photobiologySensors Version 0.3.3
Catalogue of Sensors

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1 Introduction

We will plot the spectral response of the different sensors for which data is provided in the pacakge. We plot side-by-side the response to energy (i.e. the electrical output that would be expected at each wavelengths with a source emitting equal spectral energy irradiance at all wavelengths) and the response to photons (i.e. as above but with a source emitting equal spectral photon irradiance at all wavelengths). All responses are normalized to an area of one under the whole curve.

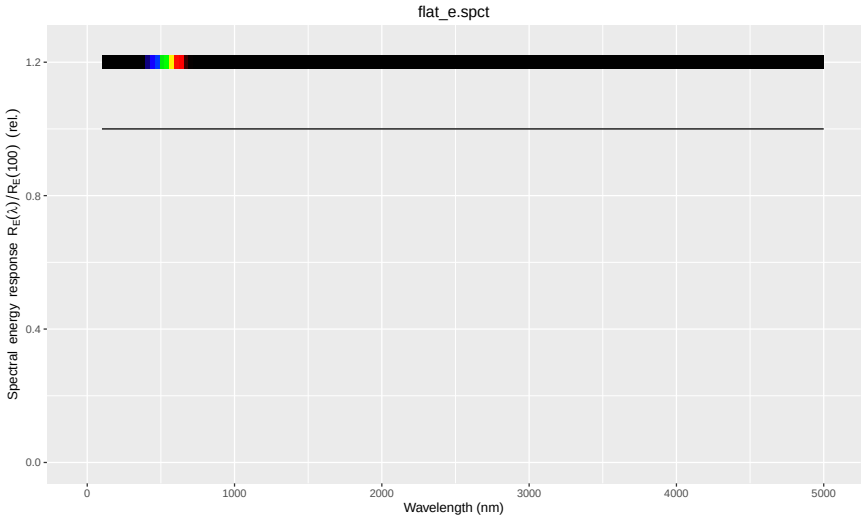
```
library(ggplot2)
library(ggspectra)
library(photobiology)
library(photobiologyWavebands)
library(photobiologySensors)
```

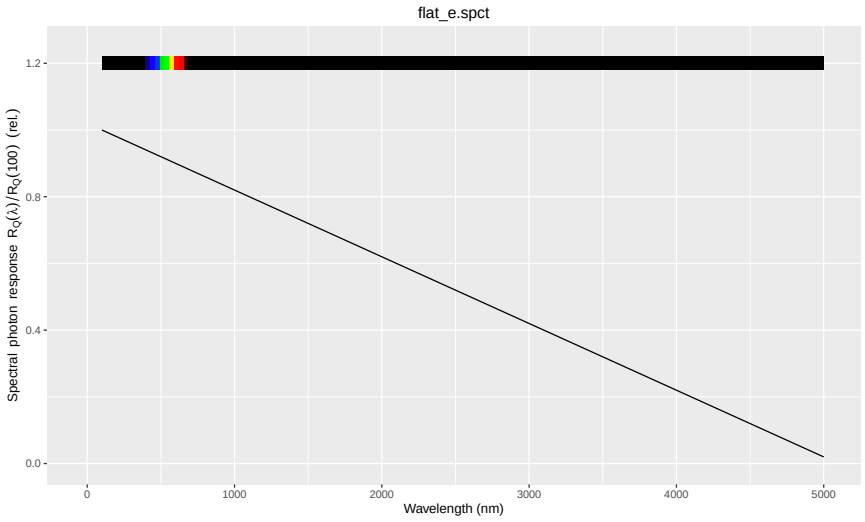
We define a function to do the actual plotting so as to not repeat code, and to make changes easier in the future.

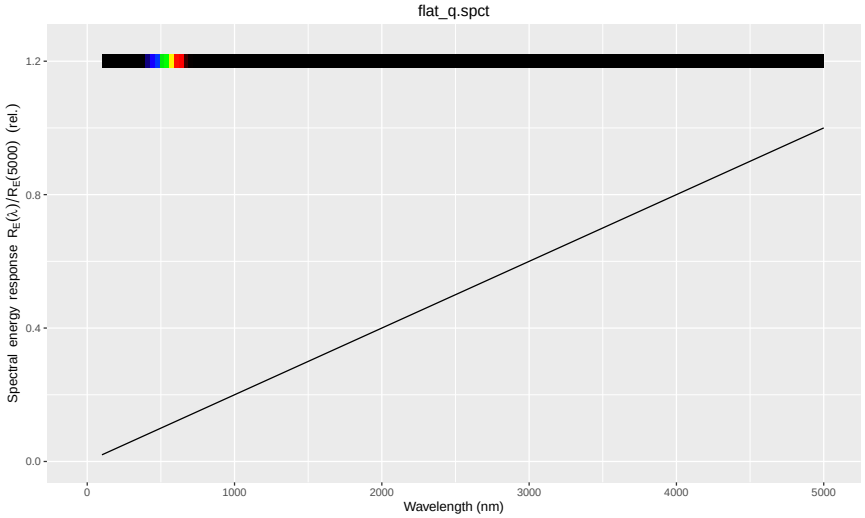
```
plotter <-
  function(spct,
           annotations = c("boxes", "labels", "summaries", "colour.guide", "title"),
           label.qty = "contribution",
           wb.trim=TRUE){
    print(plot(spct,
               unit.out="energy",
               annotations = annotations,
               label.qty = label.qty,
               wb.trim = wb.trim) +
            labs(title=deparse(substitute(spct))))
    print(plot(spct,
               unit.out="photon",
               annotations = annotations,
               label.qty = label.qty,
               wb.trim = wb.trim) +
            labs(title=deparse(substitute(spct))))
  }
```

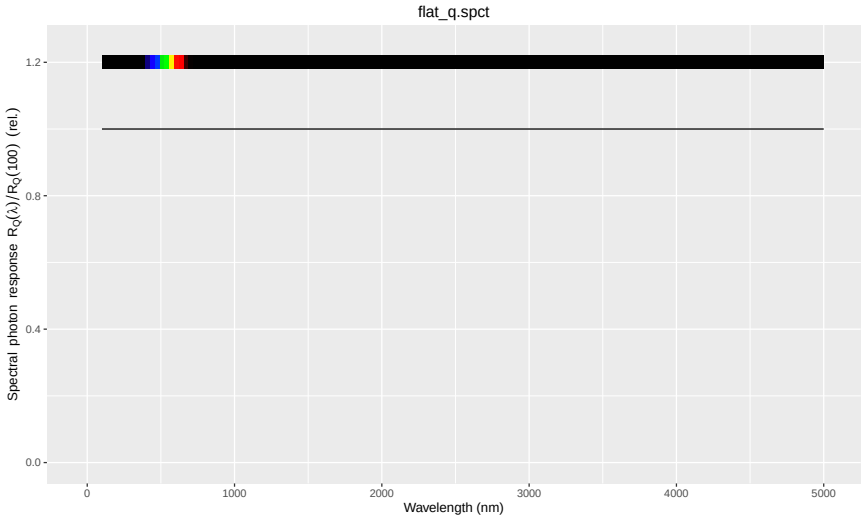
2 Flat responses

```
plotter(flat_e.spct, annotations = "colour.guide")
plotter(flat_q.spct, annotations = "colour.guide")
```



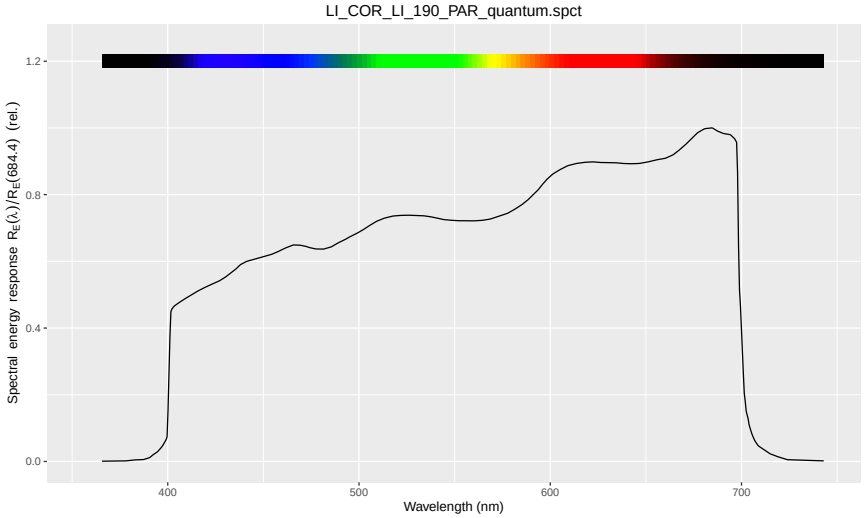


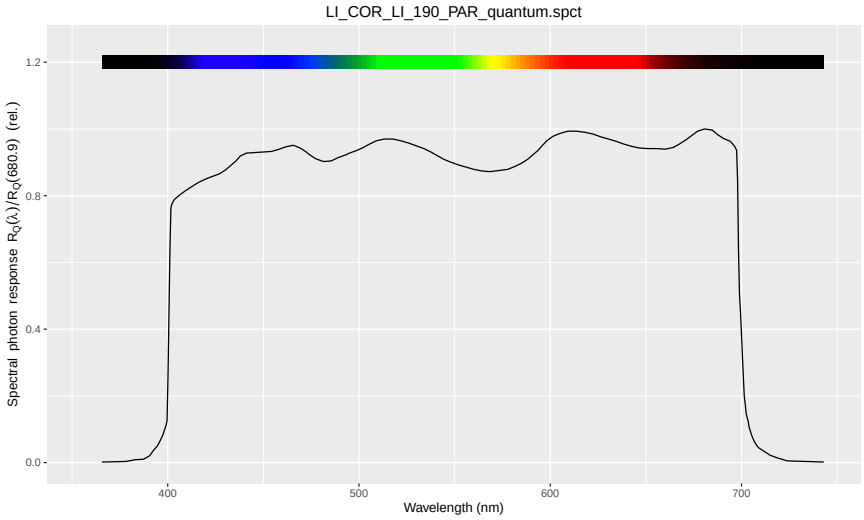


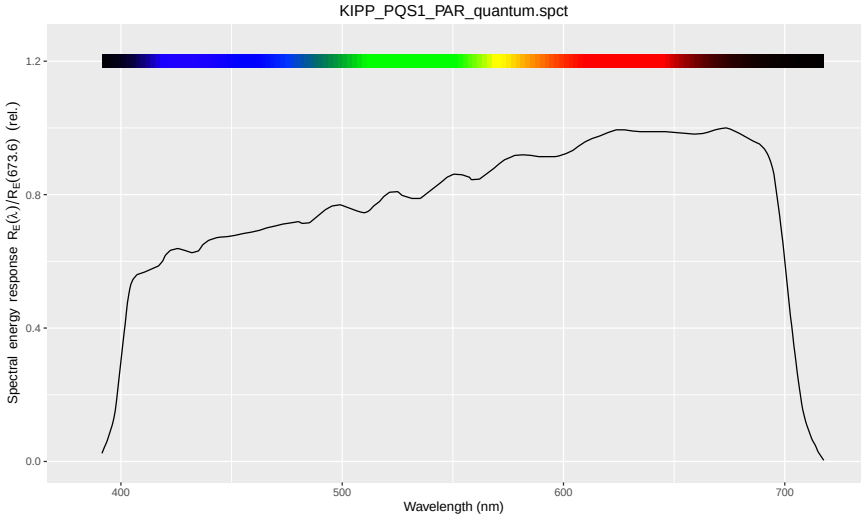


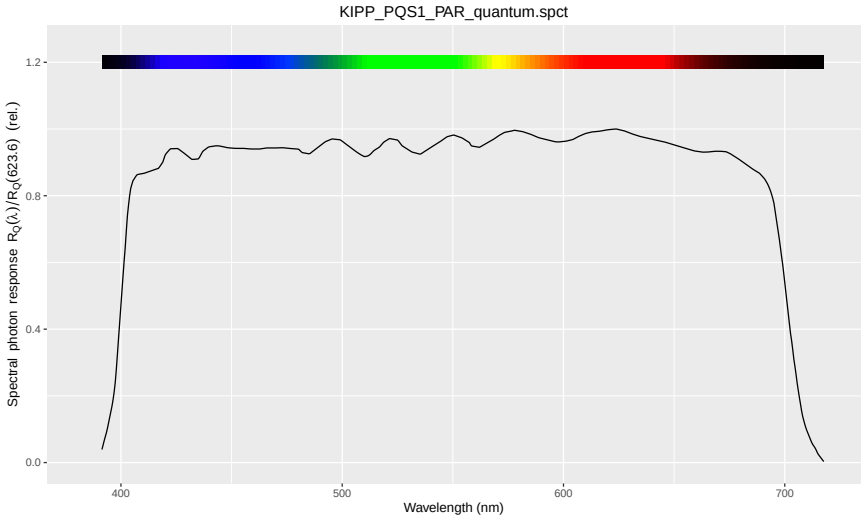
3 Quantum PAR sensors

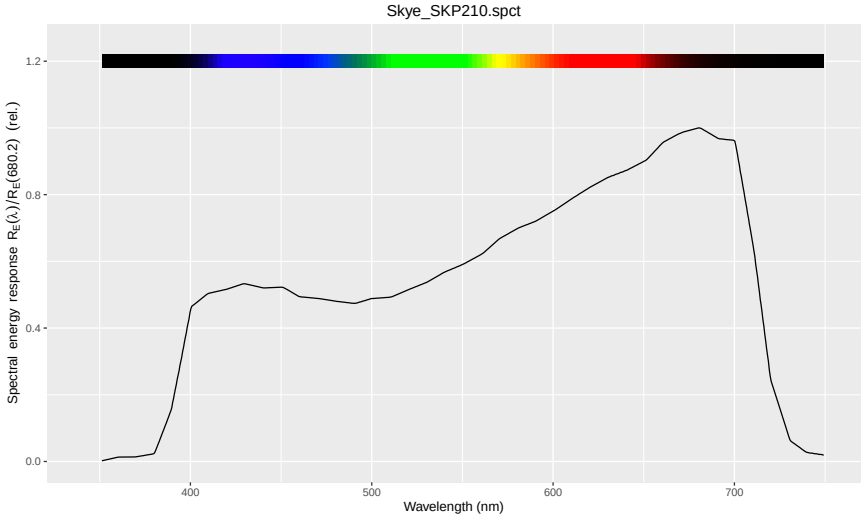
```
plotter(LI_COR_LI_190_PAR_quantum.spct)
plotter(KIPP_PQS1_PAR_quantum.spct)
plotter(Skye_SKP210.spct)
plotter(Skye_SKP215.spct)
plotter(Skye_SKE510.spct)
```

