Comparisons: The Devil's in the Details

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Warn ception

What I think my beard makes me look like

What my beard actually makes me look like

Warning 2: Compare Apple to Apples

- Comparisons between measurements by different instruments are not as simple as plotting on the same graph.
- Consideration must be given to:
  - Spectral sampling and resolution
  - Temporal sampling and resolution
  - Data product details

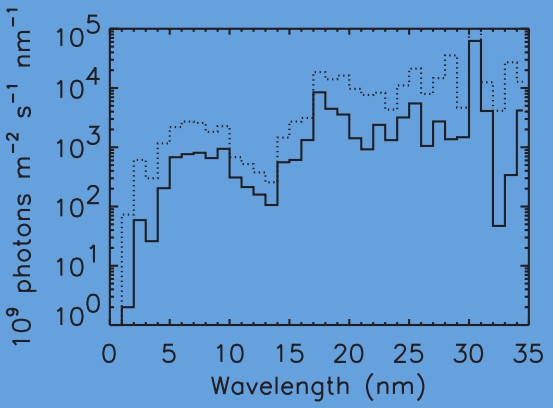
Spectral Considerations (1)

Broadband measurements:

- What are the instrument passbands?
- Are irradiance data products reported as:
  - under instrument response function?
  - in a wavelength range (modeled square response)?
- Is an incident spectral shape assumed?

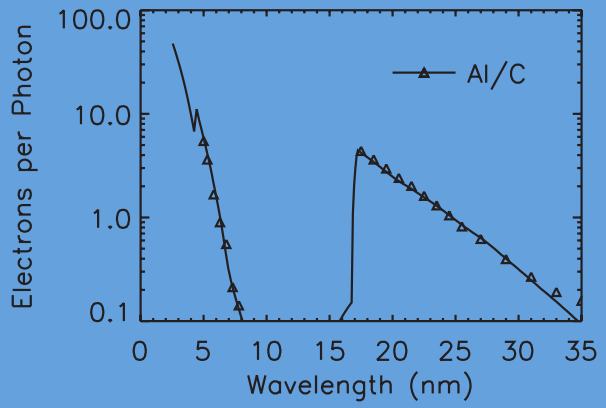
Example of Broadband Photometers

Assumed Solar Spectrum

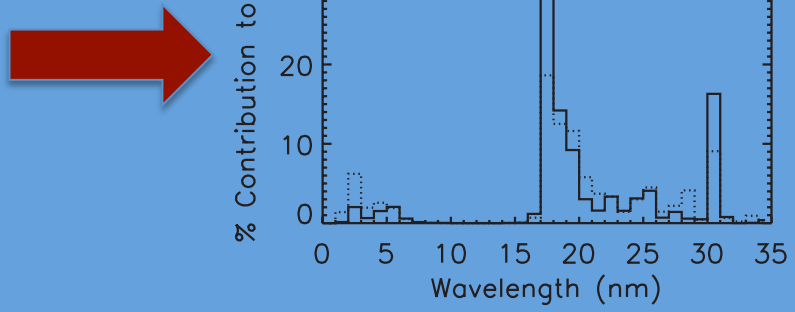


and

Photometer Responsivity



Spectral Contributions to Signal



Data Product Reported:

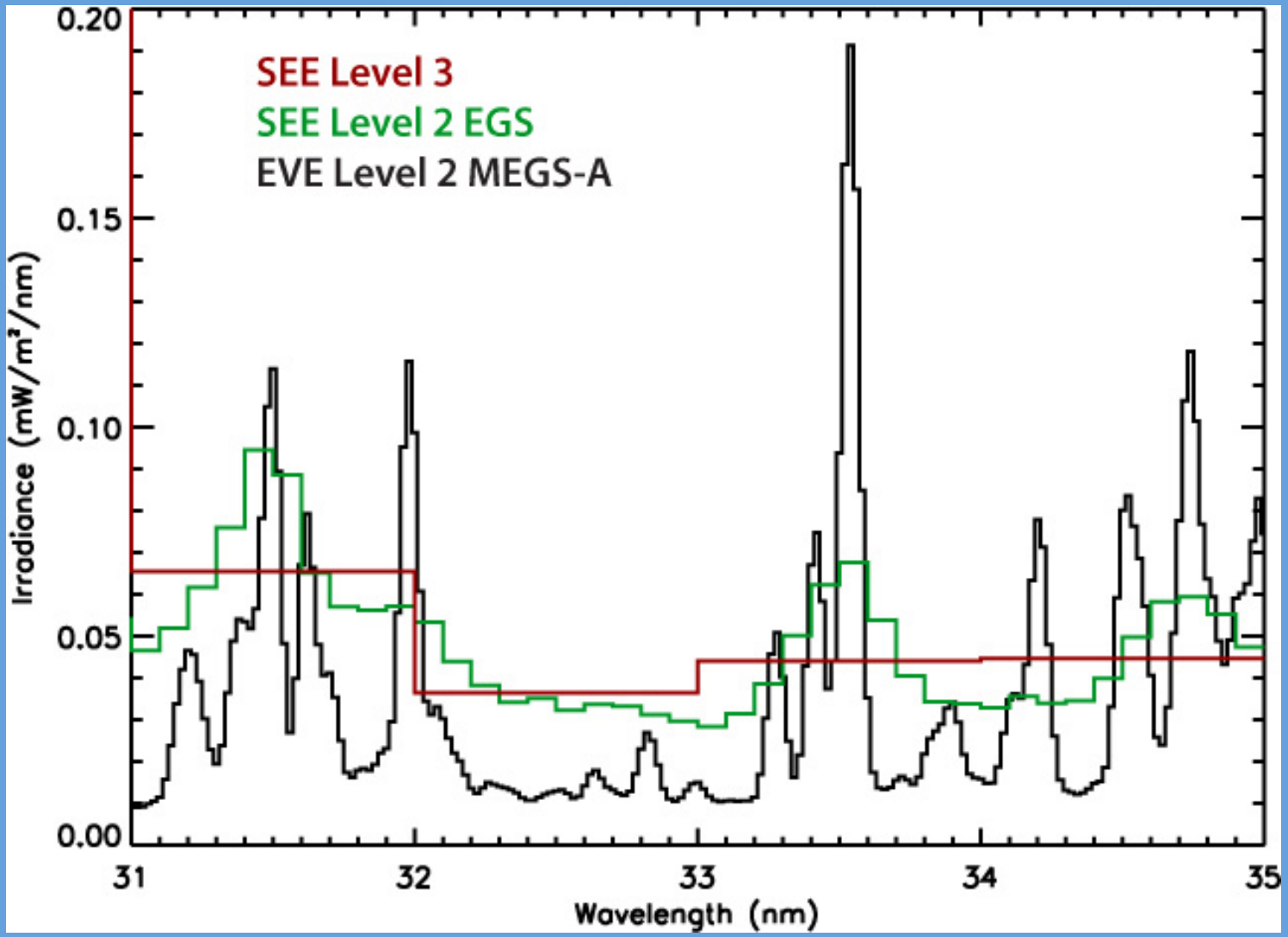
A single number

Spectral Considerations (2)

Spectrally resolved measurements:

- What are the instrument spectral resolutions and slit functions?
- How over/under-sampled is the slit function?
- Are the data products reported:
  - at instrument resolution and sampling?
  - as summed into larger bins? How?

Data at Different Resolutions



Spectral Considerations (3)

Other spectral considerations:

- Are you comparing broadband to spectrally resolved? Or low resolution to high resolution?
  - Do you bin the higher resolution data in wavelength to match the lower resolution?
  - Do you convolve the higher resolution data with the slit function or passband of the lower resolution or broadband data?
- Is the data reported mathematically filtered or smoothed in wavelength?

Temporal Considerations

- What are the integration times?
  - Are they longer than variability?
- What are the measurement cadences?
  - Are you comparing truly simultaneous, or just overlapping measurements?
- Are the data products reported as:
  - averages over time?
  - medians over time?
- Is the data reported mathematically filtered or smoothed in time? Is data thrown out?

Recommendations

- Proper comparisons require work:
  - Resample higher spectral and temporal resolution data at the lowest resolution of the measurements being compared.
  - Make sure you sample/re-sample the measurements in a similar fashion.
  - Understand underlying assumptions in the data processing and apply them to all measurements to be compared.
  - Know the measurement equations for all instruments!

Compare apples to apples!