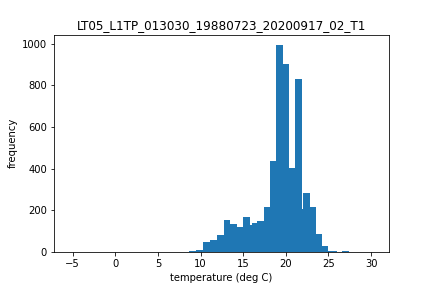
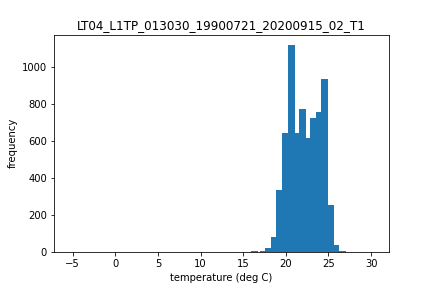
Appendix S2: Landsat Filters

lakeCoSTR: An open-source, interactive retrieval tool to facilitate use of the Landsat Collection 2 surface temperature product to estimate lake surface water temperatures

*Herrick, C, Steele, BG*, Brentrup, JA, Cook, B, Cottingham, KL, Ducey, M, Johnson, K, Lutz, DA, Palace, M, Sullivan, F, Thompson, M, Trout-Haney, JV, Weathers, KC

# Background:

Upon inspection of the Colab-exported histograms, it seemed clear that some of the ranges of data seemed ecologically unfeasible with some displaying a range of 20 degrees C or more over the surface of Lake Sunapee. In this appendix, we explore some of the additional quality assurance filters that we tried that may be helpful for others using this tool.



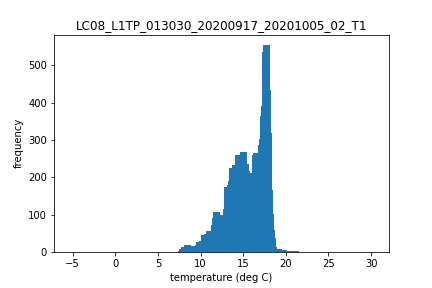
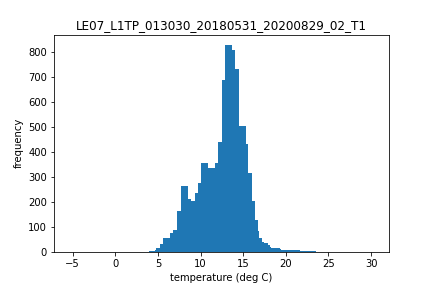


Figure S1. Four histograms, one from each Landsat Mission, exhibiting unusual frequency distributions as exported from the lakeCoSTR tool.

In addition to the possible range-of-value issues shown in Figure S1, there is also evidence of non-unimodal distributions. Because we were intersted in using a single median value to describe the scene, we determined these scenes were not suitable for our analysis. Note that bimodal distributions in surface temperature across a lake surface are certainly ecologically possible outcomes and may be useful for some systems or analyses. There were also scenes with negative temperatures reported even though pixels classified as snow or ice were filtered out in the Colab script.

Our desire was to create a filter that would filter out the scenes with presumed atmospheric interference (indicated by grossly large estimated temperature ranges) or those that were not suitable for our analysis using measurements from the extensive *in-situ* data network at Lake Sunapee. We used statistical measures of distribution, including quartile values, ranges, and measurement of distribution kurtosis (the ‘tailedness’ of the distribution). Knowing that we did not filter for clouds or cloud shadows explicitly in the tool, and given that there is documented interference with the surface temperature product (Cook, et al., 2014), we also tried a cloud filter to eliminate some scenes.

