Band averaged pure water properties

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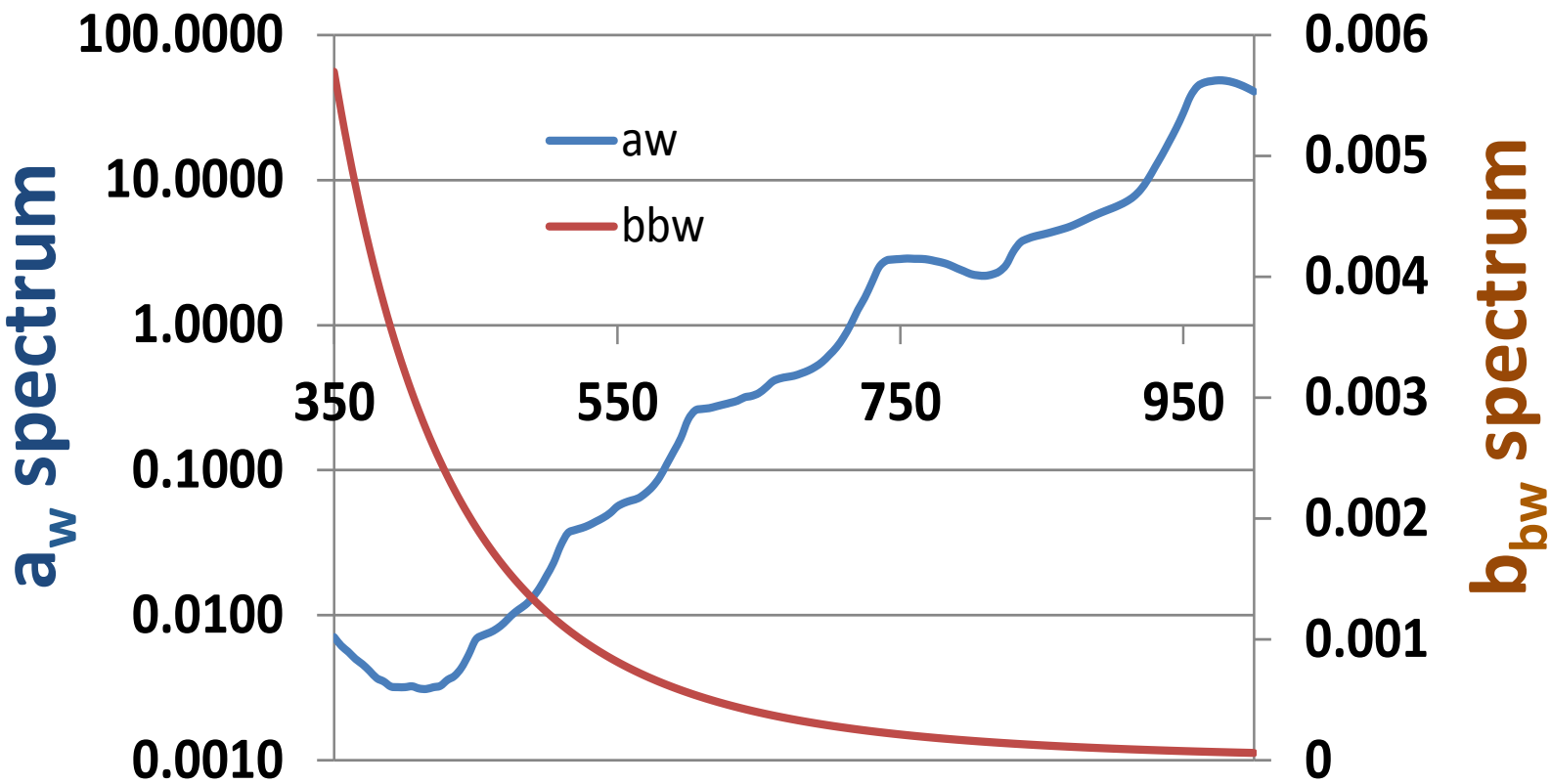
