NIWA UVI forecasts – an update on recent developments

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Abstract. We present an update of developments in UVI forecasting at NIWA since the last UV Workshop at Queenstown in 2010.

Changes in UV forecasts supplied to MetService

NIWA has supplied UV Index (see [WMO, 1994]) information to the public (http://www.niwa.co.nz/our-services/online-services/uv-ozone), and forecasts for media distribution via MetService for the last 16 years, see Turner, Renwick, and McKenzie, 2006 for a brief history. In 2012 a new way of depicting the information via the "UV sun protection alert period" was adopted in NZ. This has meant calculating and providing minute-by-minute (although the alert periods are rounded to the nearest 5 minutes) values of UV Index as threshold value of 3 often occurs at times of rapid mid-morning or mid-afternoon change in the value. Additionally, 5 day forecasts of clear-sky UV index are now supplied to MetService, previously 2-day forecast had been supplied

Changes in cloud-effects algorithm

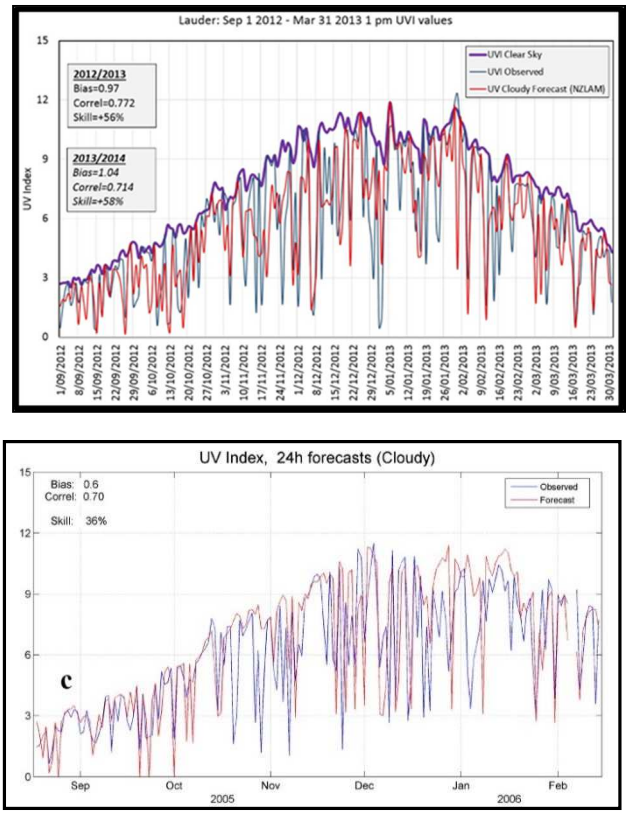
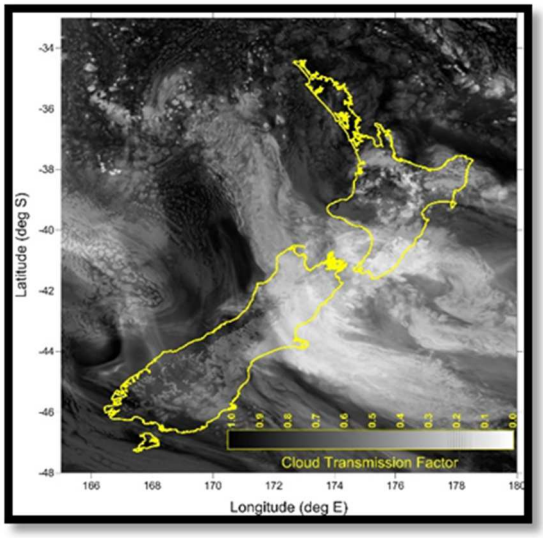


Figure 1. Comparison of observed (blue) and forecasts cloud (red) and clear-sky (purple) UV Index for Lauder for a) the 2012-2013 day-light saving period using the new method (see text) and b) for the 2005-2006 summer using the previous method. Note, when evaluating the skill scores, the reference forecast is a 1-day persistence forecast.