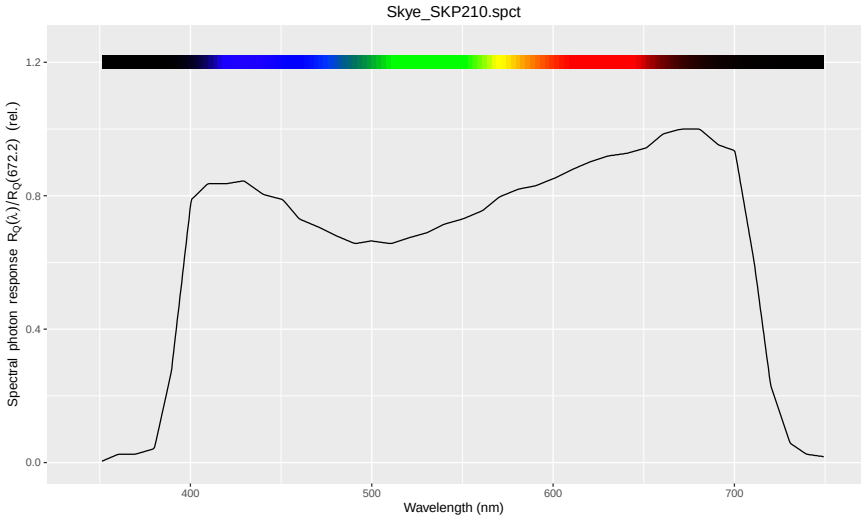

LI_COR_LI_190_PAR_quantum.spct
Spectral energy response $R_E(\lambda_r)/R_E(684.4)$ (rel.)
1.2
0.8
0.4
0.0
400
500
600
700
Wavelength (nm)

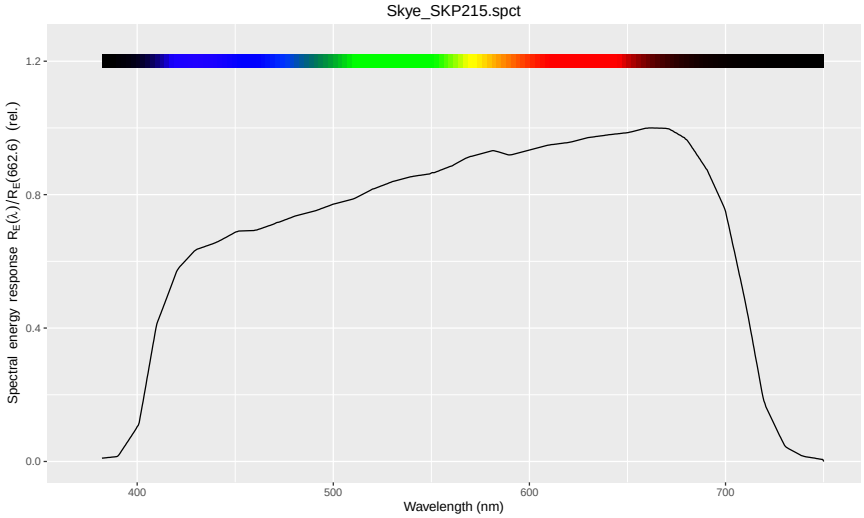

LI_COR_LI_190_PAR_quantum.spct
Spectral photon response $R_Q(\lambda_r)/R_Q(680.9)$ (rel.)
1.2
0.8
0.4
0.0
400
500
600
700
Wavelength (nm)

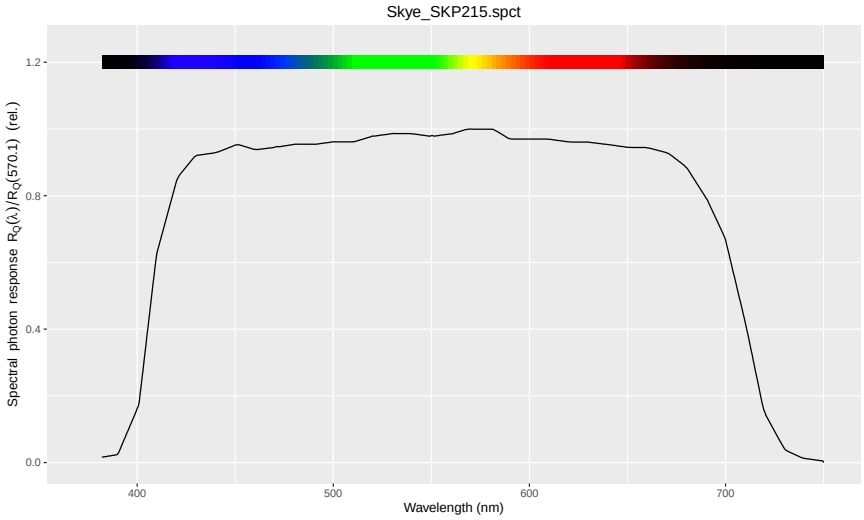

KIPP_PQS1_PAR_quantum.spct
Spectral energy response $R_E(\lambda_i)/R_E(673.6)$ (rel.)
1.2
0.8
0.4
0.0
400
500
600
700
Wavelength (nm)

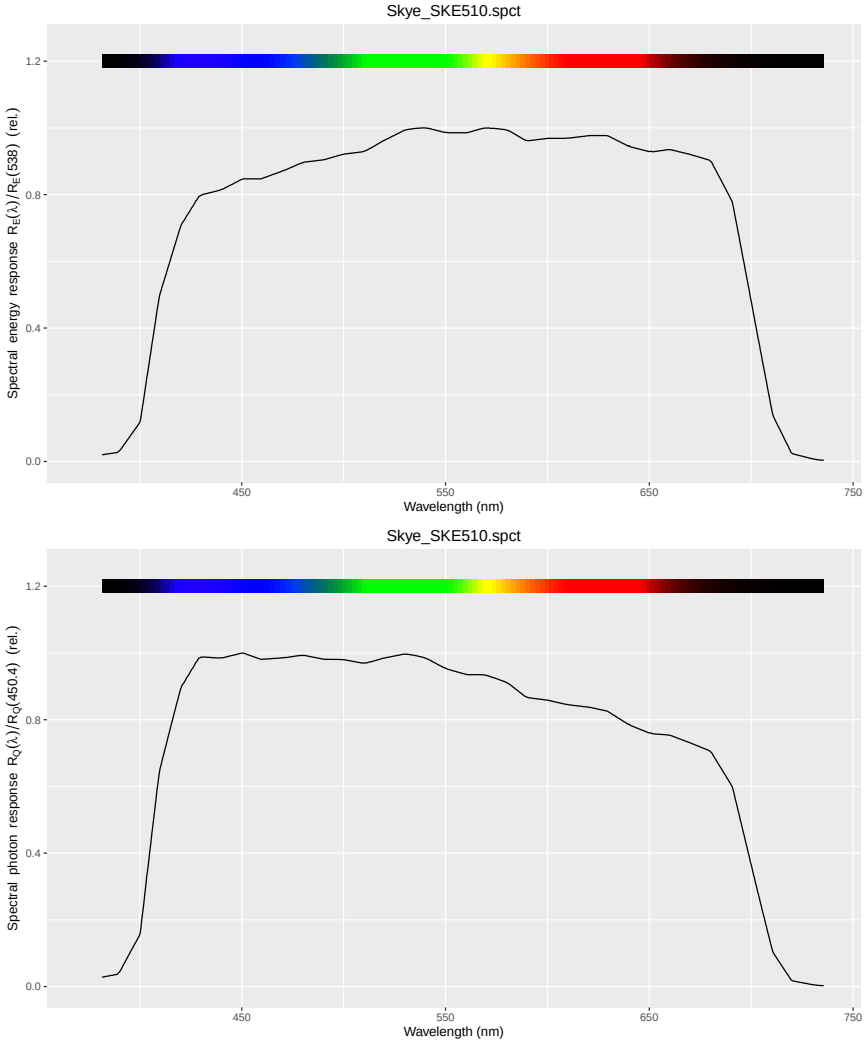

KIPP_PQS1_PAR_quantum.spct
Spectral photon response $R_Q(\lambda_i)/R_Q(623.6)$ (rel.)
1.2
0.8
0.4
0.0
400
500
600
700
Wavelength (nm)


Skye_SKP210.spct
Spectral energy response $R_E(\lambda_.)/R_E(680.2)$ (rel.)
1.2
0.8
0.4
0.0
400
500
600
700
Wavelength (nm)


Skye_SKP210.spct
Spectral photon response $R_Q(\lambda_.)/R_Q(672.2)$ (rel.)
1.2
0.8
0.4
0.0
400
500
600
700
Wavelength (nm)

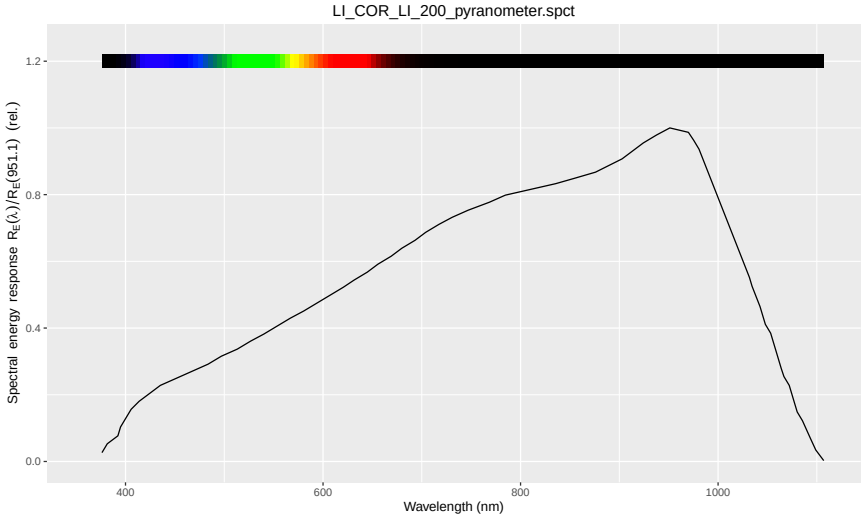

Skye_SKP215.spct
Spectral energy response $R_E(\lambda_i)/R_E(662.6)$ (rel.)
1.2
0.8
0.4
0.0
400
500
600
700
Wavelength (nm)

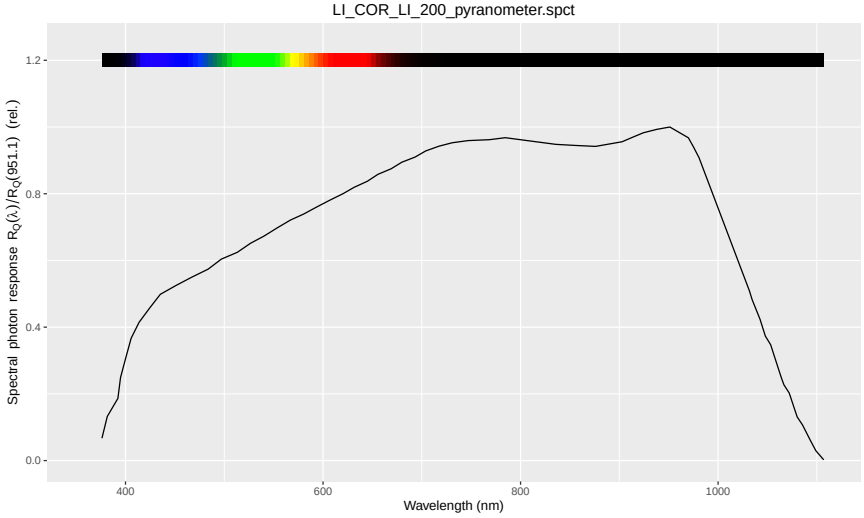

Skye_SKP215.spct
Spectral photon response $R_Q(\lambda_i)/R_Q(570.1)$ (rel.)
1.2
0.8
0.4
0.0
400
500
600
700
Wavelength (nm)

