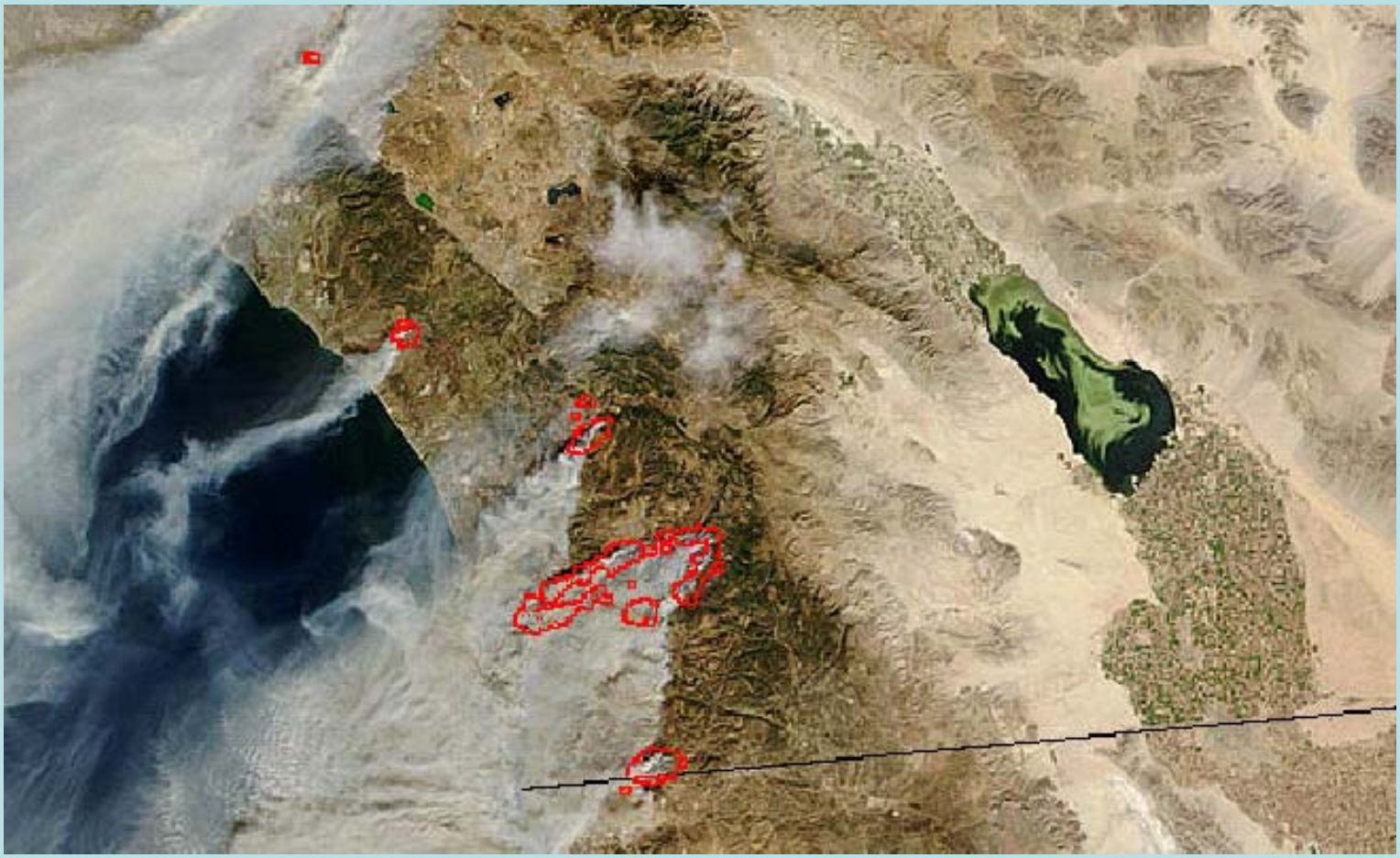
Analysis of sulfide eruptions at the Salton Sea, California, using Hydrolight and MODIS

“Sulfide eruption” at the Salton Sea, California, Oct 26, 2003

MODIS Terra true color image



Mary Ann Tiffany, Ocean Optics, 2004

Water conditions during a “sulfide eruption”