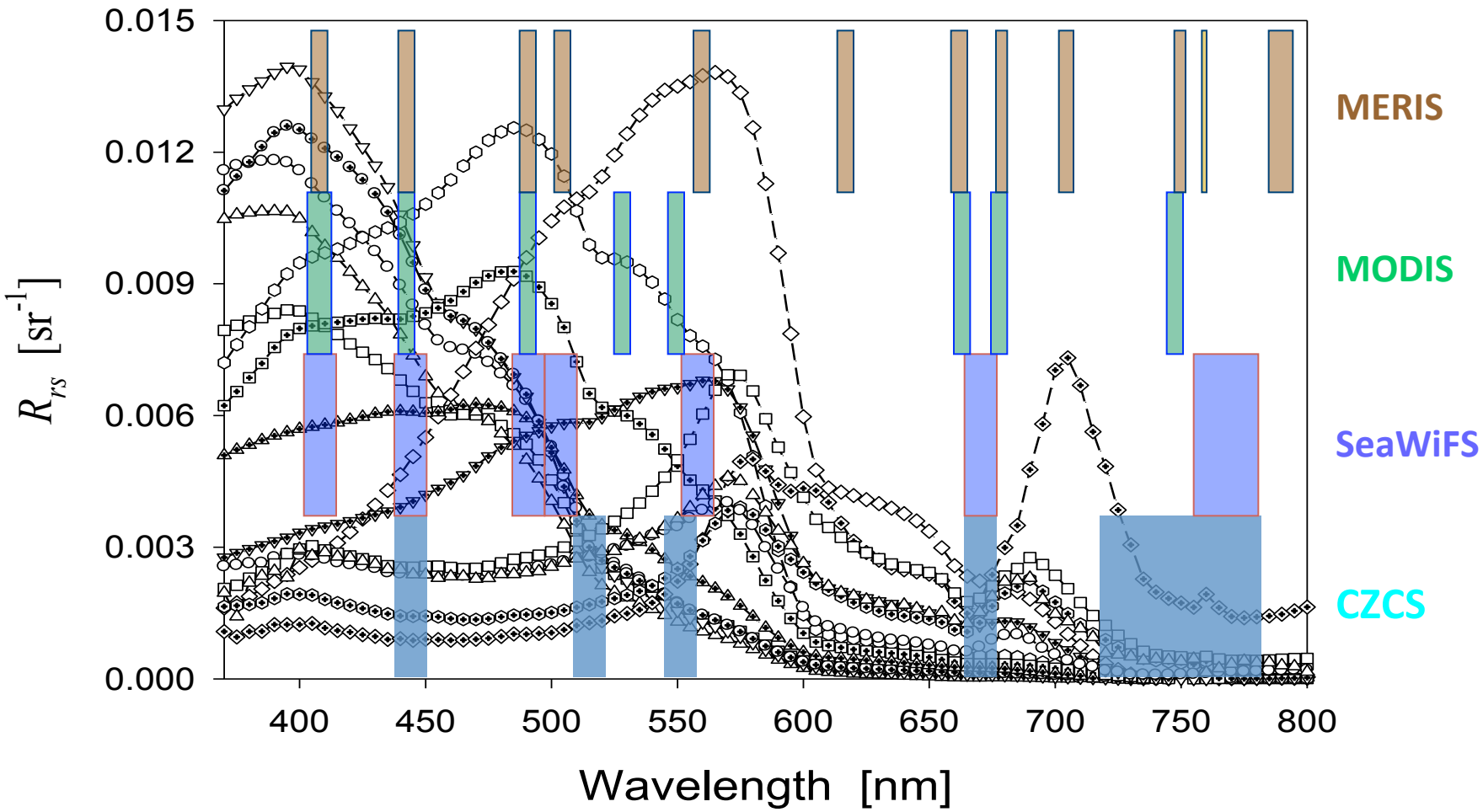
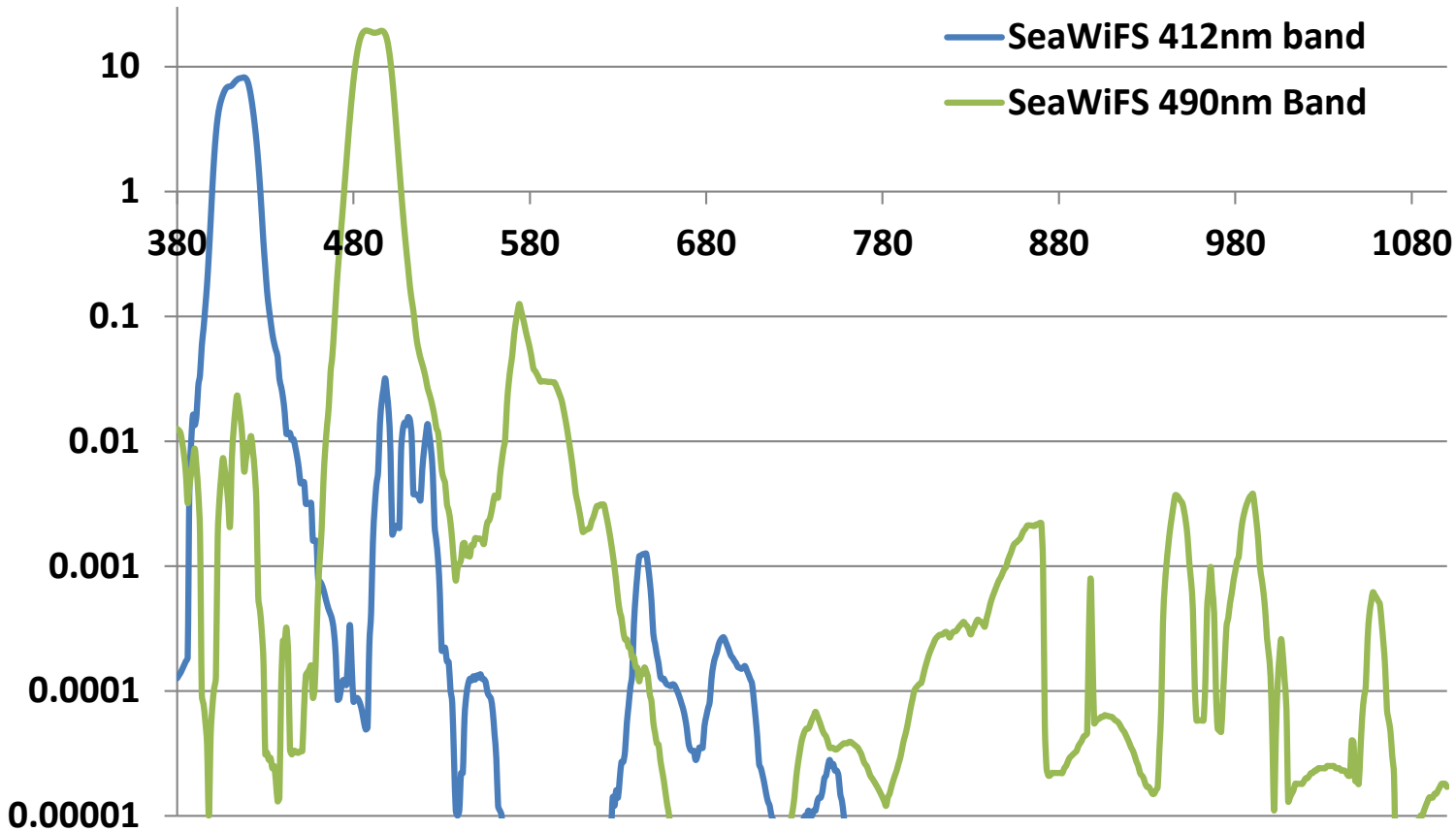
$$R_{rs}(\lambda) = G\frac{\boxed{b_{bw}(\lambda)} + b_{bp}(\lambda)}{\boxed{a_w(\lambda)} + a_x(\lambda) + b_{bw}(\lambda) + b_{bp}(\lambda)}$$