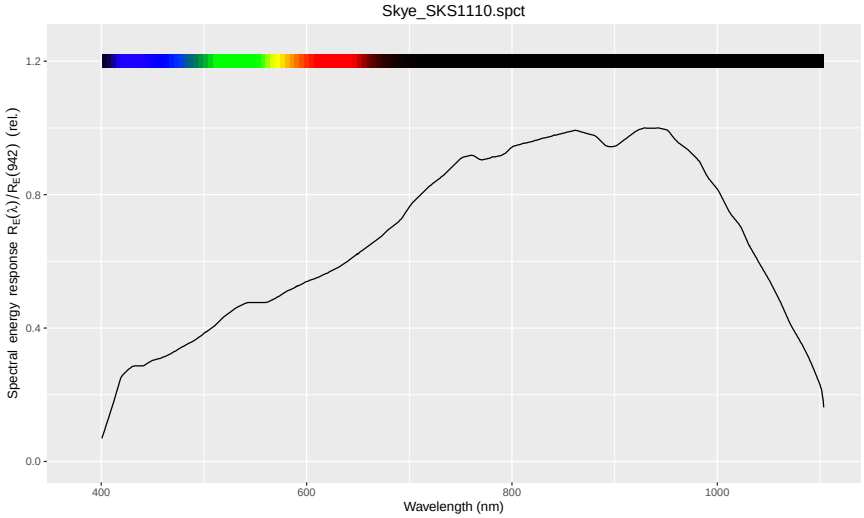


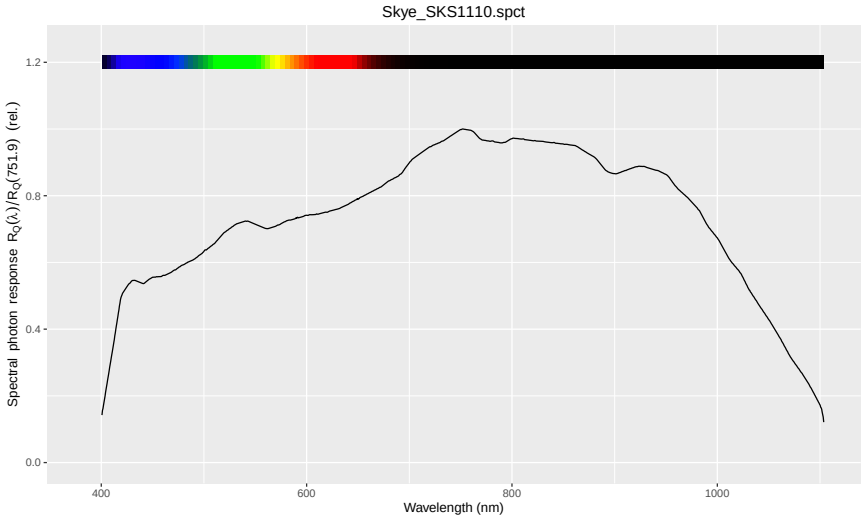
4 Other sensors

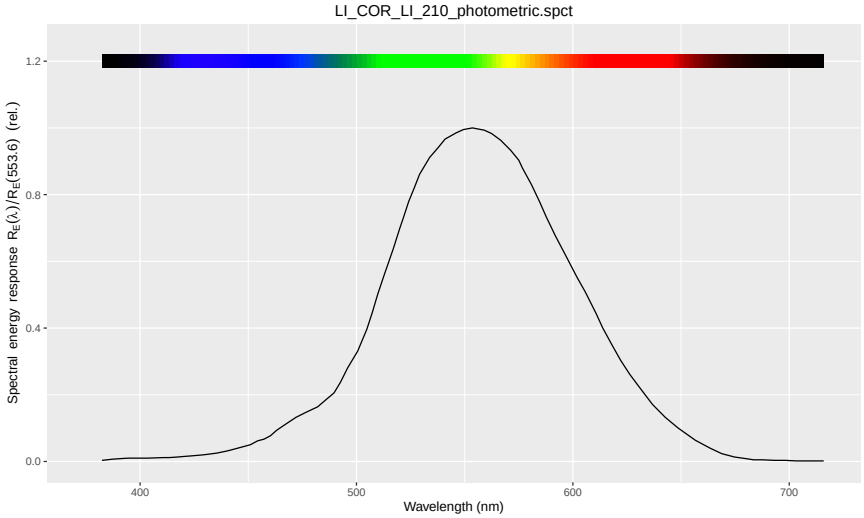
```
plotter(LI_COR_LI_200_pyranometer.spct)
plotter(Skye_SKS1110.spct)
plotter(LI_COR_LI_210_photometric.spct)
plotter(Skye_SKL310.spct)
plotter(DeltaT_BF5.spct)
```

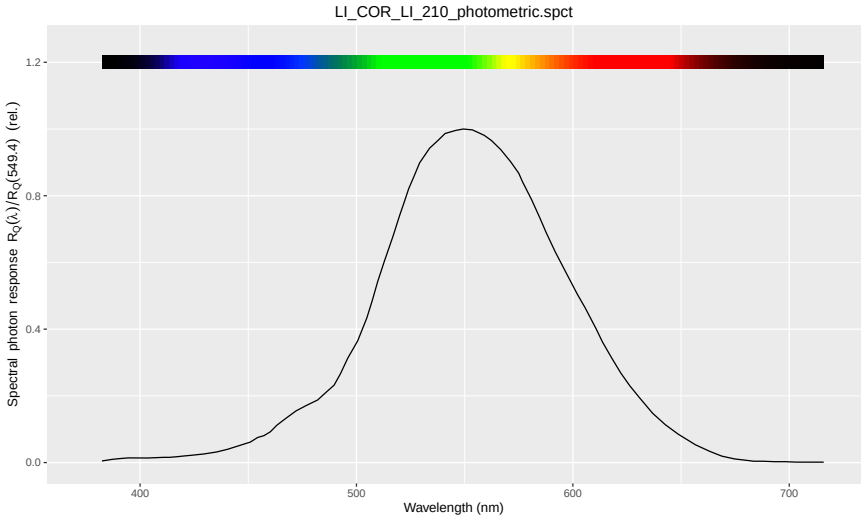

LI_COR_LI_200_pyranometer.spct
Spectral energy response $R_E(\lambda_i)/R_E(951.1)$ (rel.)
1.2
0.8
0.4
0.0
400
600
800
1000
Wavelength (nm)

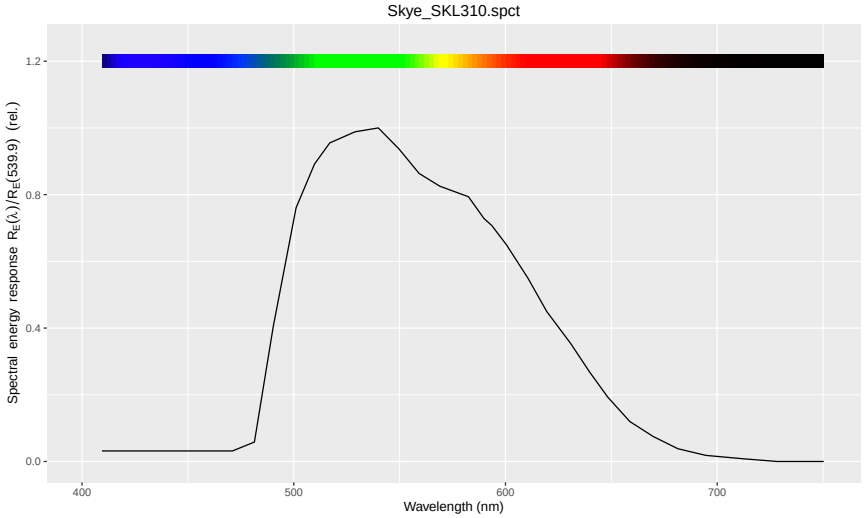

LI_COR_LI_200_pyranometer.spct
Spectral photon response $R_Q(\lambda_i)/R_Q(951.1)$ (rel.)
1.2
0.8
0.4
0.0
400
600
800
1000
Wavelength (nm)

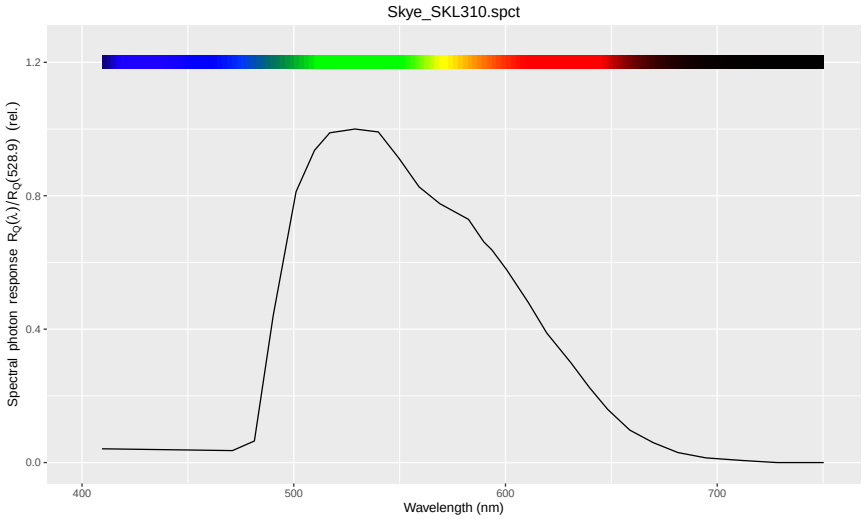

Skye_SKS1110.spct
Spectral energy response $R_{E}(\lambda)/R_{E}(942)$ (rel.)
1.2
0.8
0.4
0.0
400
600
800
1000
Wavelength (nm)

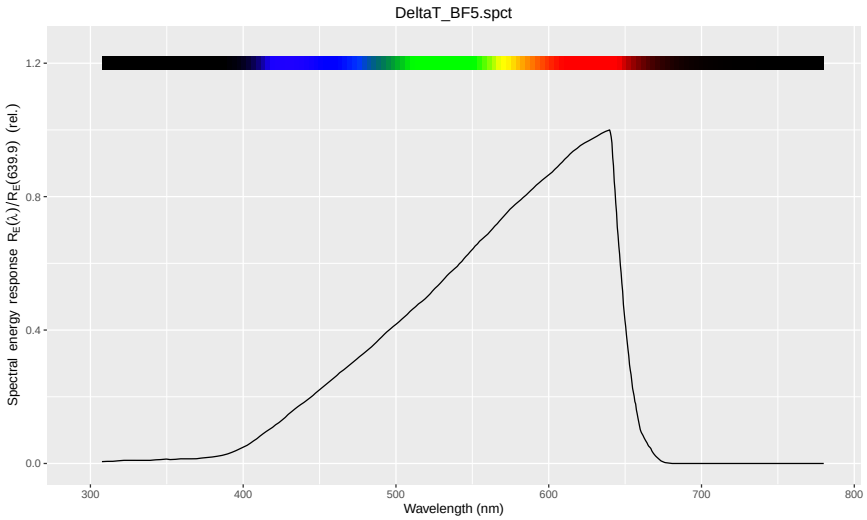

Skye_SKS1110.spct
Spectral photon response $R_{Q}(\lambda)/R_{Q}(751.9)$ (rel.)
1.2
0.8
0.4
0.0
400
600
800
1000
Wavelength (nm)

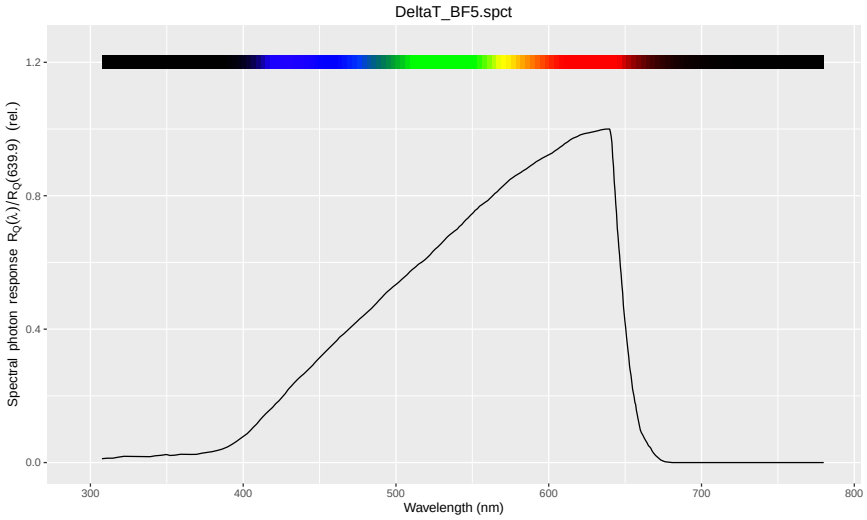

LI_COR_LI_210_photometric.spct
Spectral energy response $R_E(\lambda_i)/R_E(553.6)$ (rel.)
1.2
0.8
0.4
0.0
400
500
600
700
Wavelength (nm)


LI_COR_LI_210_photometric.spct
Spectral photon response $R_Q(\lambda_i)/R_Q(549.4)$ (rel.)
1.2
0.8
0.4
0.0
400
500
600
700
Wavelength (nm)


Skye_SKL310.spct
Spectral energy response $R_E(\lambda_.)/R_E(539.9)$ (rel.)
1.2
0.8
0.4
0.0
400
500
600
700
Wavelength (nm)

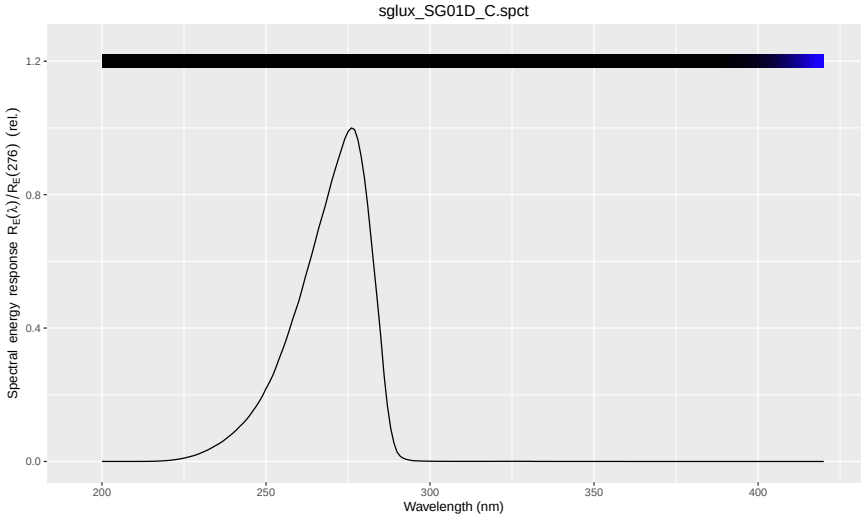

Skye_SKL310.spct
Spectral photon response $R_Q(\lambda_.)/R_Q(528.9)$ (rel.)
1.2
0.8
0.4
0.0
400
500
600
700
Wavelength (nm)

