Processing and results from RB meter networks in New Zealand

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Abstract. Raw sensor measurements are combined with ozone observations and instrument parameters to calculate the UVI. This is being done for the NIWA network and work is well underway to establish similar processing for the IRL network. The time series of the mean daily accumulated UV show little trend and the greatest spatial difference occurs in wintertime.

Introduction

Observations from the RB meter networks are archived in CLIDB which is New Zealand's nationally significant database for climate data. Access to CLIDB is freely available through the WWW by free subscription to CliFlo (http://cliflo.niwa.co.nz/). The networks were established to understand temporal and geographic variability of UV in New Zealand with NIWA and Industrial Research Ltd (IRL) each running about 6 UV stations. The earliest station was established at Invercargill in 1981, another 6 around 1990 and the rest from 2000. NIWA mainly uses second generation Robertson Berger (R-B) type meters, which are temperature controlled instruments made by Yankee Environmental Systems (YES) while IRL uses International Light Monitors (ILM). All the instruments are calibrated on a regular basis: NIWA instruments by cross calibration against a spectroradiometer at Lauder; and, IRL instruments by calibration against FEL lamps at Lower Hutt. The calibration yields factors for applying normalisation, cosine correction and bandpass correction.

Processing

Raw data from both networks are archived in CLIDB and processed NIWA data are available now. NIWA and IRL are currently working towards making processed IRL data available in the near future.

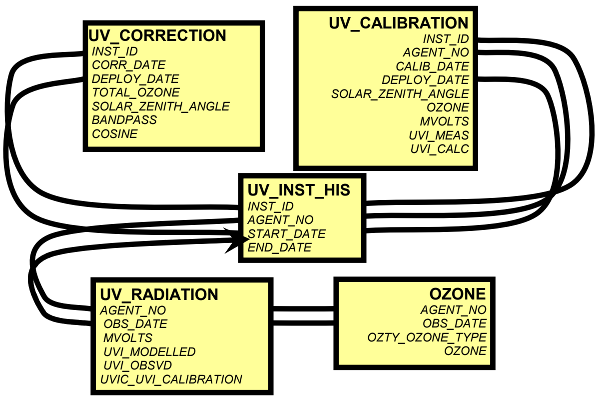

Figure 1. Tables within CLIDB involved in UV archiving and the relationships between the tables.

The convention of Figure 1 of table names in boldface and column names in italic is used in the following text. Ten minute radiometer sensor readings are collected and transferred to **UV_RADIATION**.*MVOLTS* on a hourly or daily basis. Thirty minute modelled UVI and satellite ozone measurements are transferred to **UV_RADIATION**. *UVI_MODELLED* and **OZONE**.*OZONE* once a day and any already calculated **UV_RADIATION**.*UVI_OBSVD* that are contemporary with incoming model/ozone values are removed as they will need re-calculating from the incoming new values. High quality daily assimilated ozone measurements are transferred to **OZONE**.*OZONE* about once a year and any contemporary **UV_RADIATION**. *UVI_OBSVD* are removed as above for re-calculating. New calibration/bandpass/cosine factors are transferred to **UV_CALIBRATION** and **UV_CORRECTION** about once a year and again, for the period over which the new factors apply, any **UV_RADIATION**.*UVI_OBSVD* are removed so they can be re-calculated. Calibration/bandpass/cosine factors apply to individual instruments and the sites where instruments were deployed after being calibrated are also specified in **UV_CALIBRATION**, thus, **UV_INST_HIS**, which holds the history of which instrument was "where at what time", can be populated from **UV_CALIBRATION** and **UV_CORRECTION**.

Once a day **UV_RADIATION** is inspected for entries where *MVOLTS* is present but *UVI_OBSVD* is absent, these values are then calculated from **UV_RADIATION**. *MVOLTS* and *UVI_MODELLED*, ozone observations and the appropriate calibration/bandpass/ cosine factors for the instrument concerned which is found from **UV_INST_HIS**.

Results

The time series of monthly mean daily accumulated UV radiation (KJm^{-2}) for Invercargill, shown in Figure 2, is one of the longest continuous time series of UV available in the world. The data series at the top has been split into seasonal, trend and noise components which are shown in the lower three panels. The bars on the right hand side show the scales for each panel i.e. the trend has the smallest range and is small compared with the huge seasonal variability (NB: Missing data have been estimated by the overall mean for the month concerned).

Time series of monthly mean daily accumulated UV radiation (KJm^{-2}) for all NIWA sites are shown in Figure3. Only post-1994 is shown in Figure 3 for Invercargill although, as shown in Figure 2, the record started in September 1981. Also the dotted part of the Invercargill trace is for the new instrument. No obvious trends can be seen with summertime values similar at all sites and huge seasonal variation, especially in the south.

