# UV Index: Forecast and Media Weather Reports

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**Abstract.** The UV Index forecast is under continuous development. Some available products can be found at: (http://www.bom.gov.au/weather/national/charts/UV.shtml. Here a comparison with satellite and surface measurements is illustrated and the national approach adopted for reporting UV Index to the public is presented.

## UV Index Forecast

The UV and Ozone forecasting system calculates clear-sky UV Index forecast for local noon using the meteorological fields from the Bureau of Meteorology global numeric weather forecast model. The day-and-time of the year, latitude, longitude, altitude and surface albedo are taken into account. Ozone absorption, clouds and aerosols are included. The UV Index is calculated by weighting the UV irradiance by the erythemal action spectrum (CIE) over the wavelengths 290-400nm. It is given in terms of the international standard (WMO, 1995) with one UV Index equal to 25 mW/m2. The UV Index is a numerical value associated with descriptive danger category (WHO, 2002). Values below 3 are considered low, between 3 to 5 moderate, between 6 to 7 high, between 8 to 10 very high, and 11 or above are considered extreme.

The initial UV and Ozone forecasting system (Lemus-Deschamps et al., 1999) has undergone continuous development. In the current system the UV Index is calculated using the ATLAS solar irradiance, an updated Rayleigh scattering and ozone absorption dependence on temperature. Aerosols are included in a similar way to that in UVSPEC and TOMS monthly averages broadband UV albedos are also used (briefly described in Lemus-Deschamps et al., 2004). The global total ozone amount forecast is derived from satellite data and the meteorological fields from the weather forecast model. In the current system assimilation of blended total ozone from NOAA/TOVS-TOMS has replaced the original assimilation step (Grainger, 1998) with modified ozone retrieval. The ozone forecast is derived from the latest analysis field and advection scheme using the numerical weather forecast potential vorticity fields (Atkinson et al., 1997). It is assumed that the ozone lies in a single slab. To account for the ozone that lies just above the tropopause outside the tropics, the bottom of the slab is now 380K, which increases the slab thickness.

Clouds are included assuming an empirical relationship between cloud cover and observed UV amounts for Australia (Lemus-Deschamps et al., 2004). The clear-sky UV index is multiplied by this factor depending on the forecast cloud conditions given by the weather forecast model.

## Validation and Weather Reports

Comparison of model total ozone (analysis and forecast) against TOMS data, for the globe and for several Australian cities, is performed daily. An example is illustrated in Figure 2 (top). The results show a correlation factor of 0.68 over the period 1997-2005. Comparison of model cloudy sky UV dose against TOMS is also performed daily as illustrated in Figure 1.

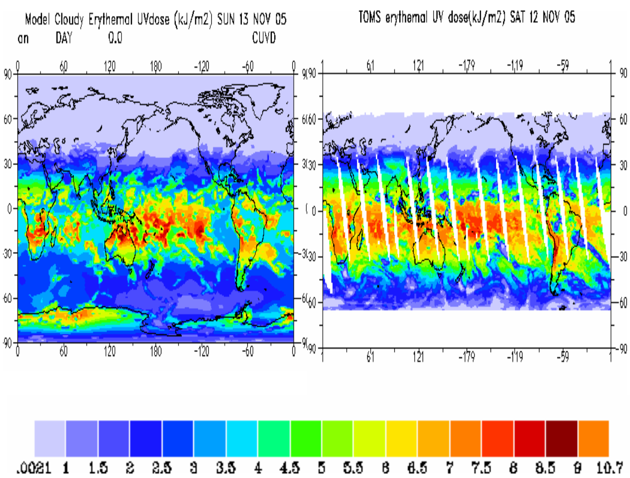


**Figure 1**. Example of daily cloudy-sky UVdose (kJ/m$^2$) from Model (left) and TOMS (right) (http://toms.gsfc.nasa.gov) for 13th November 2005.

As a result of the ongoing collaboration project between the Bureau of Meteorology and the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) the clear-sky UV Index forecast is continuously validated against ARPANSA's measurements. The example presented in Figure 2 (bottom) shows that the main differences between model and measurements are due to the cloud conditions during the measurements. The results show a bias within 1 UV Index most of the time for the period 1997-2005. Example of previous validation can be found in Gies et al. (2004) and Lemus-Deschamps et al. (2004).