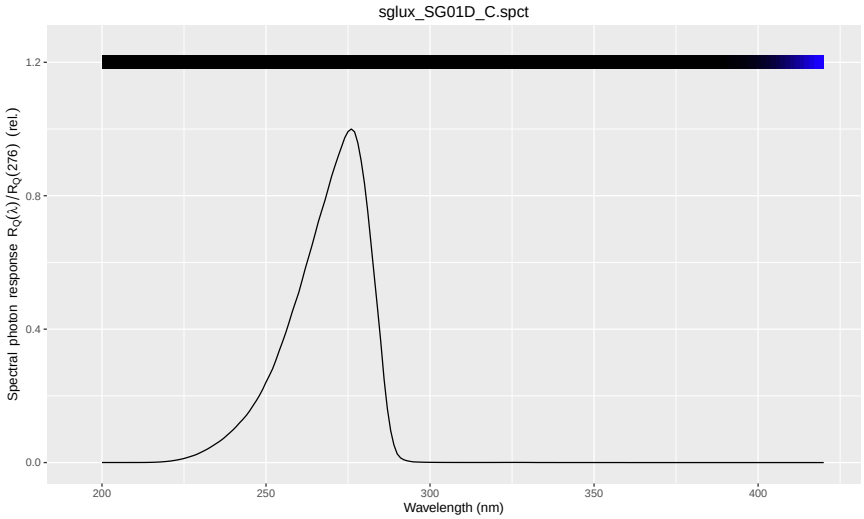




5 UVC sensors

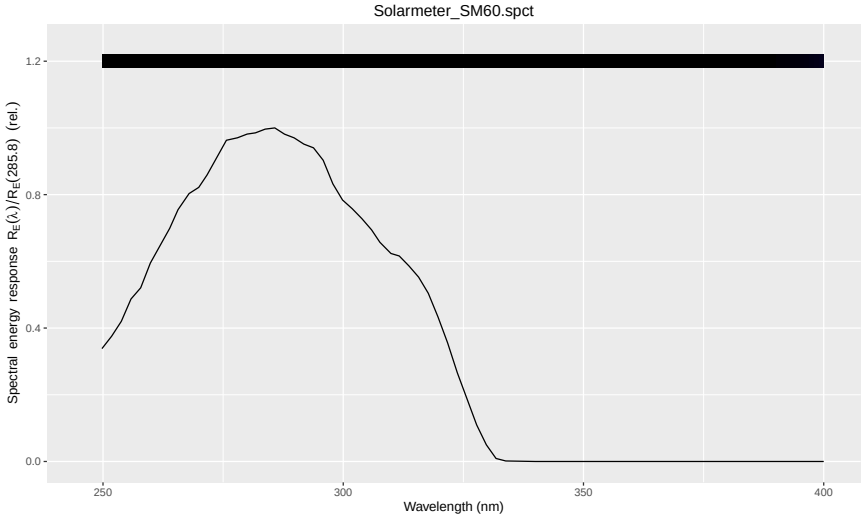
```
plotter(sglux_SG01D_C.spct)
```

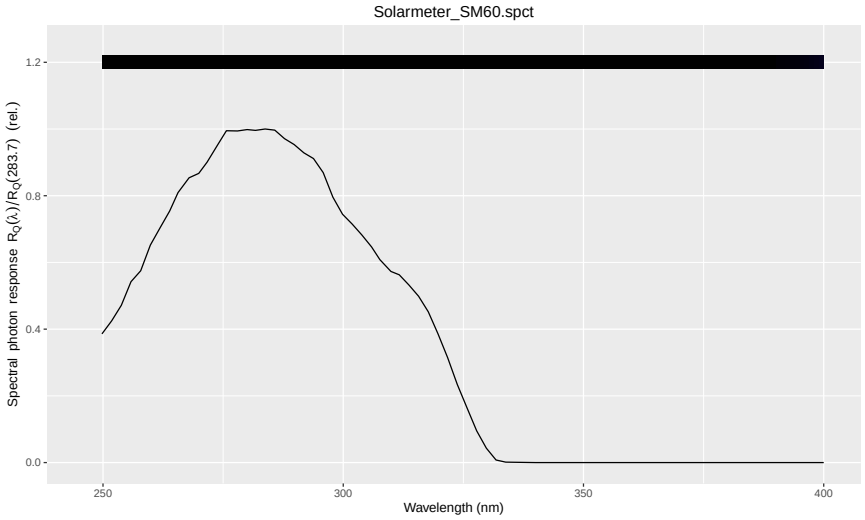


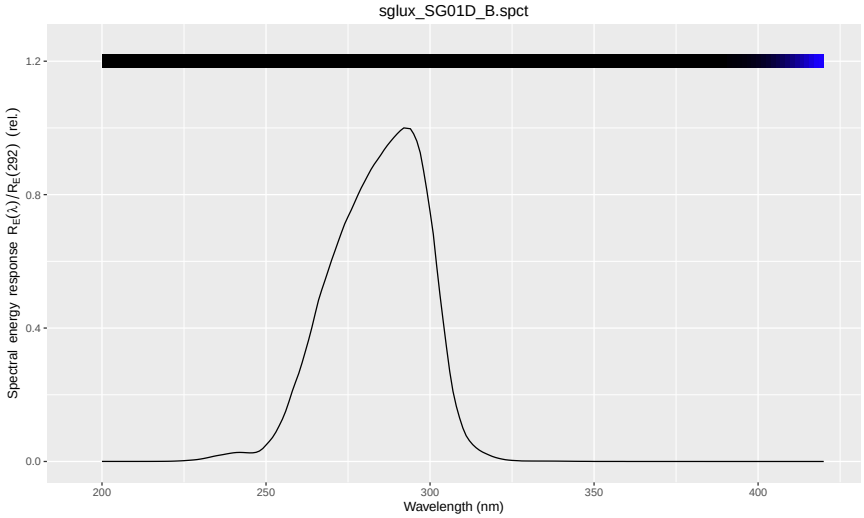


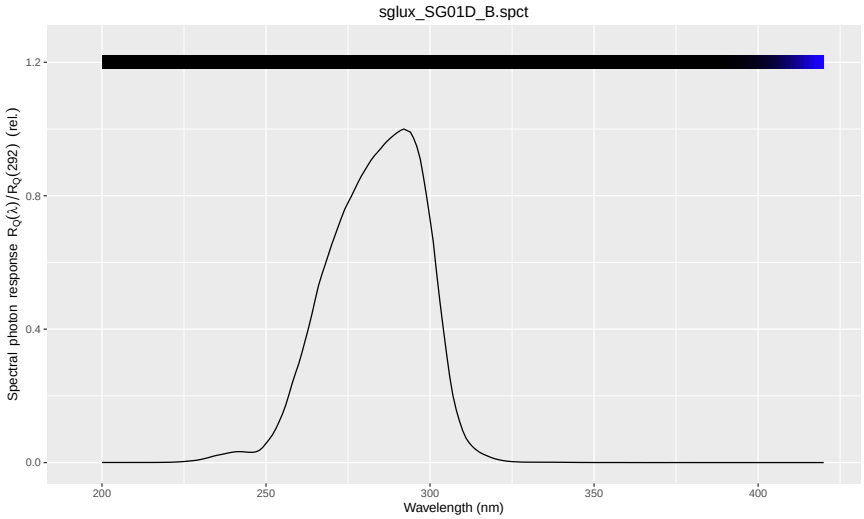
6 UVB sensors

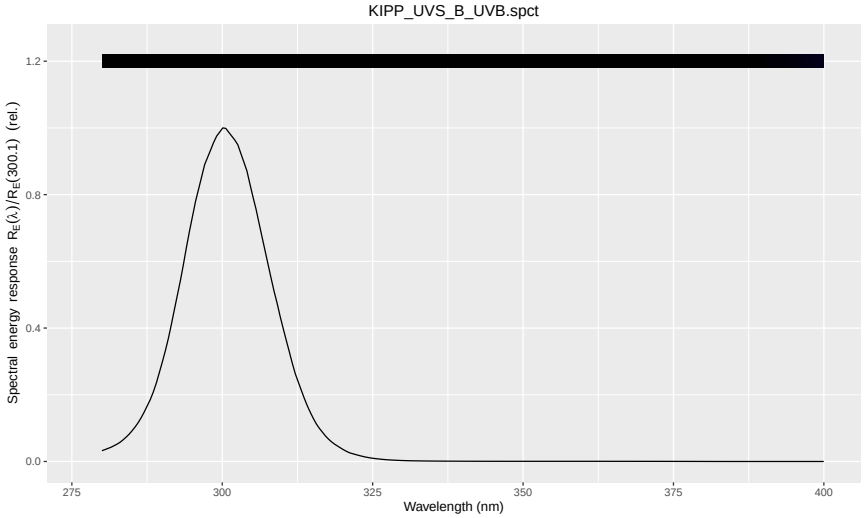
```
plotter(Solarmeter_SM60.spct)
plotter(sglux_SG01D_B.spct)
plotter(KIPP_UVS_B_UVB.spct)
plotter(Skye_SKU430a.spct)
```

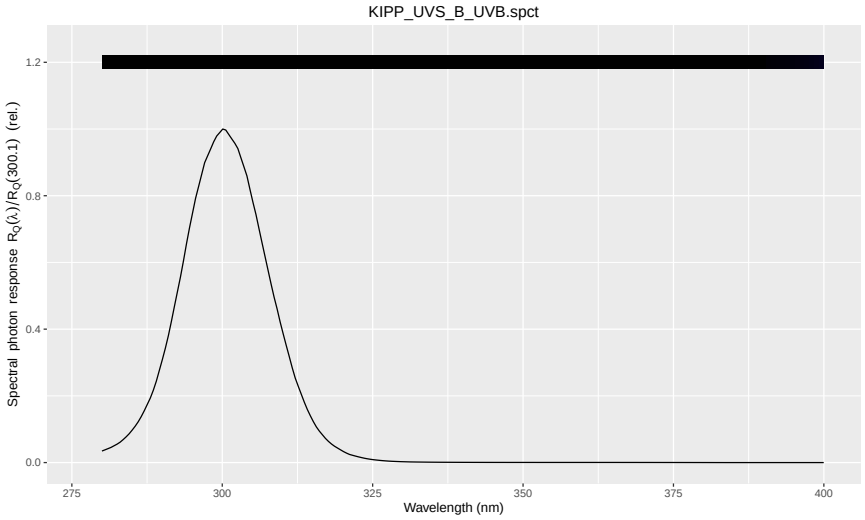

Solarmeter_SM60.spct
Spectral energy response $R_E(\lambda_i)/R_E(285.8)$ (rel.)
1.2
0.8
0.4
0.0
250
300
350
400
Wavelength (nm)

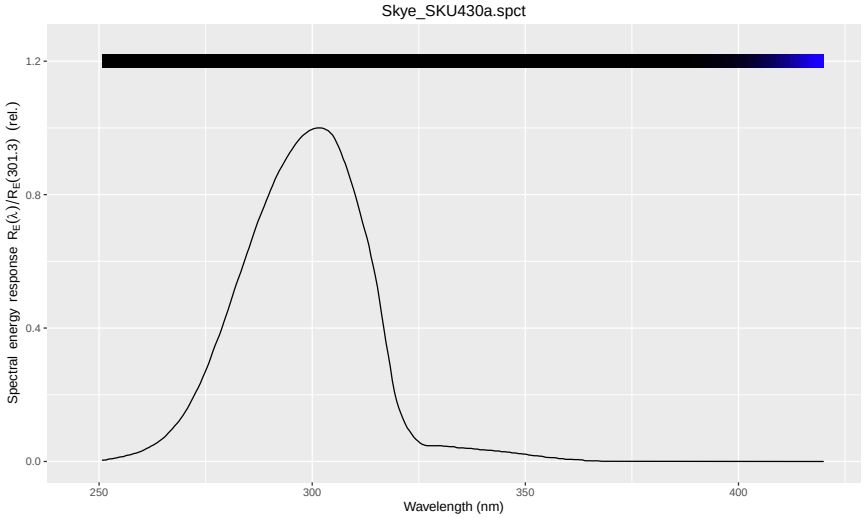

Solarmeter_SM60.spct
Spectral photon response $R_Q(\lambda_i)/R_Q(283.7)$ (rel.)
1.2
0.8
0.4
0.0
250
300
350
400
Wavelength (nm)

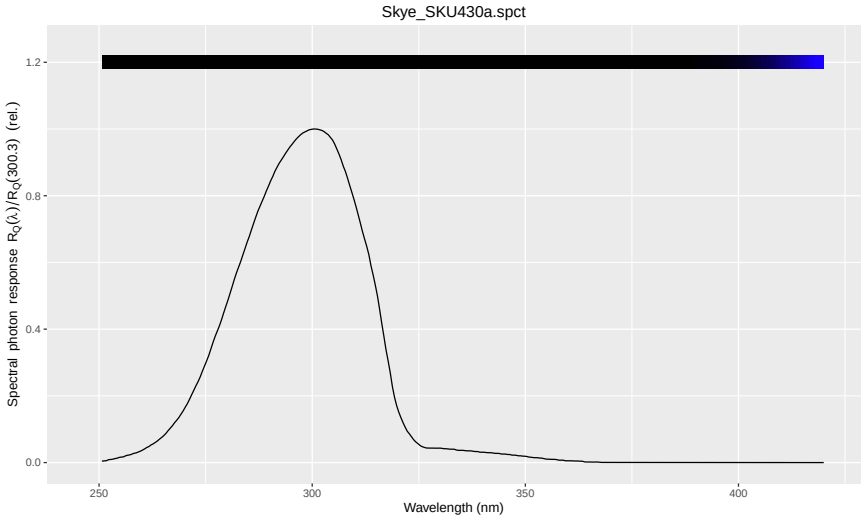

sglux_SG01D_B.spct
1.2
0.8
0.4
0.0
Spectral energy response $R_E(\lambda)/R_E(292)$ (rel.)
200
250
300
350
400
Wavelength (nm)


sglux_SG01D_B.spct
1.2
0.8
0.4
0.0
Spectral photon response $R_Q(\lambda)/R_Q(292)$ (rel.)
200
250
300
350
400
Wavelength (nm)


KIPP_UVS_B_UVB.spct
Spectral energy response $R_E(\lambda_i)/R_E(300.1)$ (rel.)
1.2
0.8
0.4
0.0
275
300
325
350
375
400
Wavelength (nm)

