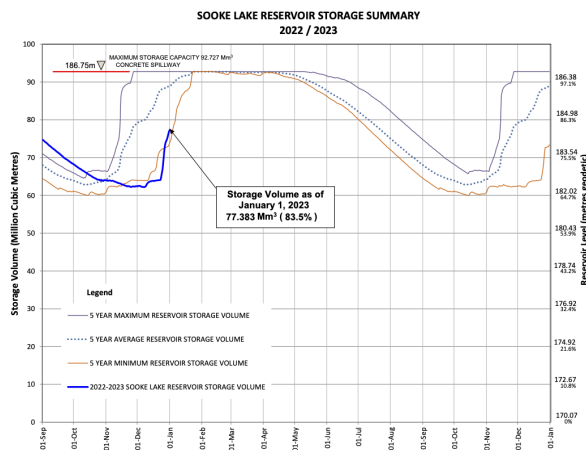


Figure 9: CRD water reservoir levels.

Rainfall in a given month is variable from year to year, and the range of possible total accumulations is large.

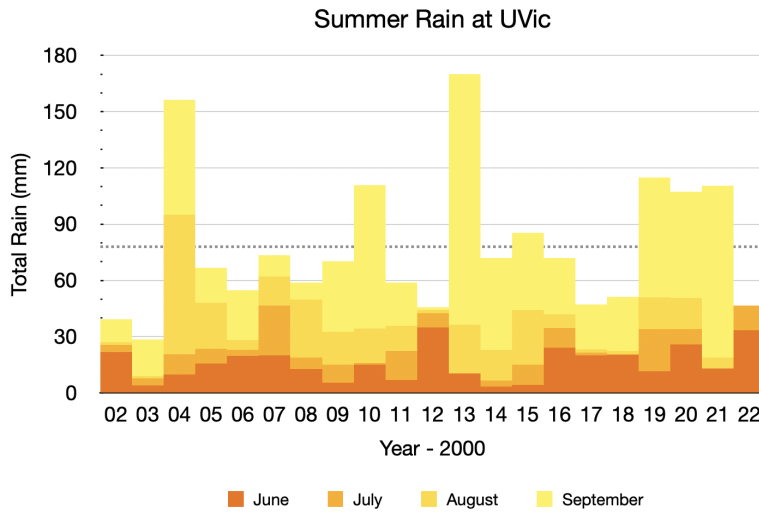


Figure 10: Summer rain accumulation.

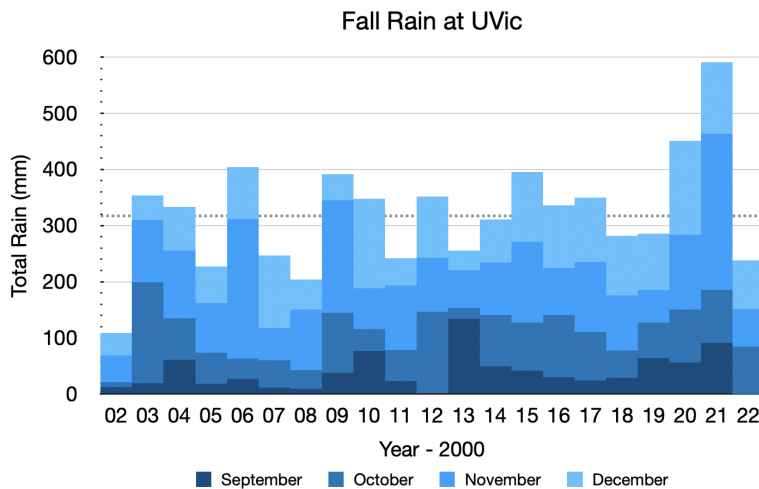


Figure 11: Fall rain accumulation.

Summer rain depends on uncommon weather patterns carrying moisture from the Pacific Ocean. These are frequently blocked or steered elsewhere by the strong high pressure systems that tend to sit near the southwest coast of Canada. Fall and winter rain is driven by cyclones that are steered toward us by the jet stream winds or by atmospheric rivers, streams of water vapour in the atmosphere, that tend to move southward along the coast of North America. Other

important weather patterns for us here at UVic are El Niño-La Niña, the Pacific Decadal Oscillation, and the so-called *Blob* in the northeast Pacific Ocean.

During December 2023 the equatorial Pacific ocean was in a La Niña phase, where cooler water is pooling in the eastern Pacific (Fig. 12²). This has a strong influence on us here at UVic since it tends to cause winter storms to deliver more moisture. That didn't seem to be the case this year though, we saw a record dry summer and fall and then reduced November and December rain (Figs. 10 and 11). The cause may be related to unusual surface warming of the northeast Pacific Ocean (Fig. 13³) and other unusual patterns such as warming in the Arctic. There are quite a few ways that large patterns of weather variability can affect our weather here at UVic.

