Quick Links

Drawing on decades of weathering leadership and expertise, the Atlas Consulting Group provides in-depth consulting services that assist you in developing and applying the best weathering test methods and strategies for your products. ***Atlas Weathering Consulting Insights*** offers interesting and valuable information on a variety of topics relevant to long-term durability testing.

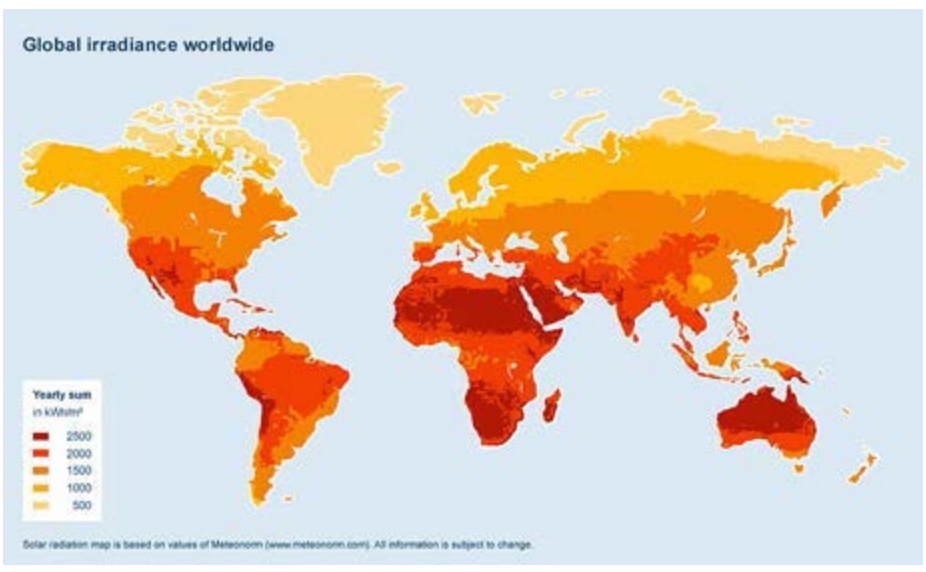
This issue of the Atlas Weathering Consulting Insights Newsletter is the third installment of a six-part series on various aspects of weathering test tailoring.

Can't Find a Standard That Fits? Maybe You Could Use a Good Custom Tailor

Weathering Test Tailoring Part 3: Solar Radiation

While there are many environmental and other types of stresses to consider, an important aspect in weathering testing is understanding the quality and quantity of solar radiation that the product will receive in service life. These values are then equated to a test exposure, whether at an outdoor test site or in an accelerated weathering instrument, to derive some empirical information.

Terrestrial sunlight is not a constant, but instead varies with many factors: the earth's axis tilt (seasons) and earth-sun distance, the solar sunspot cycle, altitude, latitude, atmospheric path length and conditions such as ozone concentration, moisture and cloud cover, dust, gasses and pollutants, etc. Product or test exposure variables include specific location and product orientation relative to the sun as it cycles through its daily and seasonal paths, as well as incidental factors such as reflections from the ground or nearby objects. And lastly, we have the actual weather during the exposure period; as we say, "climate is what you expect, weather is what you get." All these factors affect the intensity and the amount as well as the spectral power distribution of solar radiation.



Solar radiation map of the world; note that the highest solar radiation is not found at the equator.

Since the ultraviolet (UV) portion of solar radiation can especially cause severe damage to materials, the solar UV cut-on is of particular importance. Test specimens with different angles or compass orientations on outdoor exposure racks, or products in fixed field use (such as building materials), can receive substantially variant amounts of direct and diffuse radiation for both the total ultraviolet radiation (TUVR) and total solar radiation (TSR). The ratios can change due to diurnal and seasonal variations. It is not uncommon to see vertical exposures receive only about half of the daily radiant exposure of near-horizontal ones. Also, if the key exposed surface is oriented away from the equator e.g., facing other than due south in the northern hemisphere), the daily solar radiation for UV and total solar will also be very different. Per the standards, outdoor test sites utilize local native ground cover. However, products in other environments can see substantial reflections from ground cover (albedo) or reflective surfaces such as white roofs, concrete or architectural surfaces such as glass and metal. These can also substantially affect the nature of the service use solar radiation environment.

In some cases, it is not feasible to incorporate all of the solar radiation variables. In these instances, a standard reference "sun," which defines a fixed global solar radiation spectrum and irradiance value, can be used. One is *CIE Publication 85 Solar Spectral Irradiance, Table 4*, which is commonly referenced in weathering standards. However, there are other reference standards and, more importantly, reliable measured multi-year data from global benchmark sites such as Atlas' South Florida Test Site near Miami and DSET Laboratories in Arizona, for example. As there is no global terrestrial solar radiation network for uniform measurements, the data available from various sources must often be carefully interpreted. In particular, the TUVR important for polymer weathering is often not reported as a subset of the total solar radiation data. However, if many of the variables are known, or can be reasonably estimated, the solar radiation impinging on an object over time can be modeled through use of Atlas' CESORA (Calculation of Effective Solar Radiation) software.

One of the radiometer racks at Atlas' DSET Laboratories, Arizona with various measuring instruments.

Total Ultraviolet Radiometer (TUVR)

Oftentimes, real world products face unique conditions which mandate custom-tailored test programs as there may be no specific product or test standards by which to refer. If you should have such a product, contact the Atlas Consulting Group at **atlas.info@ametek.com**(US) or **atlas.info@ametek.de** (Europe) to help you. The Atlas Consulting Group specializes in test tailoring, designing and implementing testing programs for clients to yield meaningful and useful results on a cost effective basis.

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