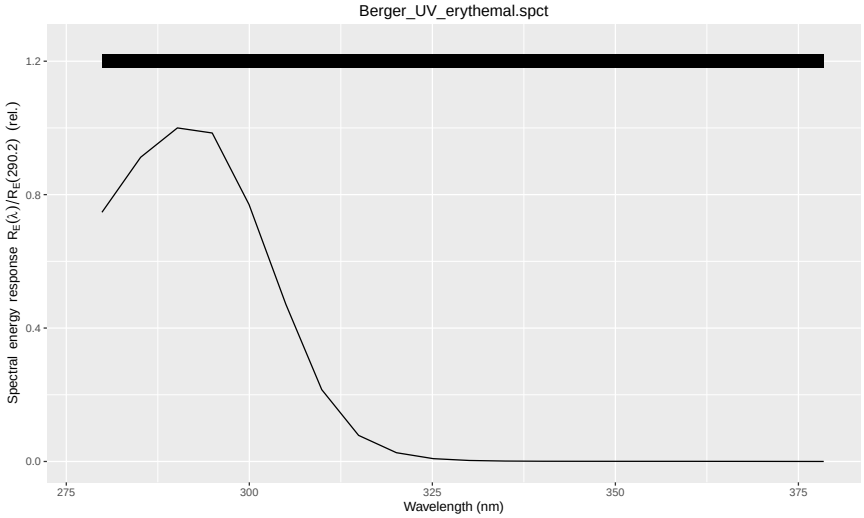

KIPP_UVS_B_UVB.spct
Spectral photon response $R_Q(\lambda_i)/R_Q(300.1)$ (rel.)
1.2
0.8
0.4
0.0
275
300
325
350
375
400
Wavelength (nm)

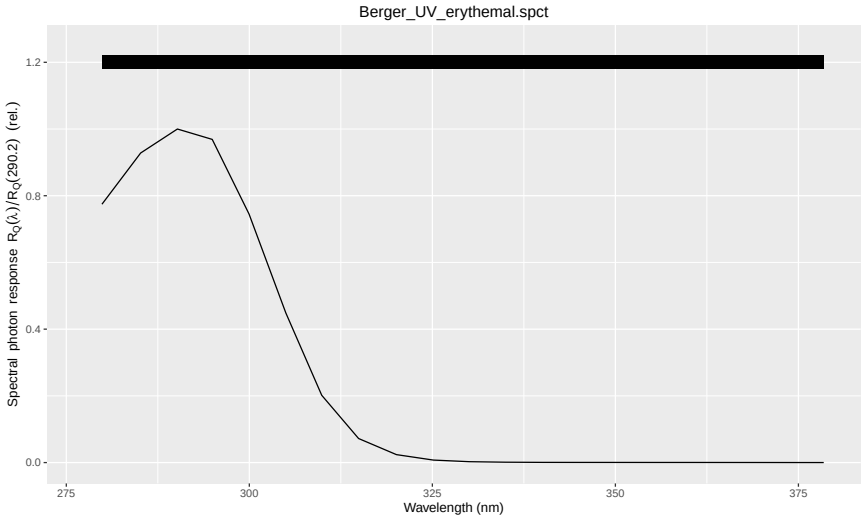


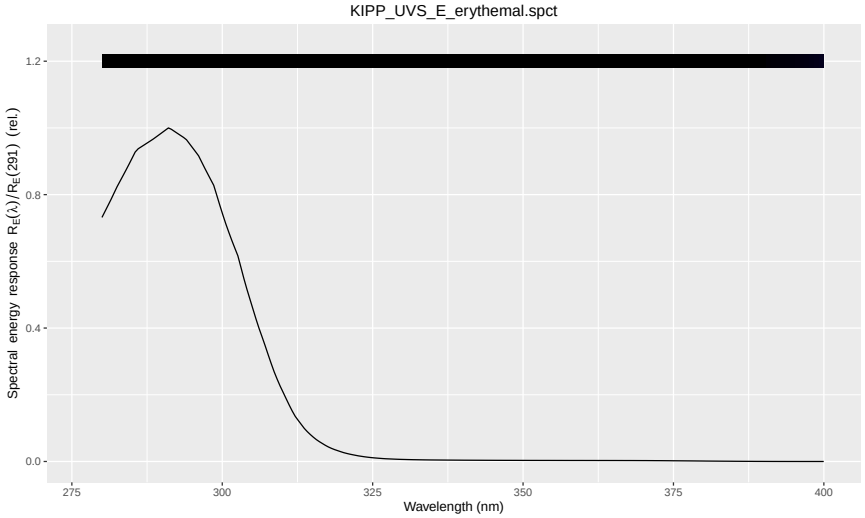


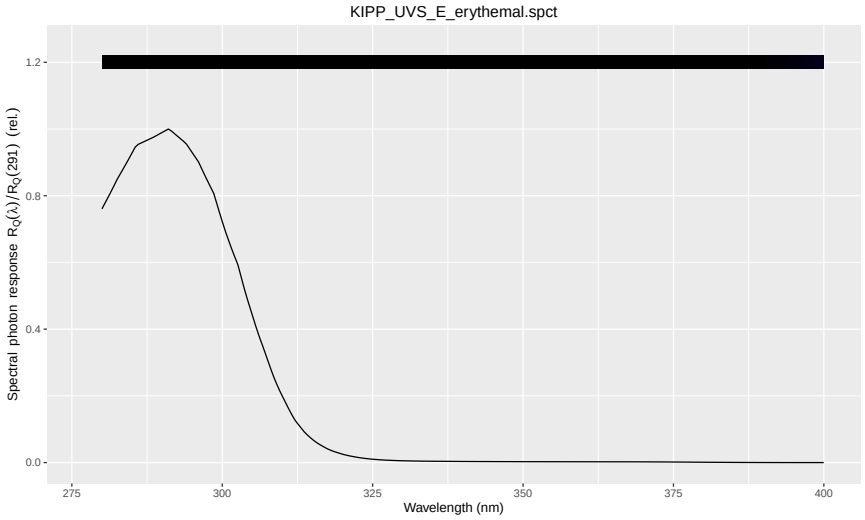
7 Erythemal UV sensors

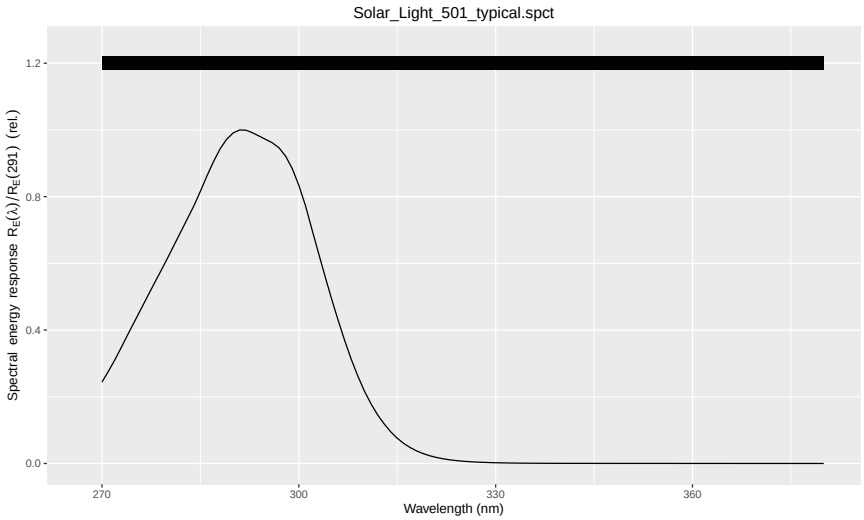
```
plotter(Berger_UV_erythemal.spct)
plotter(KIPP_UVS_E_erythemal.spct)
plotter(Solar_Light_501_typical.spct)
plotter(Solar_Light_501_high_UVA.spct)
plotter(Solar_Light_501_low_UVA.spct)
plotter(Vital_BW_20.spct)
plotter(Thies_E1c.spct)
plotter(Skye_SKU440a.spct)
```

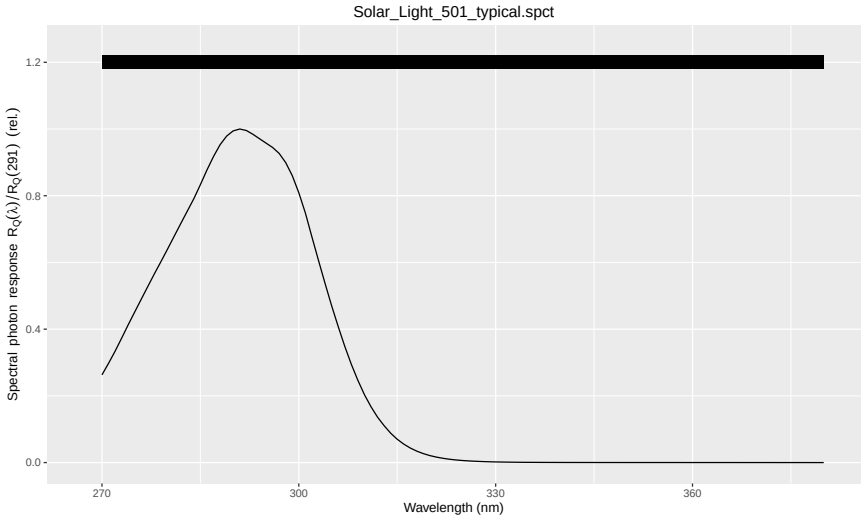

Berger_UV_erythemal.spct
Spectral energy response $R_E(\lambda_i)/R_E(290.2)$ (rel.)
1.2
0.8
0.4
0.0
275
300
325
350
375
Wavelength (nm)

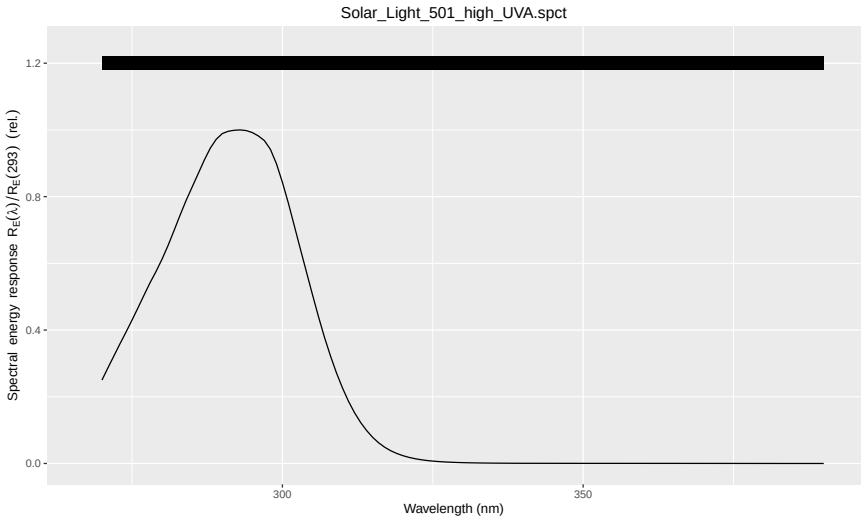

Berger_UV_erythemal.spct
Spectral photon response $R_Q(\lambda_i)/R_Q(290.2)$ (rel.)
1.2
0.8
0.4
0.0
275
300
325
350
375
Wavelength (nm)

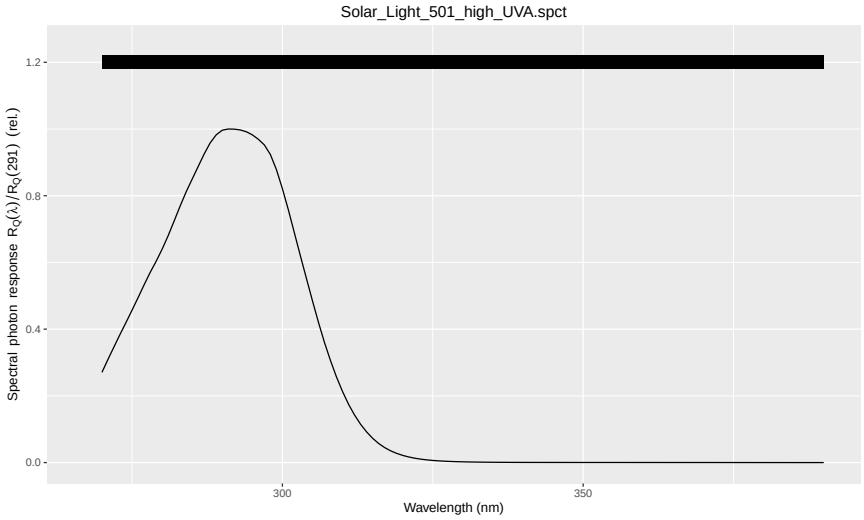

KIPP_UVS_E_erythemal.spct
Spectral energy response $R_{E\lambda}(\lambda)/R_{E\lambda}(291)$ (rel.)
1.2
0.8
0.4
0.0
275
300
325
350
375
400
Wavelength (nm)

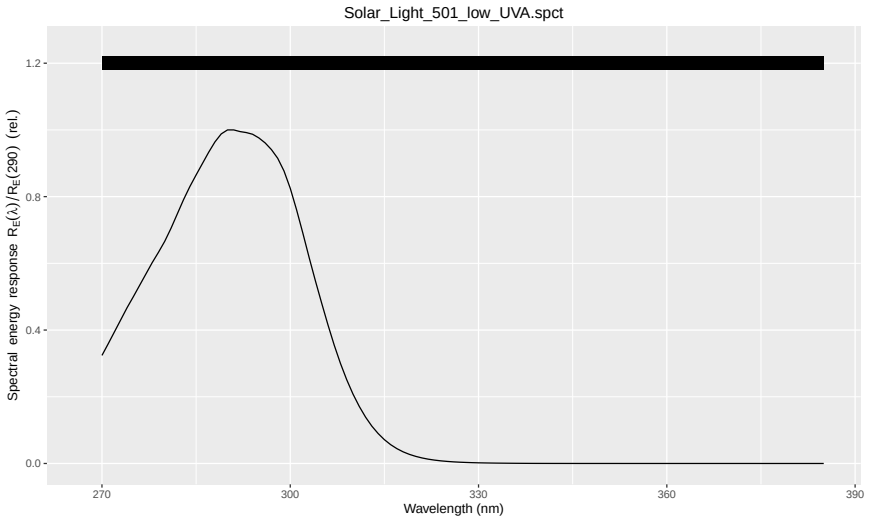

KIPP_UVS_E_erythemal.spct
Spectral photon response $R_Q(\lambda)/R_Q(291)$ (rel.)
1.2
0.8
0.4
0.0
275
300
325
350
375
400
Wavelength (nm)