For each month of the year the long-term mean daily accumulated UV radiation (KJm-**2**) divided by Lauder's long-term mean is shown in Figure 4

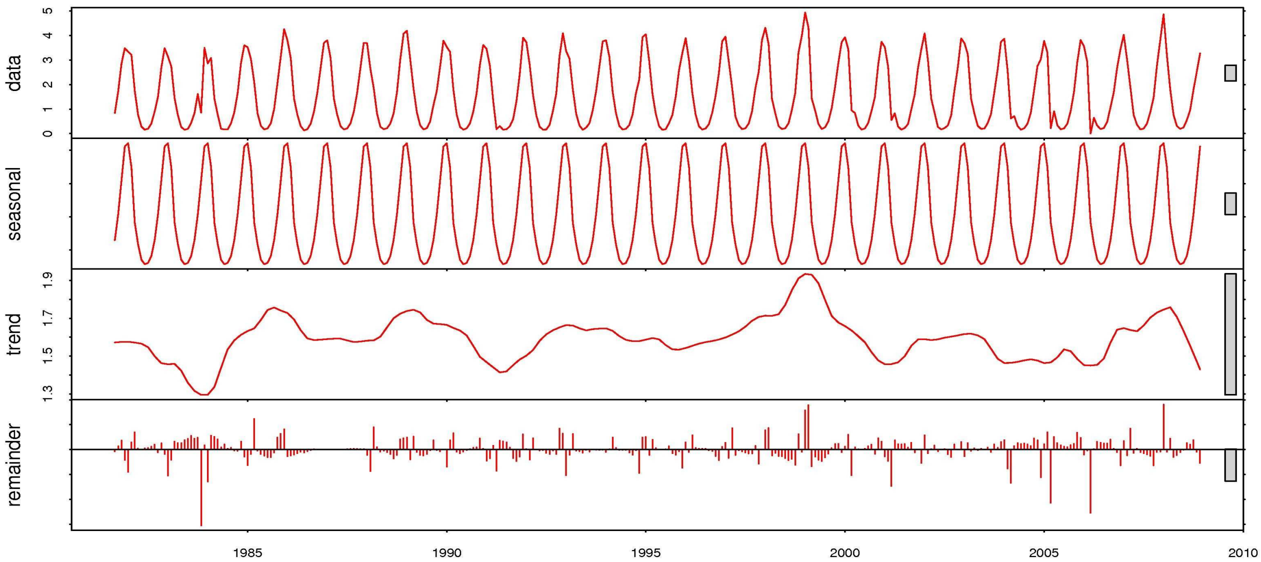

Figure 2. Time series of mean daily accumulated UV radiation (KJm^{-2}) for Invercargill

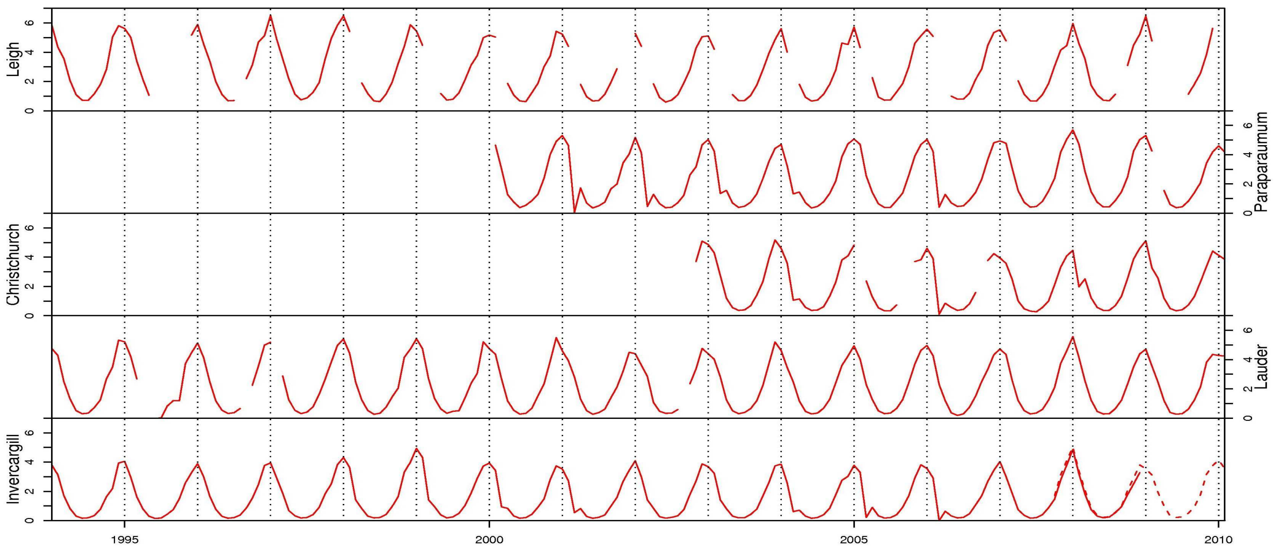

Figure 3. Time series of mean daily accumulated UV radiation (KJm^{-2}) for all NIWA sites

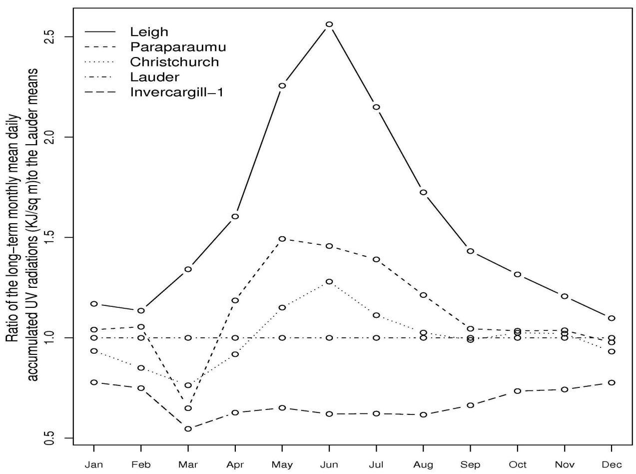

Figure 4. Comparison with the Lauder reference site.

Conclusion

This presentation highlights the huge differences in wintertime UV over New Zealand's latitude range. This may be an important limitation for winter vitamin D production in the south