0.015
0.012
0.009
0.006
0.003
0.000
R_{rs} [sr^{-1}]
400
450
500
550
600
650
700
750
800
Wavelength [nm]
MERIS
MODIS
SeaWiFS
CZCS

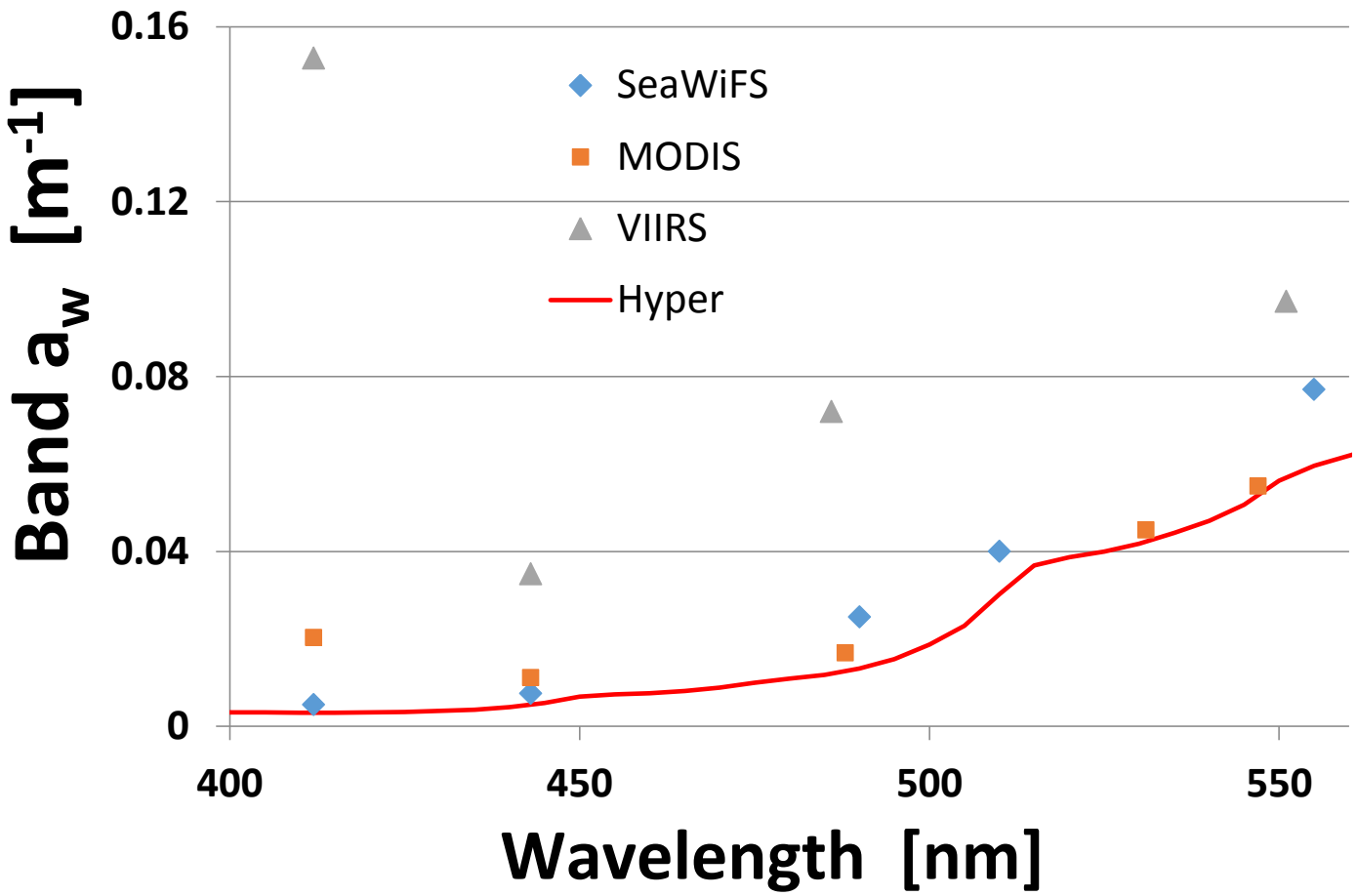
OC Satellite band is not a narrow-sharp band