# Methods

The filters we explored, listed in order of increased stringency based on the number of scenes eliminated from analysis, were:

* **freeze**: removing all scenes whose minimum temperature was below 0 degrees Celsius
* **IQR**: *freeze* filter removing scenes that reported interquartile temperature ranges greater than 110% in a summary of the *in-situ* temperature record
* **kurtosis**: removing any scenes whose histogram has a kurtosis value less than 2
* **cloud**: *freeze* filter plus removing scenes with cloud cover greater than 40%
* **range**: *freeze* filter plus removing scenes that reported temperature ranges greater than 110% observed in a summary of the *in-situ* temperature record

## Load, summarize, and filter data

In order to define the maximum acceptable Landsat range from the *in-situ* data, we limited the validation dataset described in section 3.1.2 of the main text to those values measured between the hours of 9 and 11 am (the approximate time of Landsat flyover). These values were aggregated to daily values of range, interquartile range, and number of locations contributing the ranges. From the dail values we calculated the maximum range and interquartile range in the observed temperature data.

## [1] "Maximium spread observed is:"

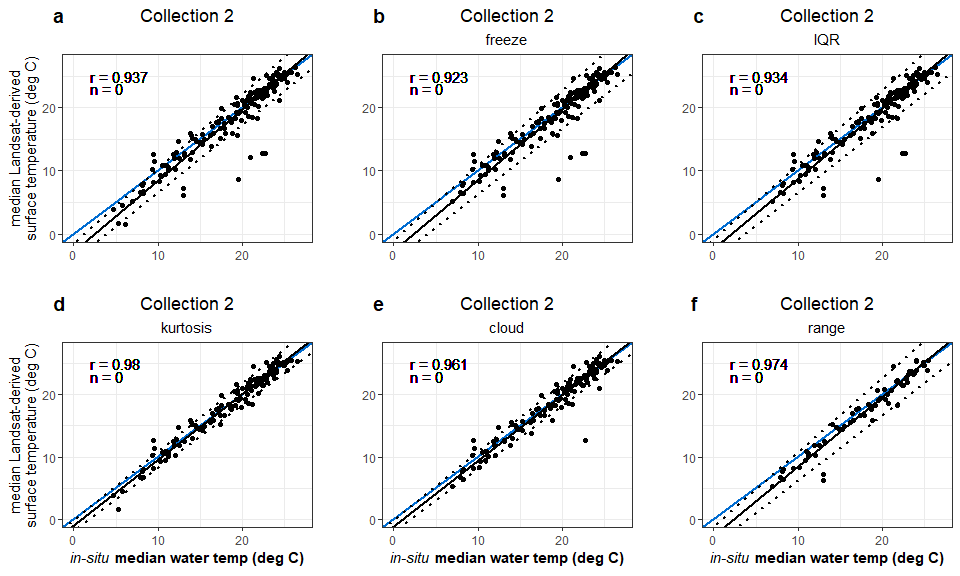
## [1] 9.19

## [1] "Maximium interquartile range observed is:"

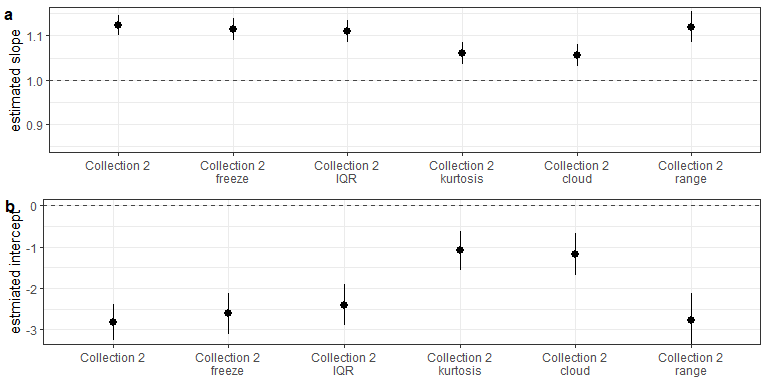
## [1] 2.6575

# Presentation and discussion of filter performance

## Comparison of filter performance



## Summarize the slope and intercepts for each of the Deming regressions



Cook, et al., 2014