We performed outdoor experiments to evaluate the effect of temperature on photoinhibition properties in the cosmopolitan diatom *Thalassiosira weissflogii*. Cultures were exposed to solar radiation with or without ultraviolet radiation (UVR, 280–400 nm), UV-A (320–400 nm), and UV-B (280–320 nm) at both 20°C and 25°C. Four possible cellular mechanisms involved in UVR stress were simultaneously addressed: carbon incorporation, chlorophyll *a* fluorescence of photosystem II, xanthophyll cycle activity, and ribulose-1,5-biphosphate carboxylase : oxygenase (Rubisco) activity and gene expression. Experiments consisted of daily cycles (i.e., the daylight period) and short-term incubations (i.e., 1 h centered on local noon). Samples incubated at 25°C had significantly less UVR-induced inhibition of carbon fixation and effective photochemical quantum yield compared to those incubated at 20°C. At 25°C Rubisco activity and gene expression were significantly higher than at 20°C. The higher Rubisco activity and gene expression were correlated with less dissipation of excess energy, evaluated via non-photochemical quenching, and the de-epoxidation state of the xanthophyll pigments, as more photons could be processed. An increase in temperature due to climate change would partially counteract the negative effects of UVR by increasing the response of metabolic pathways, such as those involved in Rubisco. This, in turn, may have important consequences for the ecosystem, as higher production (due to more Rubisco activity) could be expected under a scenario of global warming.