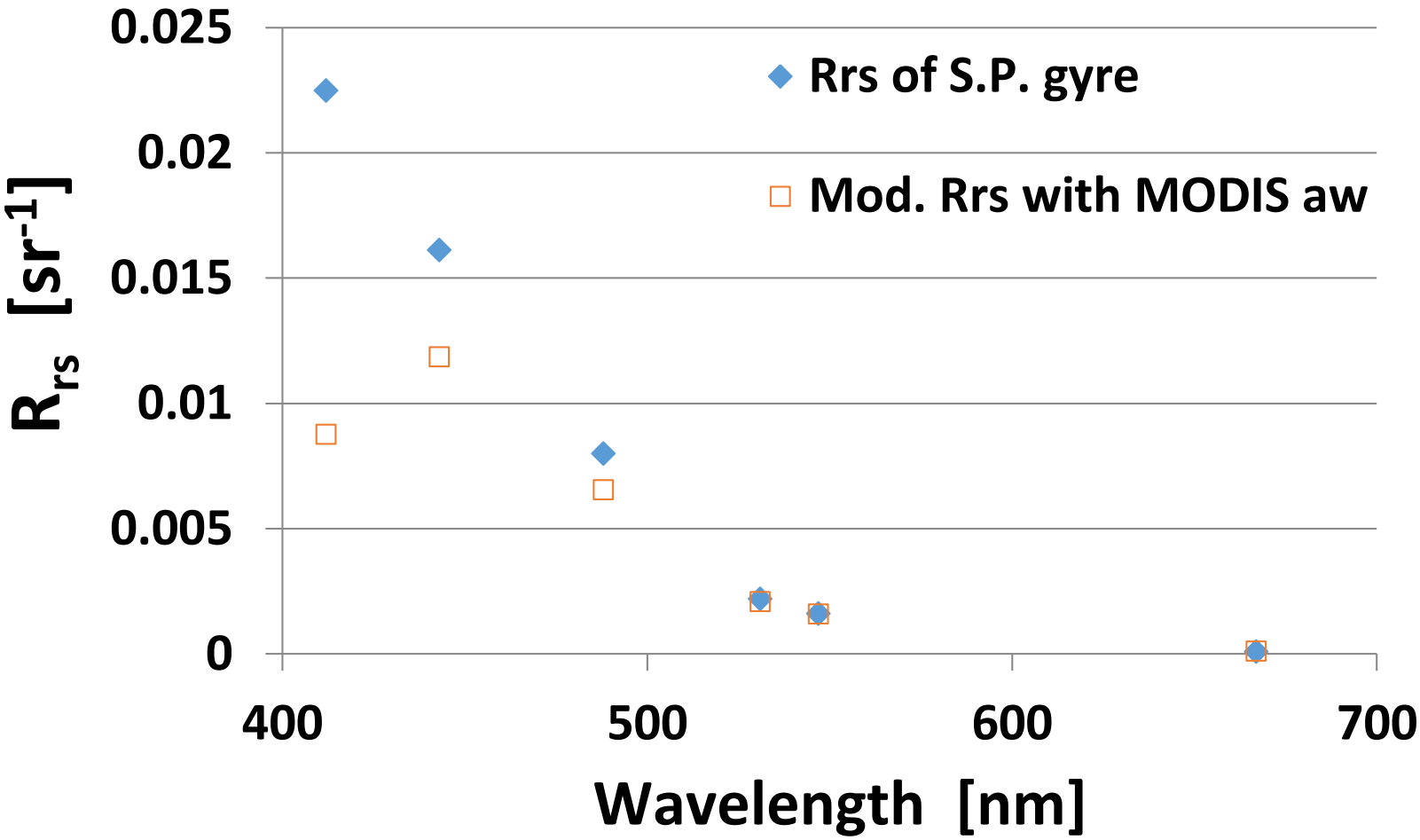
How to get band-representing pure-water constants for remote sensing?

NASA Standard Approach:

$$a_w(i) = integral\{aw(\lambda) * RSRi(\lambda) * F0(\lambda) * d\lambda / intergral\{RSRi(\lambda) * F0(\lambda) * d\lambda\}\}$$