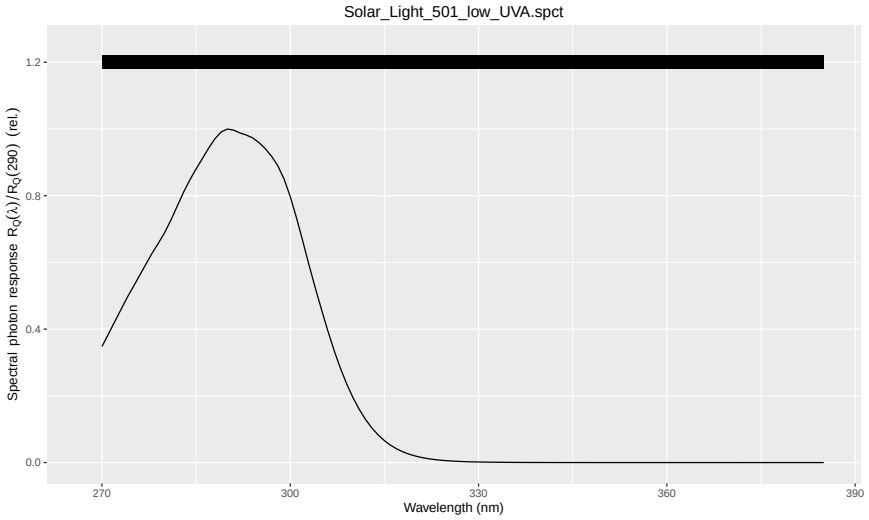

Solar_Light_501_typical.spct
Spectral energy response $R_{E}(\lambda)/R_{E}(291)$ (rel.)
1.2
0.8
0.4
0.0
270
300
330
360
Wavelength (nm)

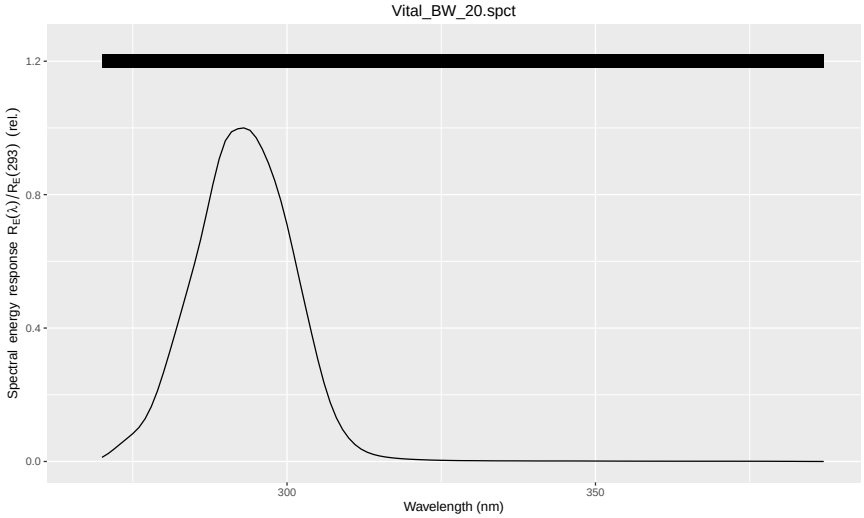

Solar_Light_501_typical.spct
Spectral photon response $R_{Q}(\lambda)/R_{Q}(291)$ (rel.)
1.2
0.8
0.4
0.0
270
300
330
360
Wavelength (nm)

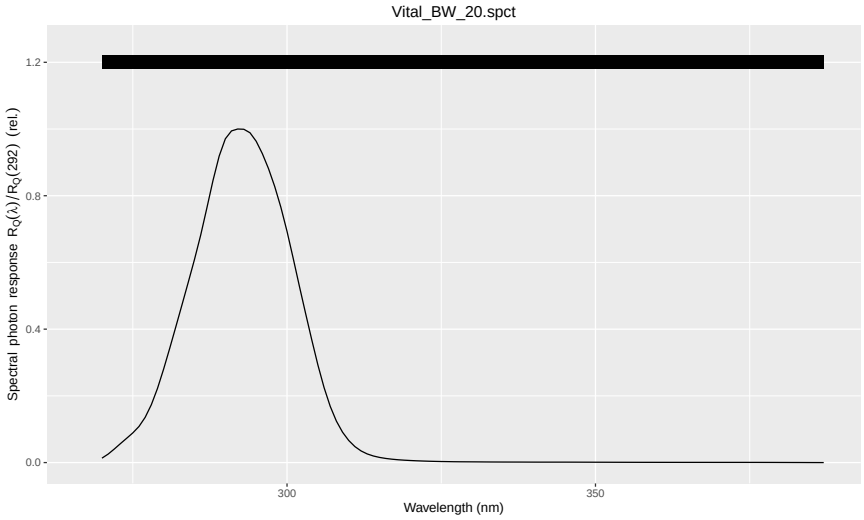

Solar_Light_501_high_UVA.spct
Spectral energy response $R_E(\lambda)/R_E(293)$ (rel.)
1.2
0.8
0.4
0.0
300
350
Wavelength (nm)

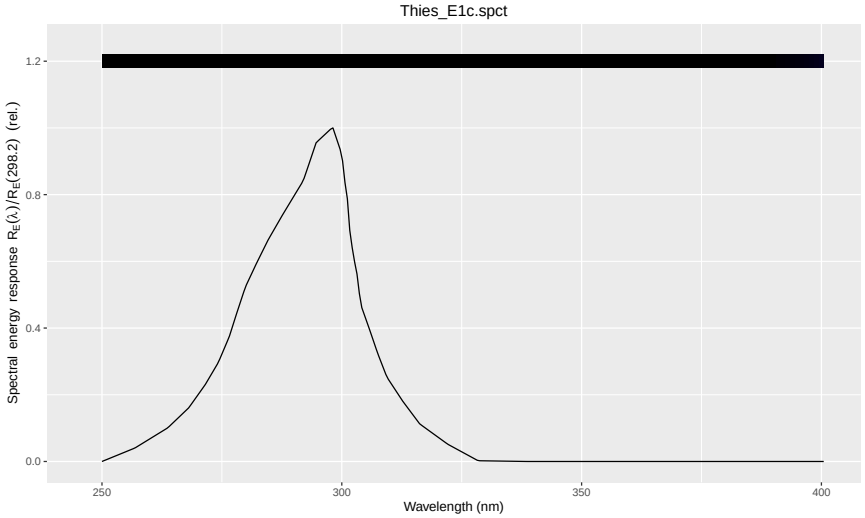

Solar_Light_501_high_UVA.spct
Spectral photon response $R_Q(\lambda)/R_Q(291)$ (rel.)
1.2
0.8
0.4
0.0
300
350
Wavelength (nm)

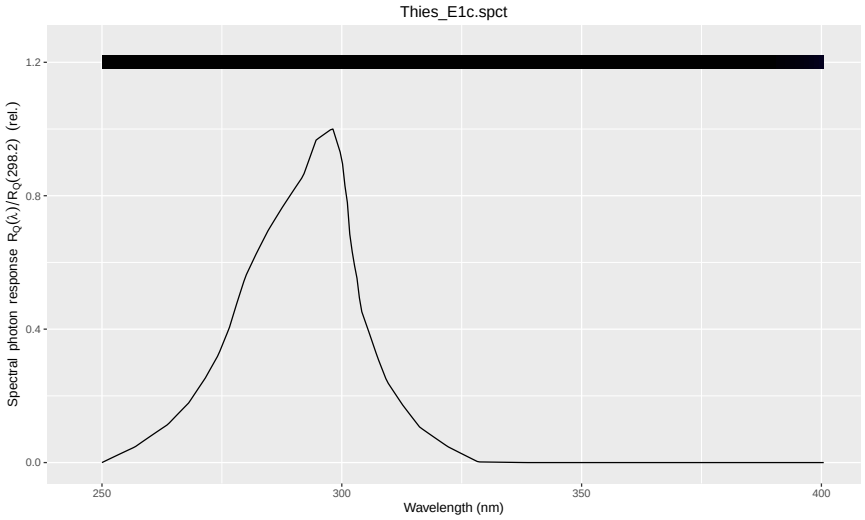

Solar_Light_501_low_UVA.spct
Spectral energy response $R_{E}(\lambda)/R_{E}(290)$ (rel.)
1.2
0.8
0.4
0.0
270
300
330
360
390
Wavelength (nm)

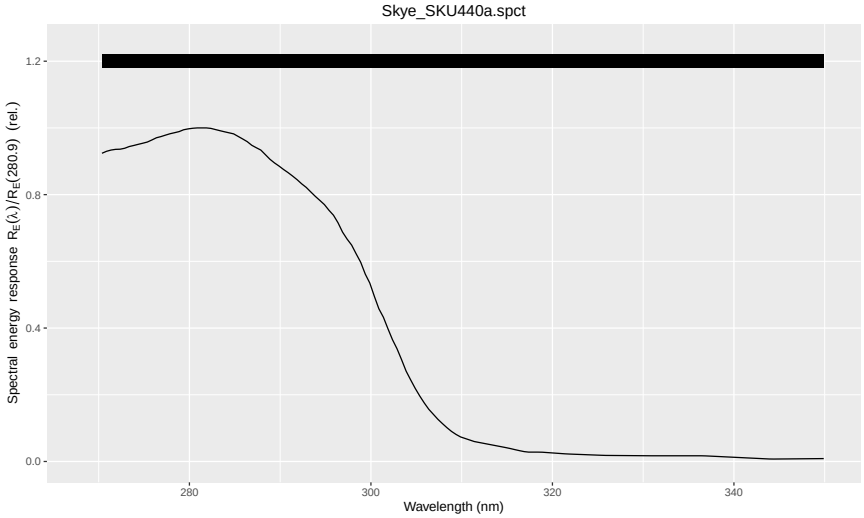

Solar_Light_501_low_UVA.spct
Spectral photon response $R_{Q}(\lambda)/R_{Q}(290)$ (rel.)
1.2
0.8
0.4
0.0
270
300
330
360
390
Wavelength (nm)

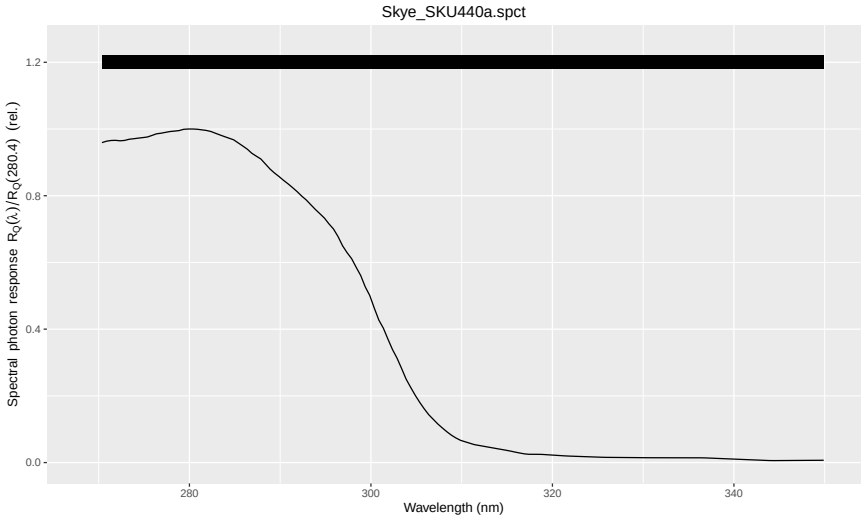

Vital_BW_20.spct
1.2
0.8
0.4
0.0
Spectral energy response $R_E(\lambda)/R_E(293)$ (rel.)
300
350
Wavelength (nm)


Vital_BW_20.spct
1.2
0.8
0.4
0.0
Spectral photon response $R_Q(\lambda)/R_Q(292)$ (rel.)
300
350
Wavelength (nm)


Thies_E1c.spct
Spectral energy response $R_E(\lambda_i)/R_E(298.2)$ (rel.)
1.2
0.8
0.4
0.0
250
300
350
400
Wavelength (nm)

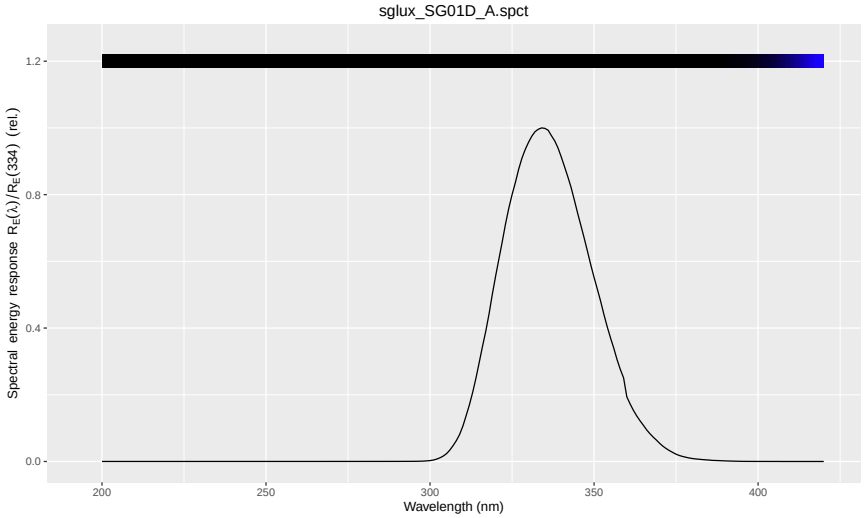

Thies_E1c.spct
Spectral photon response $R_Q(\lambda_i)/R_Q(298.2)$ (rel.)
1.2
0.8
0.4
0.0
250
300
350
400
Wavelength (nm)

