Last Spring Freeze

The cool, short summers of Southeast Alaska can be a challenge for warm season activities like gardening and construction. The last freeze in the spring is a good indicator for the start of the warm season, but how can you be certain the last one has occurred until well into summer? Although we may not be able to say with absolute certainty that freezes are over for the season, a statistical analysis of historical temperature records can provide the kind of information that we would need to make informed decisions about this event based on probability and risk.

The table below shows several standard statistical measures of the last freeze for southeast Alaska locations. One common approach is to use the "average date" or "mean" as a reference value, but by itself this could be misleading. For one thing, approximately half of the years studied will have occurrences later than the average. This wouldn't be very helpful if you were planning freeze sensitive activities, like moving tender plants outside. "Earliest" and "Latest" dates will give you an idea of the extremes that are possible, but in most cases planning around these dates would be too conservative to be useful. The standard deviation is useful for delineating the number of days on either side of the mean that a significant number of these events have occurred.

With any statistical study, there is a problem when the amount of data is relatively small, because the sample may not represent the distribution of possibilities. Extreme events can have a large impact causing the mean to be biased in one direction or another. For this reason, it is good to compare the median with the average. When close to the mean, the distribution of the data is less likely to be biased.

These basic statistical parameters are useful, but there is still more that can be done. To quantify the likelyhood of an event on a particular day, we can try to "fit" the data to a normal probability curve. This procedure assumes that, given enough years of data, the frequency distribution of the last freeze dates would be distributed in a "bell-shaped" pattern with the greatest number of events concentrated around the mean. Once the normal curve has been approximated we can determine probabilities for any given day.

From the normal curves we can then estimate the dates at which the freeze probabilities drop below certain thresholds. This provides a way of selecting a date based on an acceptable level of risk. For example, if you were planning a freeze sensitive outdoor activity in Downtown Juneau and could accept a 20% risk from one year to the next, you would plan the activity for May 6th.

So far, we have determined some general characteristics about the last spring freeze that would apply to any year, but we are not able to compare one year to the next, and we know that some springs arrive early and some late. To do this, we need to compare freeze dates to something that would reflect these annual differences. In the transition from winter to summer, the daily average temperature (average of the high and low) experiences the greatest change during the spring months as it warms to its summer maximum. We can relate the last freeze of the season to this transition, by evaluating it in terms of the number of days before or after an average temperature threshold was first reached.

For most southeast Alaska stations, when the average temperature first reaches 50 degrees, the chance of another freeze is fairly small and it decreases rapidly with time. The last four columns in the table show a statistical summary of the difference between these two dates. The numbers are positive when freezes occur after the first 50 degree average. One thing to note is that some inland locations have a wider range between the daily high and low temperature. These are the sites where the average number of days to the last freeze is positive by more than a week. At these stations, the 50 degree threshold is probably

too low and a threshold of 55 degrees may be more useful.

Last Spring Freeze Statistics Table. Select the Station Name to View Probability Curves

Station	Mean Date	Median Date	Earliest Date	Latest Date	Std. Dev. (days)	Mean Days after First 50	Median Days after First 50	Std. Dev. (days after First 50)	Prob on Day of First 50	Years of data
Yakutat	5/26	5/25	5/05	6/21	10.8	4.7	1.0	14.8	49%	52
Skagway	5/16	5/15	4/23	6/28	13.4	16.6	18.5	14.3	83%	17
Petersburg	5/16	5/15	4/20	6/16	14.7	11.7	9.0	15.7	65%	40
Sitka Mag Obs	5/14	5/15	3/29	6/10	14.0	-13.9	-14	20.1	16%	76
Juneau Airport	5/12	5/12	4/18	6/13	12.4	-2.8	0	9.8	28%	57
Haines Dock	4/28	4/28	4/05	6/04	13.6	-3.3	-5	13.2	32%	23
Juneau Downtown	4/28	4/30	3/29	5/26	12.4	-3.4	-4	12.9	30%	64
Ketchikan	4/22	4/22	3/18	5/24	15.2	1.5	4	20.6	40%	38
Sitka Airport	4/20	4/19	3/15	5/15	12.3	-10.4	-9.5	13.0	14%	48
Annette	4/16	4/16	3/19	5/15	13.9	-5.0	20.0	20.0	30%	52

So, how can all these numbers be put to use? Suppose you were in Juneau and wanted to determine a date that had no more than a 20% chance of a freeze. From the first graph for the Juneau Airport (Spring freeze date probabilities), you find that normally the chance of a freeze drops to 20% around May 20th. Now as spring progresses, if the average temperature should reach 50 degrees by May 1st, you can start using the second graph in which day zero is the day the first 50 degree average was reached. From this graph, you can see that a 20% chance of a freeze is only 3 days away, or May 4th. On the other hand, if you have not yet recorded an averate temperature of 50 degrees by May 12th (the mean date of all years), you should probably wait another 3 days or so.