→ Consequence is no closure of Rrs



$$R_{rs}(\lambda) = \frac{L_w(\lambda)}{E_d(\lambda)}$$

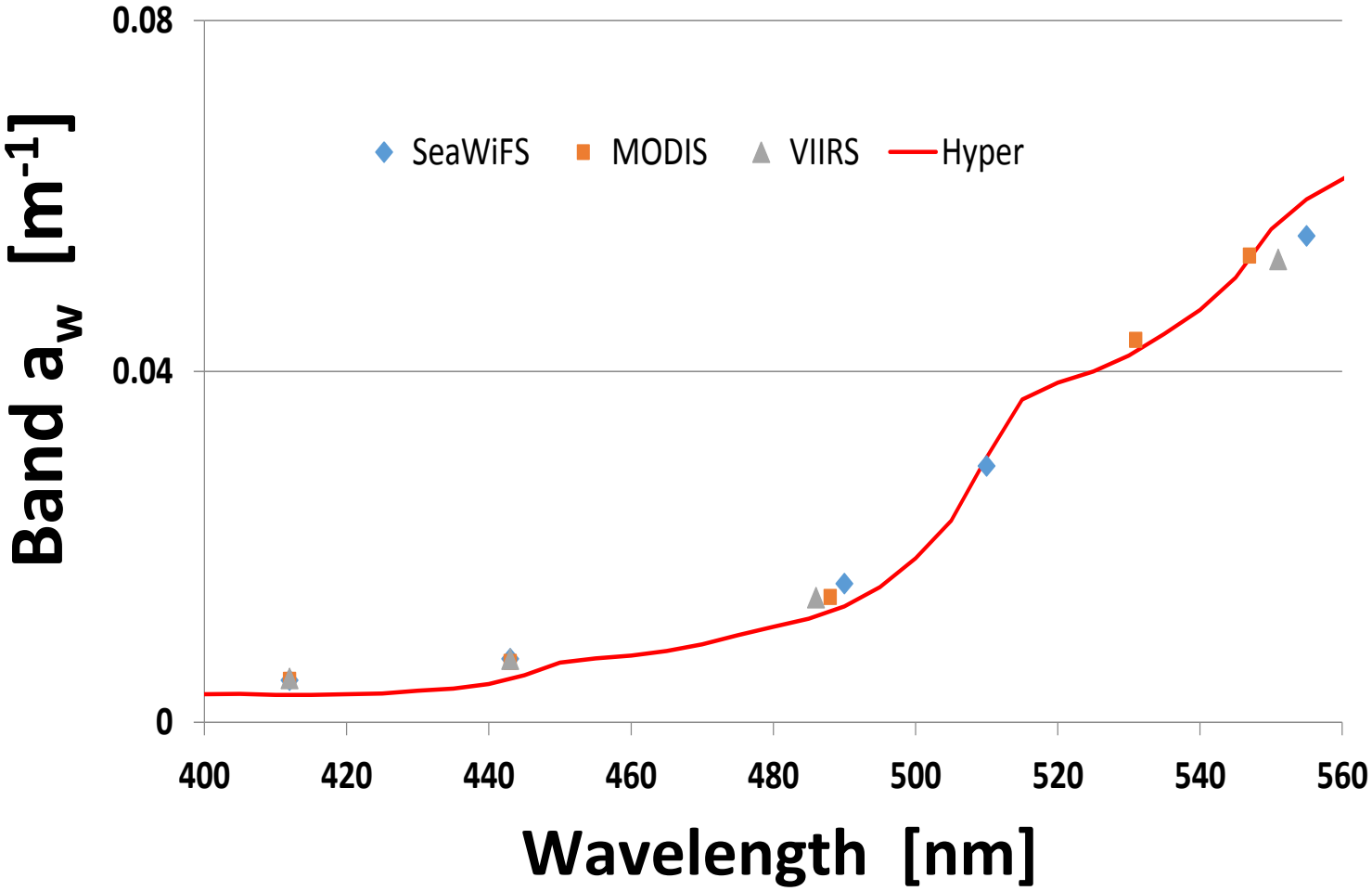
$$R_{rs}(\lambda) = G\frac{b_{bw}(\lambda) + b_{bp}(\lambda)}{a_w(\lambda) + a_x(\lambda) + b_{bw}(\lambda) + b_{bp}(\lambda)}$$

$$x_w\left(B_i\right) = \frac{\int RSR_i(\lambda)\left(1/a_w(\lambda)\right)d\lambda}{\int RSR_i(\lambda)d\lambda}$$