² <https://scijinks.gov/la-nina/>

³ <https://www.severe-weather.eu>

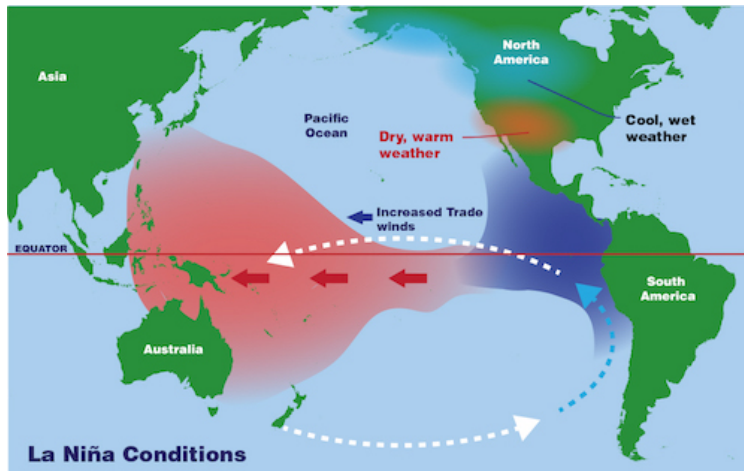


Figure 12: Cartoon of the La Niña phenomenon.

So far at least, we find that the return of rain in the fall and winter is reliable and refills the reservoir. Will this always be the case? How will climate change affect us?

Climate change is already impacting the region around UVic. Figure 14 shows us observations (blue curve) of temperature change (relative to the 1951–1980 climatological reference period). Also shown are four model projections for possible future temperatures in Victoria. Which path we follow depends on our choices now and in the future. This figure only shows temperature but we know that warmer air can hold more moisture, so there is an important effect on rain and snow as well.

One of the key expectations of climate change is that we're going to see drier dry seasons and wetter wet seasons around the globe. This past summer and fall was exceptional because no significant rain fell in August or September. This resulted in exceptionally dry soils around the region which has important impacts on plants such as Western red

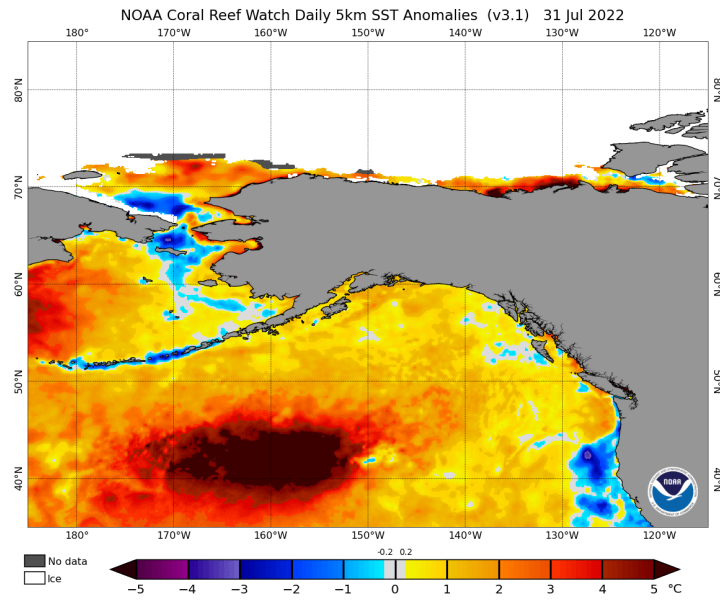


Figure 13: The *blob*, 2022-07-3.

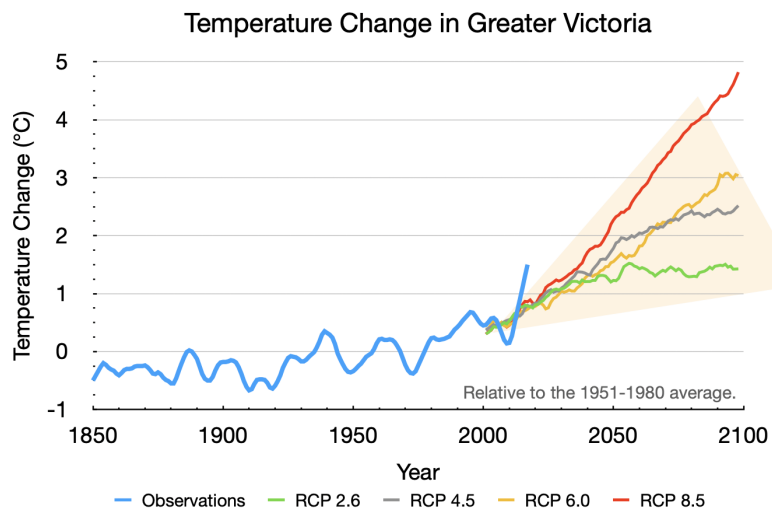


Figure 14: Climate change impacts on temperature at UVic with projections.

cedar, a tree that has been showing signs of significant decline on the southeastern margin of Vancouver Island and around Georgia Strait.

Looking forward to 2023, projections are showing the current extended La Niña continuing through January. After that models are suggesting equal odds for that continuing further or switching to a Neutral state. Environment and Climate Change Canada's seasonal forecasts suggest that the next three months will remain close to normal temperature ranges for Greater Victoria with suggestions of above average rainfall. The seasonal temperature forecast on the coast has better historical accuracy than the precipitation forecast so it's probably best to assume we won't see too many events that stray far from what we'd expect.