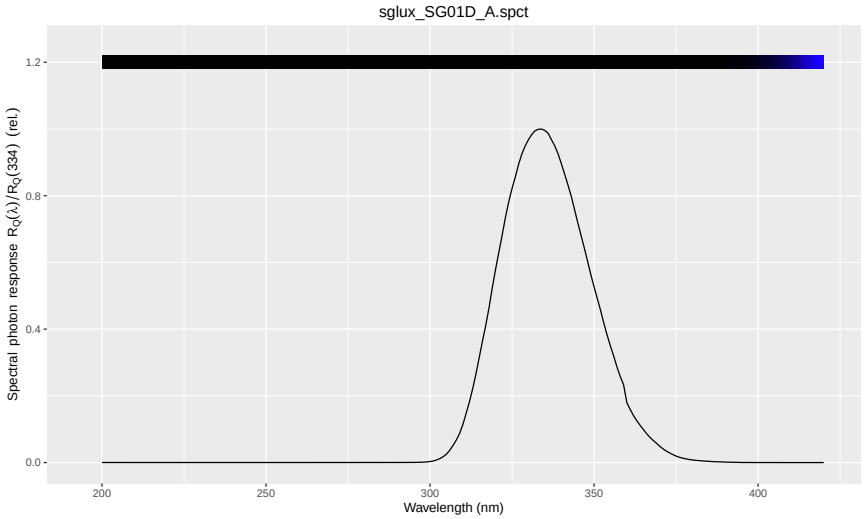


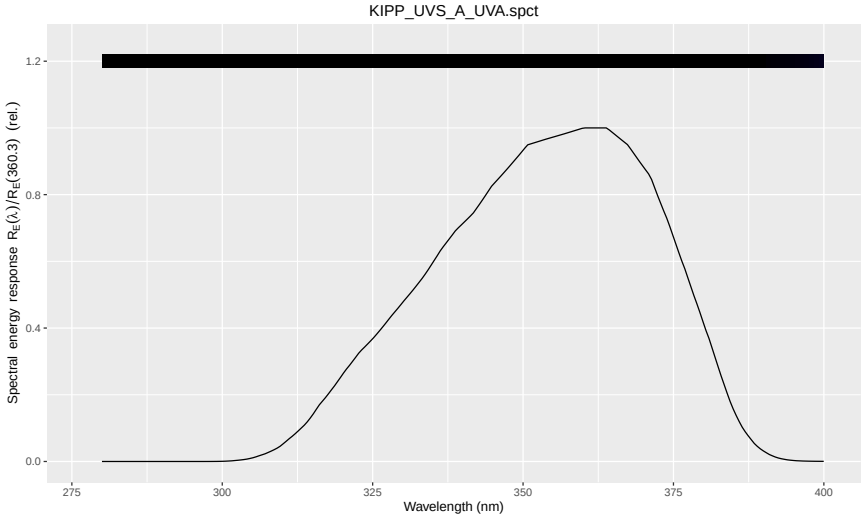


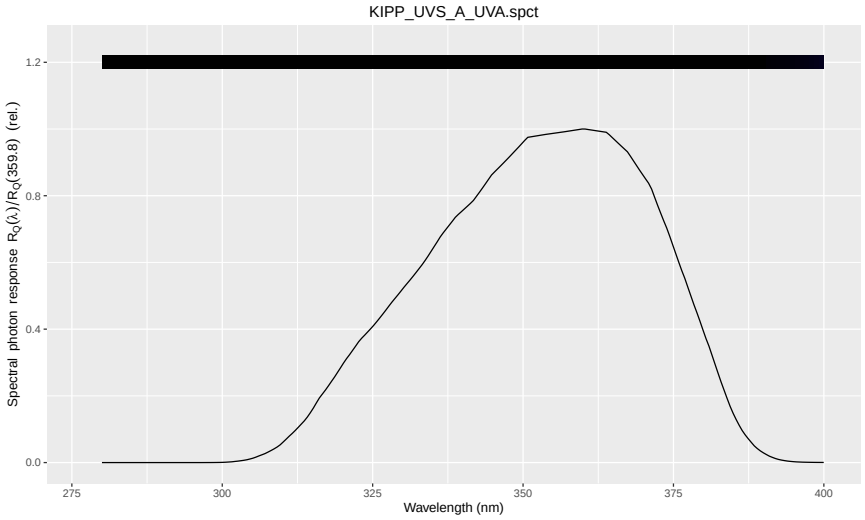
8 UVA sensors

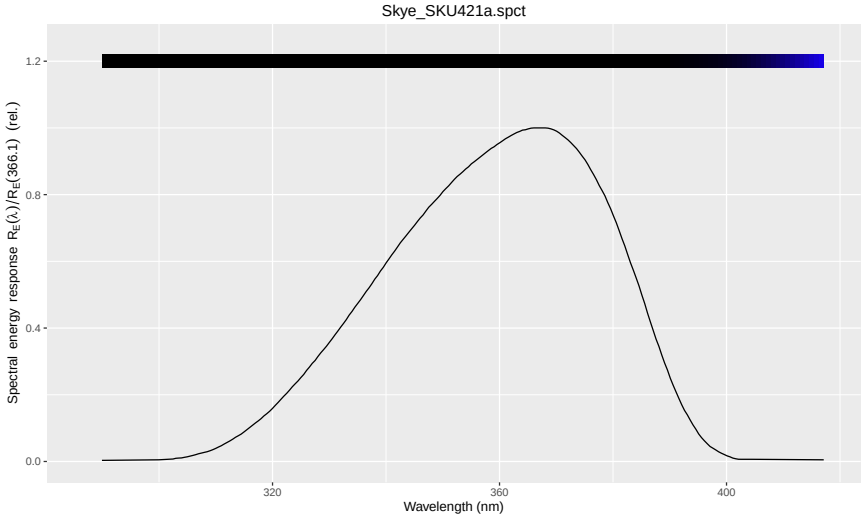
```
plotter(sglux_SG01D_A.spct)
plotter(KIPP_UVS_A_UVA.spct)
plotter(Skye_SKU421a.spct)
plotter(Skye_SKU421.spct)
```

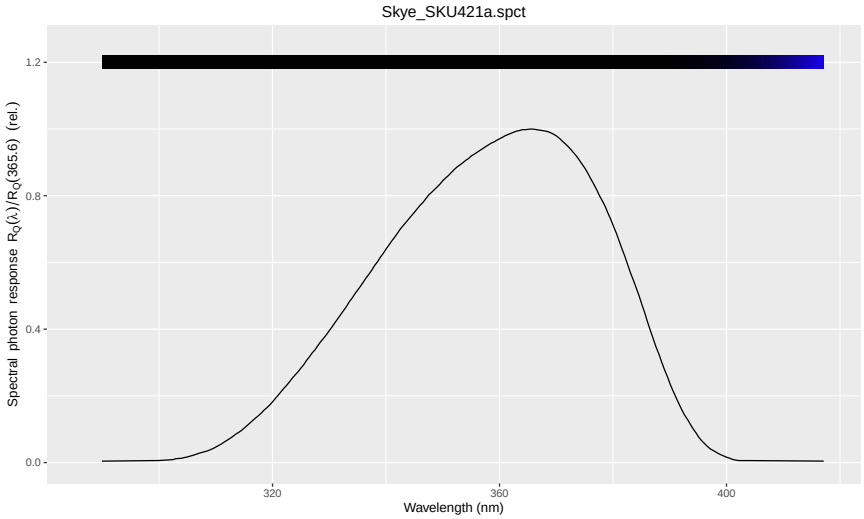

sglux_SG01D_A.spct
1.2
0.8
0.4
0.0
Spectral energy response $R_E(\lambda)/R_E(334)$ (rel.)
200
250
300
350
400
Wavelength (nm)

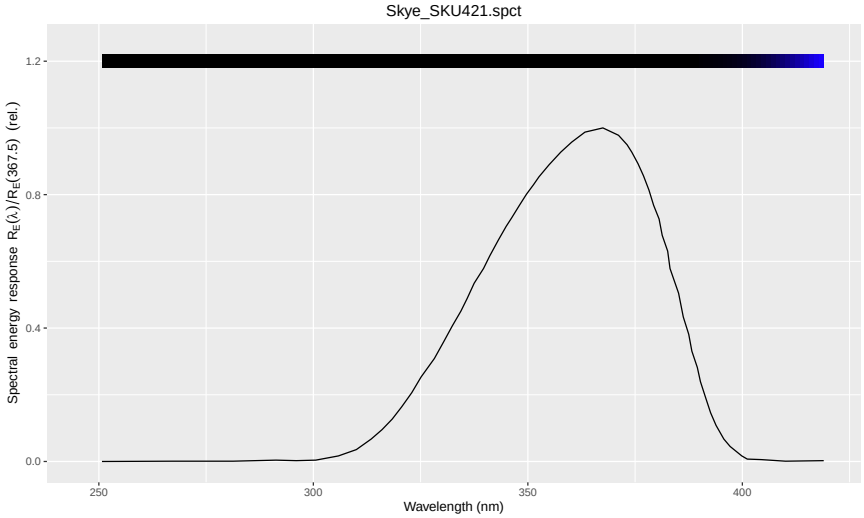

sglux_SG01D_A.spct
1.2
0.8
0.4
0.0
Spectral photon response $R_Q(\lambda)/R_Q(334)$ (rel.)
200
250
300
350
400
Wavelength (nm)

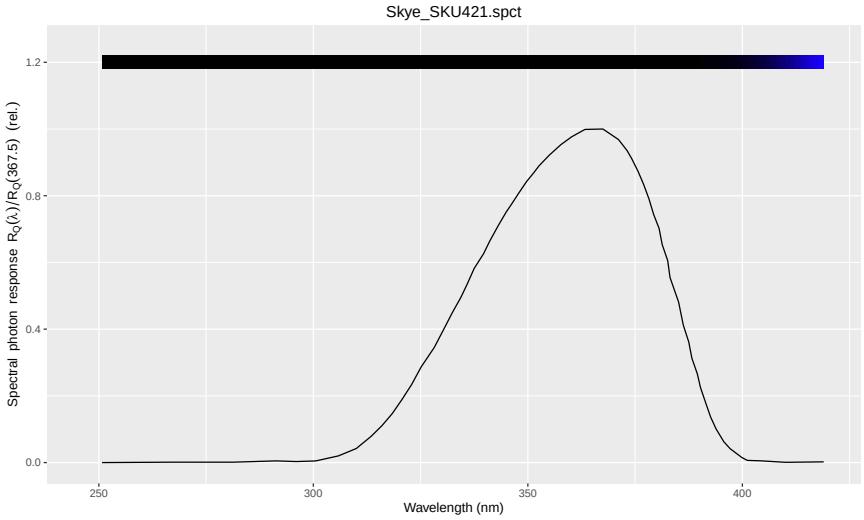

KIPP_UVS_A_UVA.spct
Spectral energy response $R_E(\lambda_.)/R_E(360.3)$ (rel.)
1.2
0.8
0.4
0.0
275
300
325
350
375
400
Wavelength (nm)


KIPP_UVS_A_UVA.spct
Spectral photon response $R_Q(\lambda_.)/R_Q(359.8)$ (rel.)
1.2
0.8
0.4
0.0
275
300
325
350
375
400
Wavelength (nm)


Skye_SKU421a.spct
Spectral energy response $R_E(\lambda_.)/R_E(366.1)$ (rel.)
1.2
0.8
0.4
0.0
320
360
400
Wavelength (nm)

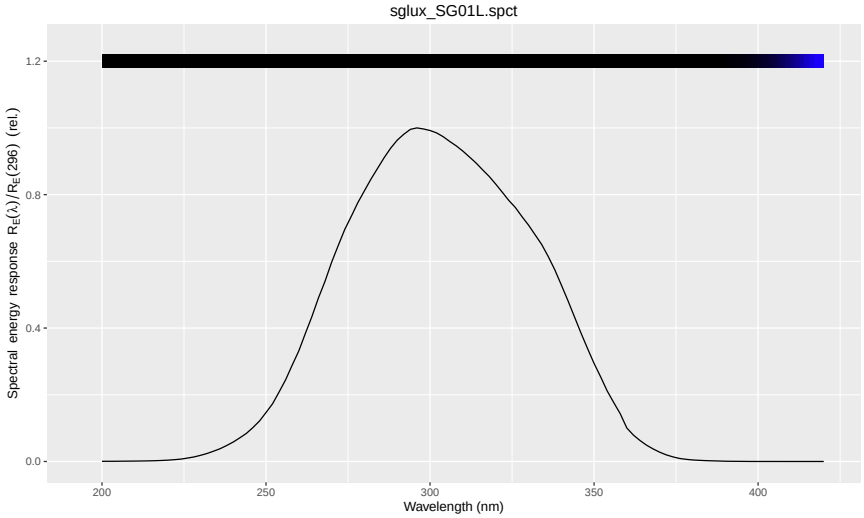

Skye_SKU421a.spct
Spectral photon response $R_Q(\lambda_.)/R_Q(365.6)$ (rel.)
1.2
0.8
0.4
0.0
320
360
400
Wavelength (nm)