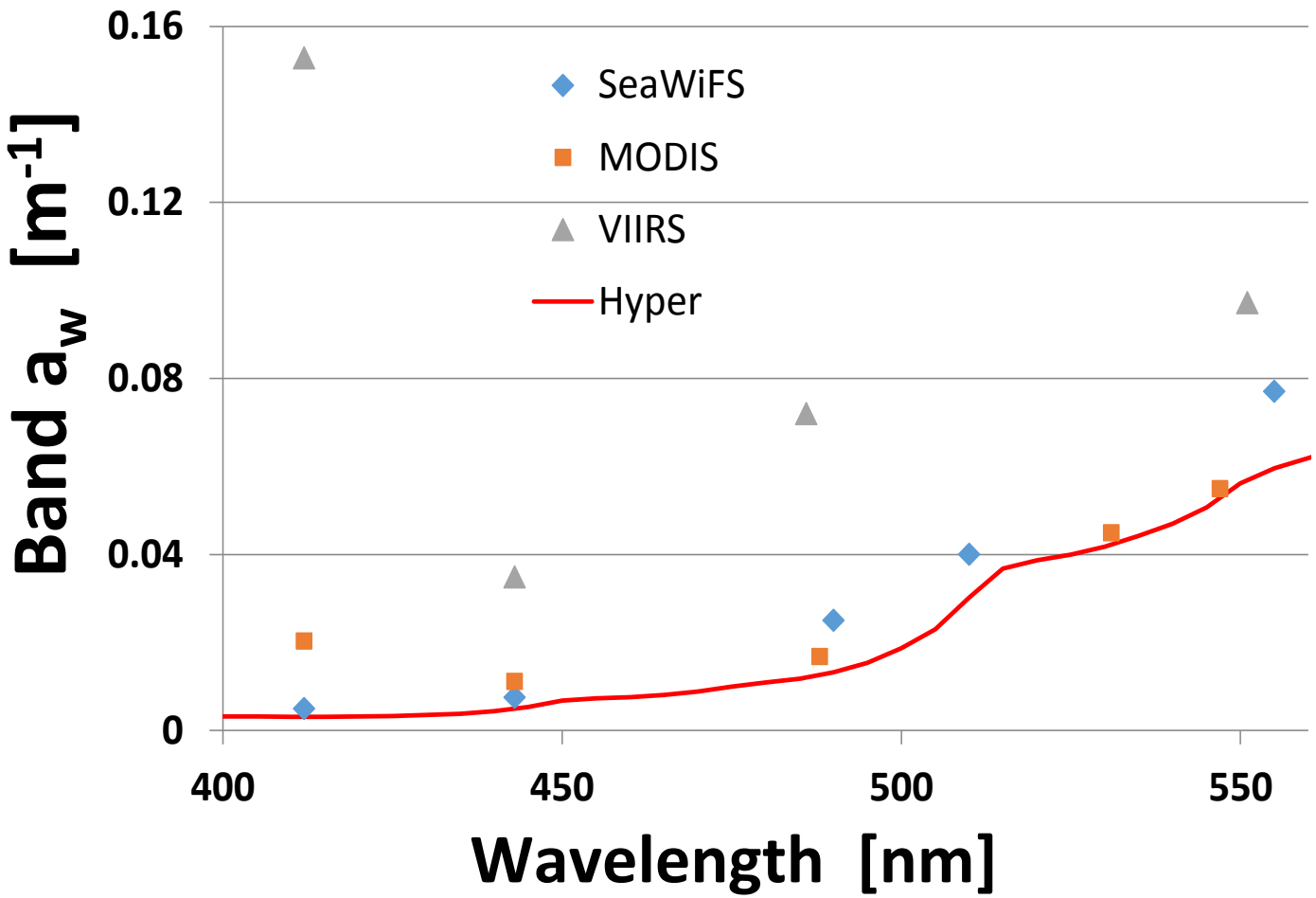
$$a_w\left(B_i\right) = \frac{1}{x_w\left(B_i\right)}$$