Following, NIWA's move away from using the RAMS weather model to the NZLAM-12 (a 12-km horizontal grid-space version of the United Kingdom's Unified Model (UM), see Edwards et al.,2004 and Webster et al. 2008) total cloud cover was used to predict the reduction of clearly sky UVI for cloudy days, but this was not entirely satisfactory as it resulted in UVI values that were too low. Therefore, we have developed a new method which uses weighted cloud fractions at low (Surface to 800 hPa, about 0-2km), mid (800 – 500 hPa, about 2-5.7 km), and high (500 – 150 hPa about 5.7 to 11.5 km) levels of the atmosphere. Maximum correlations and minimum bias were achieved using weights of 0.27,0.43, and 0.27 for linear combinations of low, mid, and high cloud fractions respectively, The comparison with observations was done for the 5 sites of Invercargill, Lauder, Christchurch (Kyle St), Paraparaumu, and Leigh. Results for 2012-2013 summer using this new method for Lauder are shown in Figure 1a, and the improvements over the previous method are clear when comparing with Figure 1b (reproduced from Turner et al, 2006). Another, small change is that a correction of an error in method for calculating clear sky UV at low sun elevation angles $85° < SZA < 90°$ has been applied.

Near future: Use of higher resolution NWP cloud forecasts.

While the improvements in the cloud-effects algorithm have been encouraging we believe there is still room for improvement and so we are currently experimenting with using NZCSM (a 1.5 km horizontal grid version of the UM) cloud forecasts (See Fig 2a and b) and re-analysing the 2013-2014 summer to develop best relationship between observed UV and forecast cloud amounts, available at 50 levels in troposphere. This should result in greater and more accurate spatial and temporal detail in the cloud effects and bring us to the point of including cloud effects in public forecasts, However, if this is to be done, ways of including and communicating the uncertainty in the cloud forecasts will have to be developed and/or incorporated.



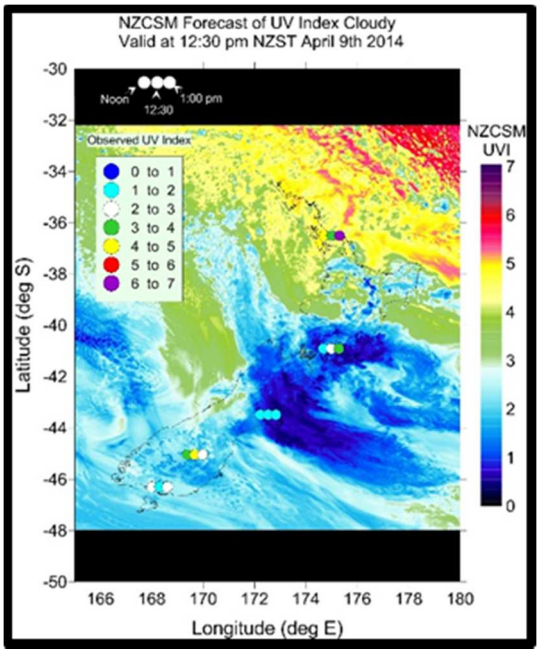


Figure 2. a) Cloud-transmission effect at 12:30 pm NZST April 9, 2014 over New Zealand as modelled by NZCSM and b) the corresponding cloudy-sky UV index (forecast). Observed values are shown in the filled circles,

Acknowledgements

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Acronyms:

- MODIS: Moderate Resolution Imaging Spectroradiometer (NASA)
- NZLAM: New Zealand Limited Area Model – A Numerical Weather Model run at NIWA (12 km horizontal grid version of the UKMO's Unified Model)
- NZCSM: New Zealand Convective Scale Model – A 1.5km horizontal grid version of the UKMO's Unified Model with explicit convection (i.e., no parameterization of cloud convection effects).
- RAMS: Regional Atmospheric Modelling System
- SZA: Solar Zenith Angle
- UKMO: United Kingdom Met Office.
- UM: Unified Model