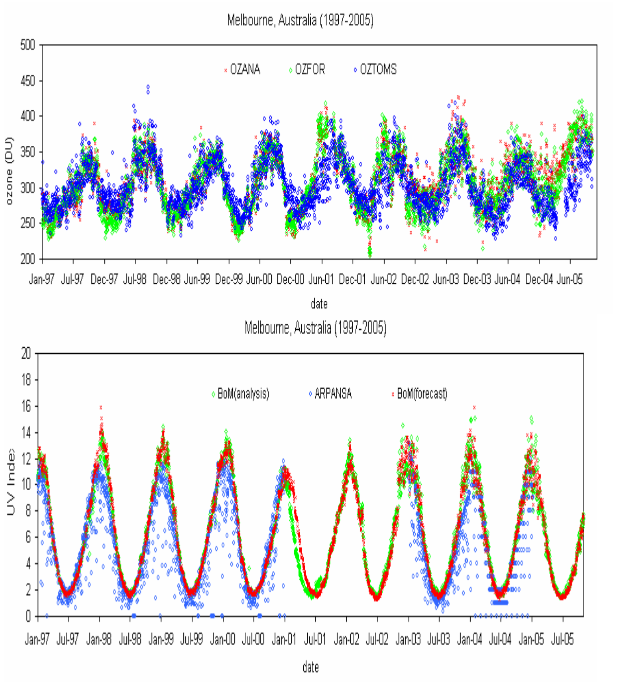


**Figure 2**. Melbourne 1997-2005; (top) total ozone amount Model (OZAN-OZFOR) and TOMS and (bottom) UV Index BoM Model (analysis and forecast) and ARPANSA measurements.

The UV Index forecast has been included in the Bureau of Meteorology weather forecast report provided to the media since 1997. To increase awareness of the levels of ultraviolet radiation and dangers of sun-overexposure close collaboration between the Bureau of Meteorology, ARPANSA and the Cancer Council Victoria has been established. As a result, the international standard and descriptive danger category (WHO, 2002) were adopted nationally in 2002 (Dixon et al., 2002) as illustrated by the UV Index forecast graph in Figure 3. To further raise awareness of the levels of ultraviolet radiation and to promote sun protection nationally the National Skin Cancer Council SunSmart UV alert concept (http://www.sunsmart.com.au) was included in the UV Index forecast graph. The SunSmart UV alert encourages people to "be SunSmart" within the hours when the UV Index forecast is moderate or higher. The SunSmart UV alert is issued by the Bureau of Meteorology, as part of the weather forecast report, when the UV Index forecast is equal or greater than three (Figure 3) as recommended by WHO. The weather reports are provided daily to the media and a national promotional-educational campaign is underway.

Final comment. The UV and Ozone forecasting system also supports the monitoring and development of the ozone-hole and the study of the UV radiances (http://www.bom.gov.au/bmrc/mdev/expt/uvindex/uv_ext.shtml) in the Southern Hemisphere.

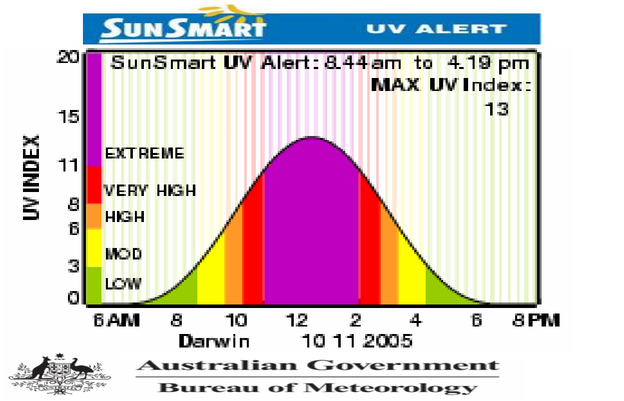


**Figure 3.** Example of diurnal clear-sky UV Index forecast for Darwin with the UV alert from 8:40am-4:30 pm when the UV Index is equal or above 3.

## References


Atkinson, R., Grainger, S. and Udelhofen, P.M., A scheme for the routine analysis and deterministic prediction of the global total ozone distribution. *Proceedings of AMS International Conference on the Meteorology of the Southern Hemisphere*, Pretoria, Africa, 1997.

Dixon, H., Lemus-Deschamps, L. and Gies, P., Meteorology meets public health: UV forecasts and reports for sun safety. *Health Promotion, Journal of Australia*, **13**, 252, 2002.

Gies P., Roy C., Javorniczky S., Lemus-Deschamps L. and Driscoll C., Global Solar UV Index: Australian Measurements, Forecasts and Comparison with the UK. *Photochem.Photobiol*, **79**,32-39, 2004.

Grainger, S., Global analysis of ozone by statistical interpolation of satellite data. *PhD Thesis*, 182pp, Monash University, Melbourne Australia, 1998.

Lemus-Deschamps, L., Rikus, L. S.Grainger, Gies, P. Sisson, J. and Li, Z., UV Index and UV dose distributions for Australia (1997-2001). *Aus.Met.Mag*., 53, 239-250, 2004.

Lemus-Deschamps, L., Rikus, L. and Gies, P., The operational Australian ultraviolet index forecast 1997. *Meteorol. Appl*., **6**, 241-251, 1999.

World Meteorological Organisation (WMO), Panel Report of the WMO Meeting of Experts on UV-measurements, Data Quality and Standardization of UV Indices. *WMO/T No.* 625, 1995.

World Health Organisation (WHO). Global Solar UV Index, A practical Guide. *Fact Sheet* 271, 2002.