（Lee et al 2016）

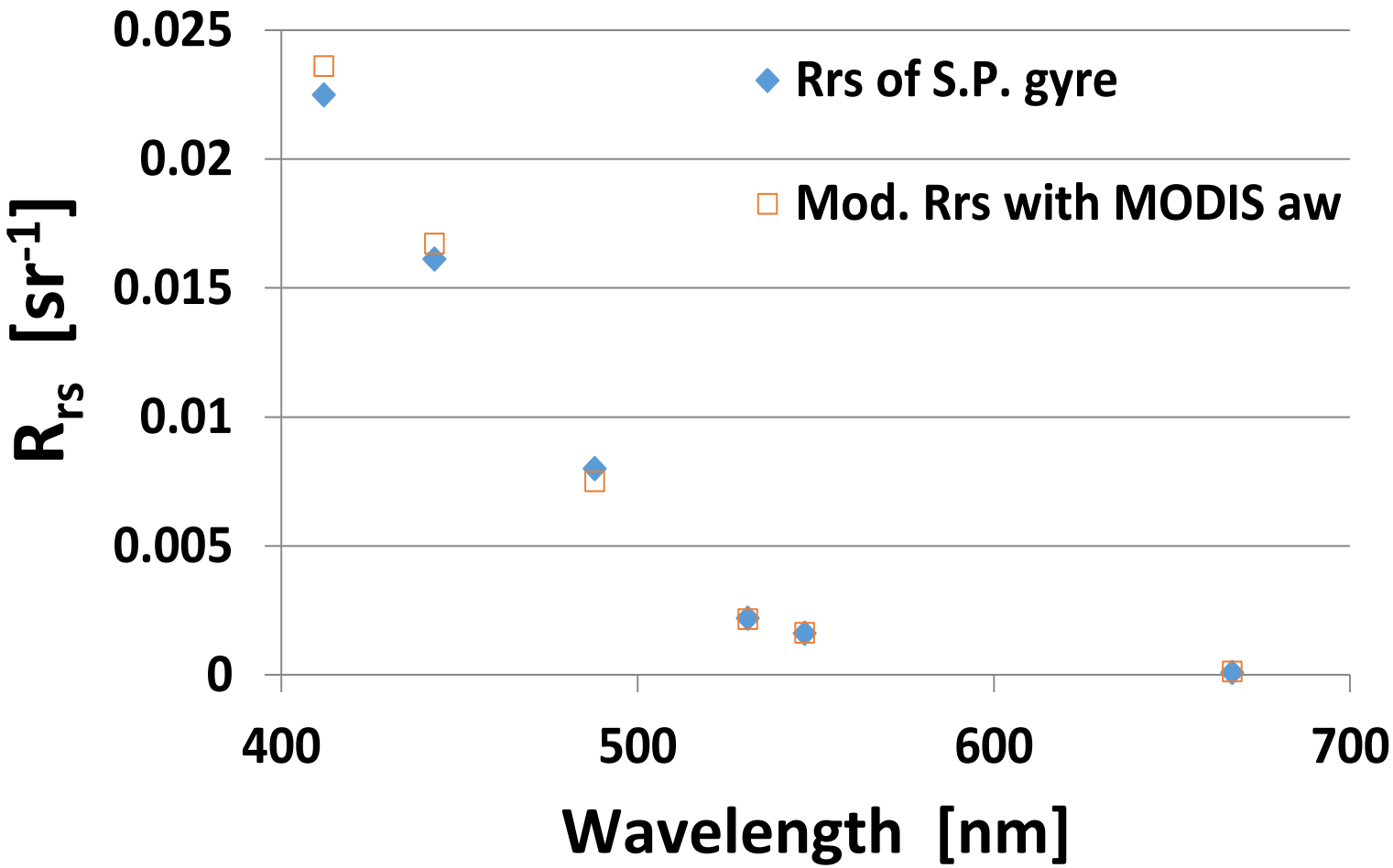
→ New band-averaged a_w for Rrs



NASA Band aw:


0.16
0.12
0.08
0.04
0
400
450
500
550
Band a_w [m^{-1}]
Wavelength [nm]
SeaWiFS
MODIS
VIIRS
Hyper

→ Closure of Rrs



$$b_{bw}\left(B_i\right) = \frac{\int b_{bw}(\lambda)\, RSR_i(\lambda) d\lambda}{\int RSR_i(\lambda) d\lambda}$$

$$K_d(B_i) \approx K_{dw}(B_i) + K_{dx}(B_i)$$

$$a_w(B_i) = \frac{\int a_w(\lambda)\, RSR_i(\lambda)\, d\lambda}{\int RSR_i(\lambda)\, d\lambda}$$

Conclusions:

For band-averaged constants, no one-size-fits-all equation.

Important and necessary to know the purposes and properties involved.