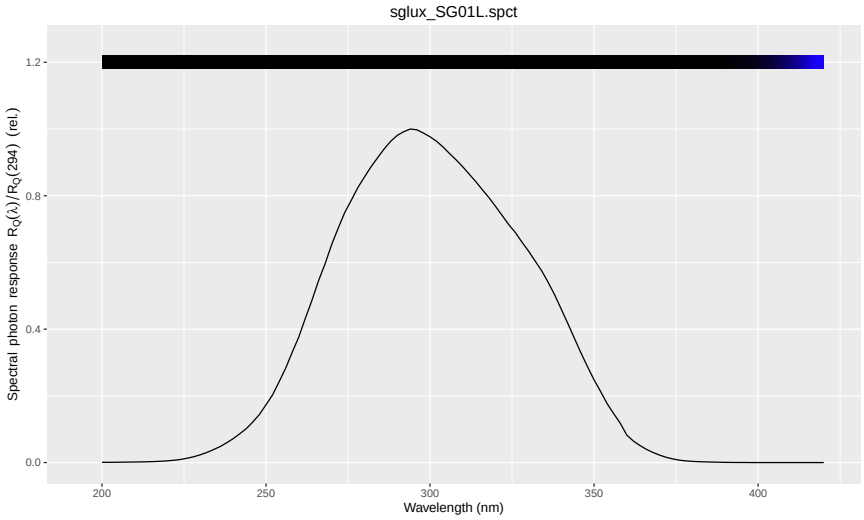


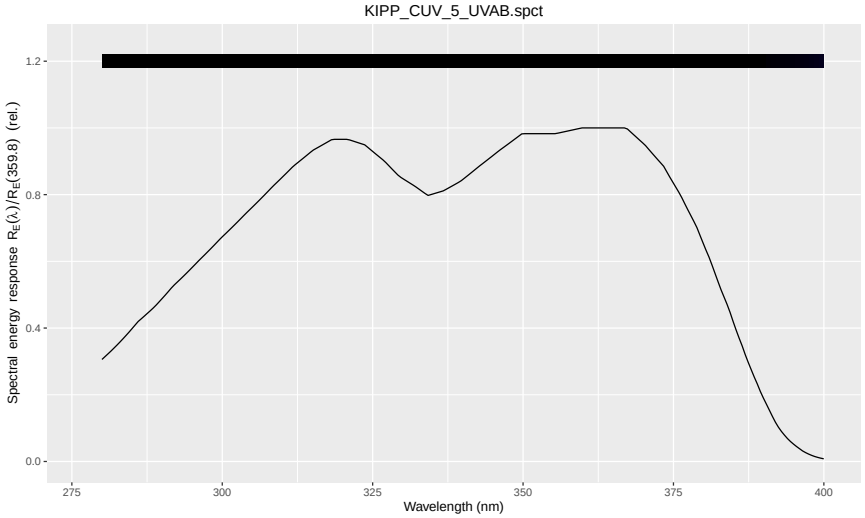


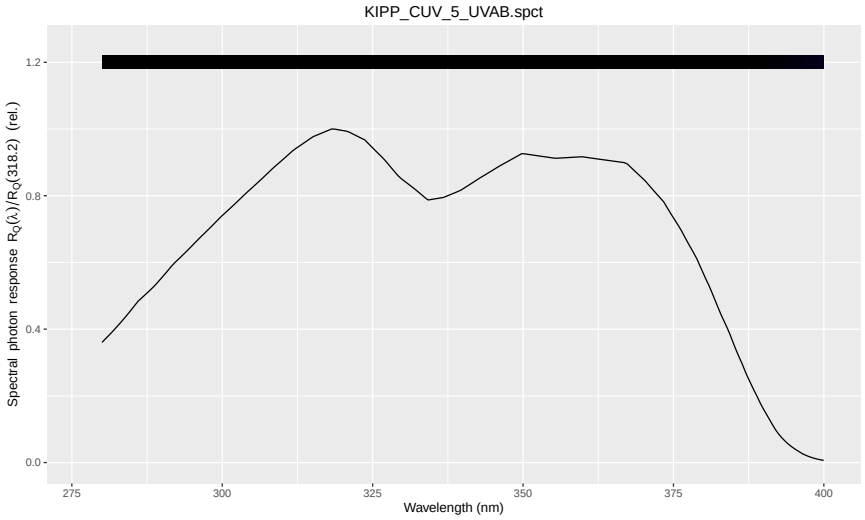
9 Broadband UV sensors

```
plotter(sglux_SG01L.spct)
plotter(KIPP_CUV_5_UVAB.spct)
```


sglux_SG01L.spct
Spectral energy response $R_{E}(\lambda)/R_{E}(296)$ (rel.)
1.2
0.8
0.4
0.0
200
250
300
350
400
Wavelength (nm)


sglux_SG01L.spct
Spectral photon response $R_{Q}(\lambda)/R_{Q}(294)$ (rel.)
1.2
0.8
0.4
0.0
200
250
300
350
400
Wavelength (nm)

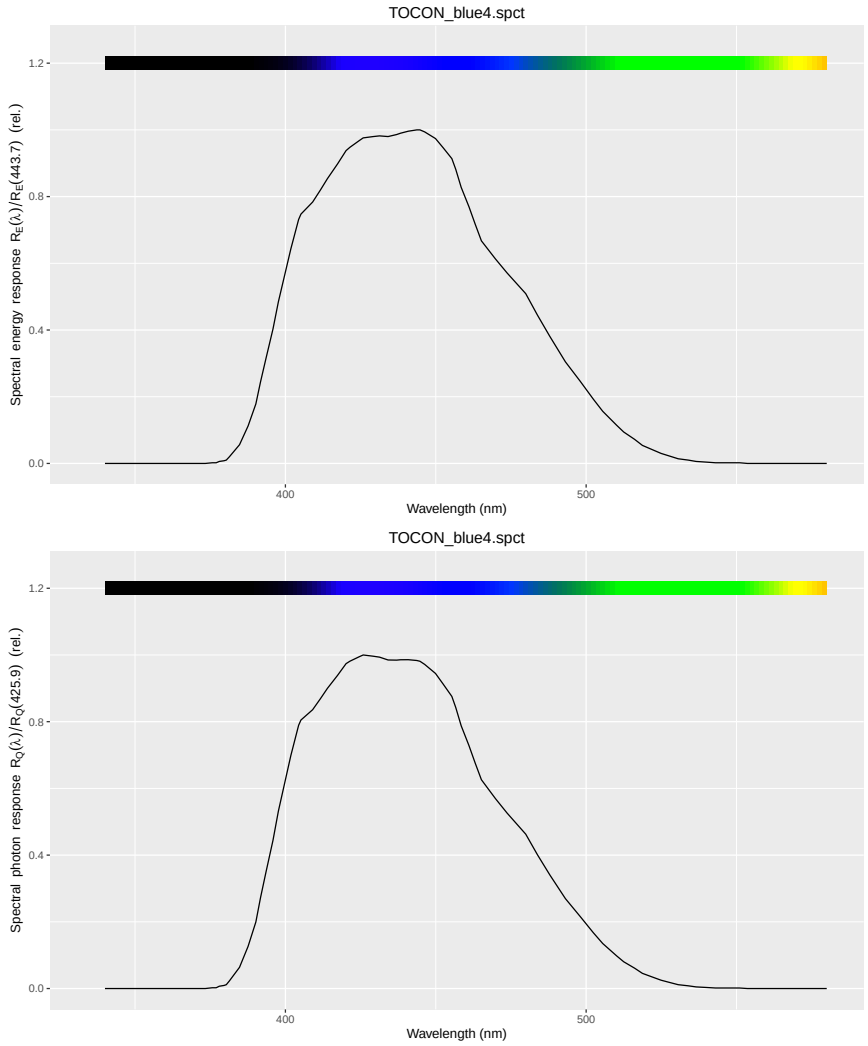




10 Blue sensors

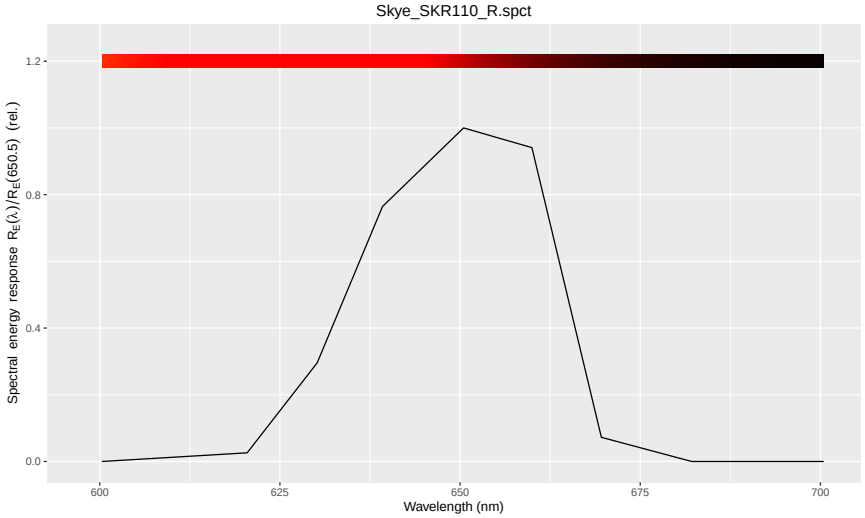
```
options(photobiology.plot.bands = Plant_bands("sensory"))
```

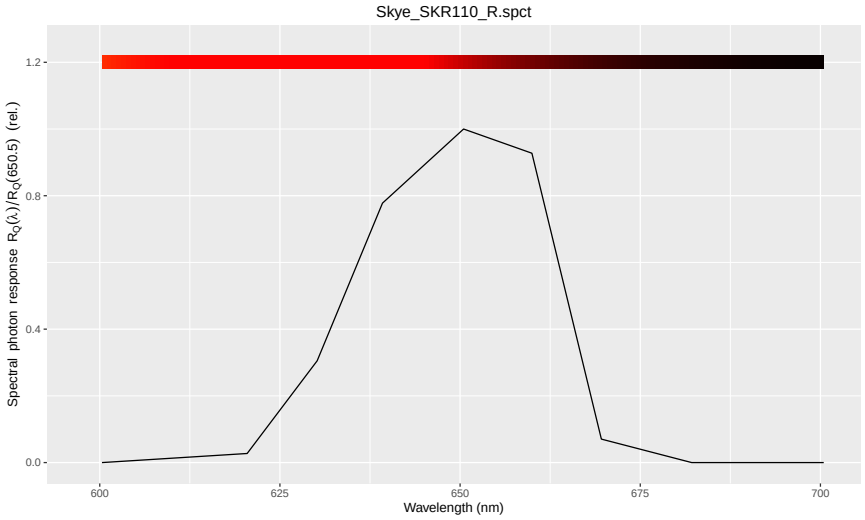
```
plotter(TOCON_blue4.spct)
```

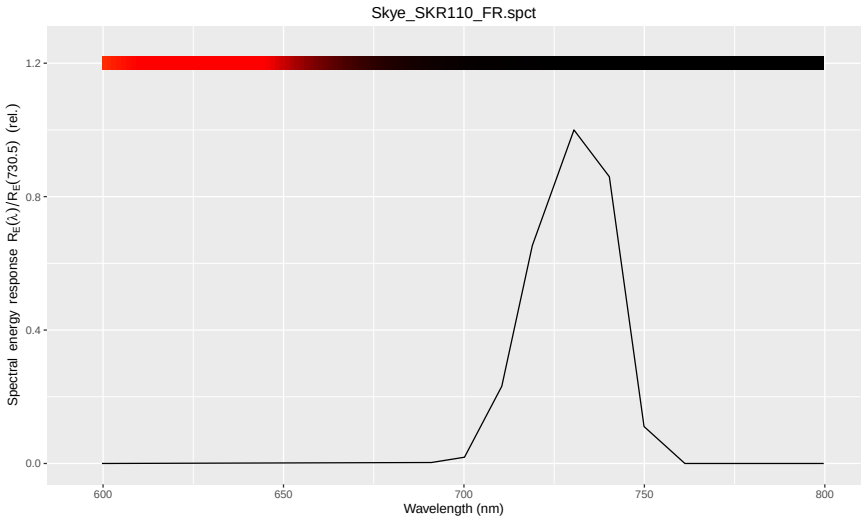


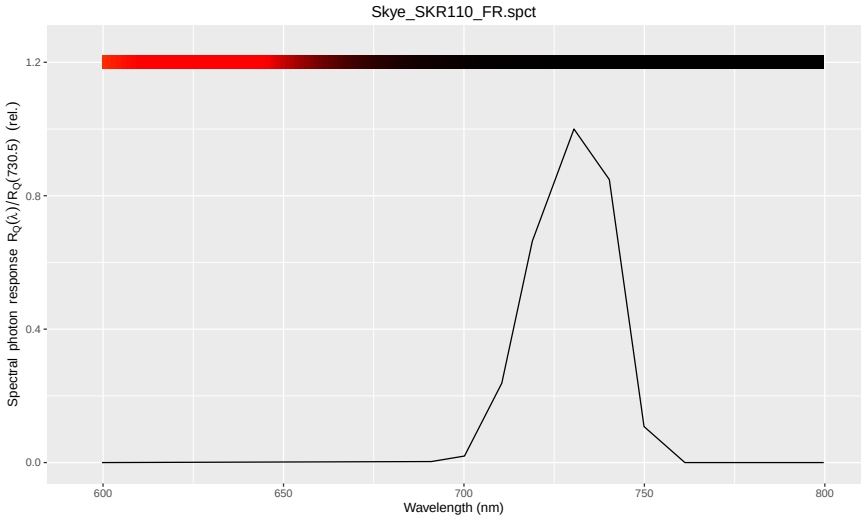
11 Red and far-red sensors

```
plotter(Skye_SKR110_R.spct)
plotter(Skye_SKR110_FR.spct)
```


Skye_SKR110_R.spct
Spectral energy response $R_E(\lambda_i)/R_E(650.5)$ (rel.)
1.2
0.8
0.4
0.0
600
625
650
675
700
Wavelength (nm)


Skye_SKR110_R.spct
Spectral photon response $R_Q(\lambda_i)/R_Q(650.5)$ (rel.)
1.2
0.8
0.4
0.0
600
625
650
675
700
Wavelength (nm)


Skye_SKR110_FR.spct
Spectral energy response $R_E(\lambda_i)/R_E(730.5)$ (rel.)
1.2
0.8
0.4
0.0
600
650
700
750
800
Wavelength (nm)


Skye_SKR110_FR.spct
Spectral photon response $R_Q(\lambda_i)/R_Q(730.5)$ (rel.)
1.2
0.8
0.4
0.0
600
650
700
750
800
Wavelength (nm)