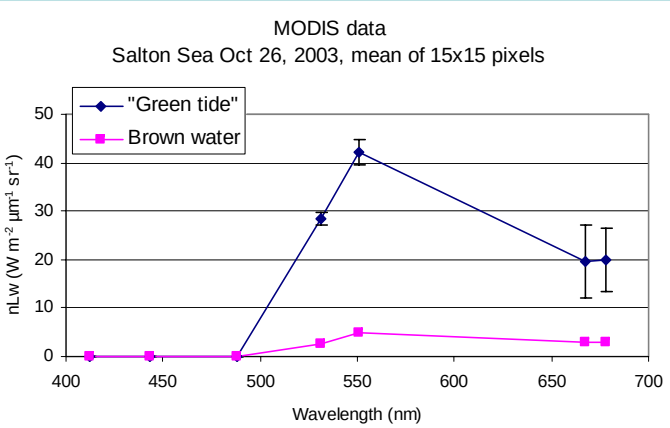
Oct 26, 2003

very low O_2
high H_2S
gypsum crystals
low chlorophyll
dead fish

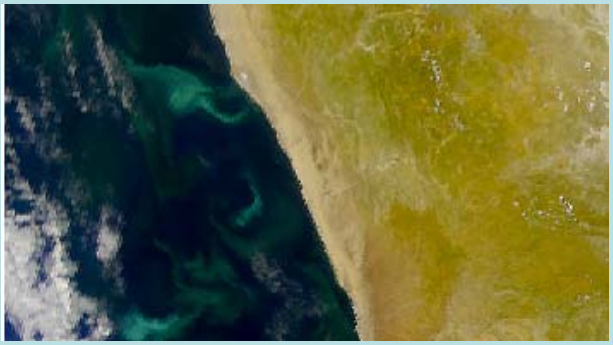
high O_2
no gypsum crystals
high chlorophyll
live fish

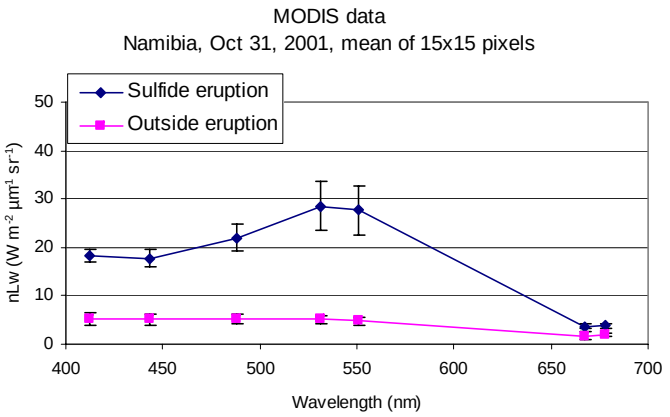
Normalized water-leaving radiances

Salton Sea
Oct 26, 2003
Sulfide eruption?

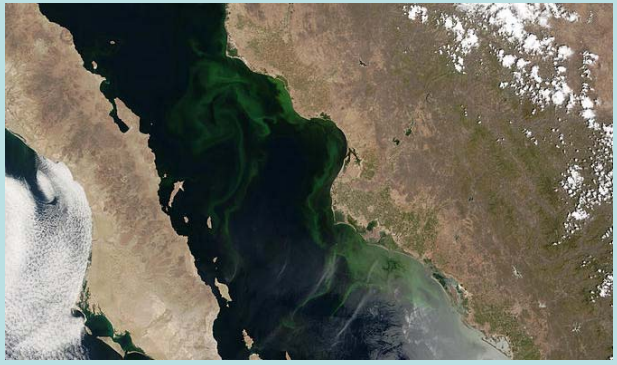


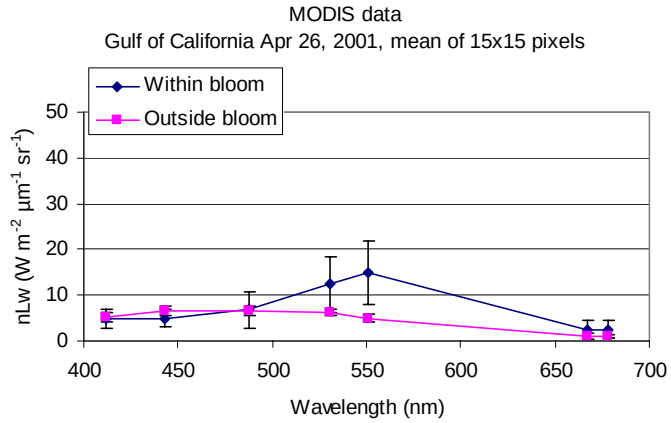
Namibia
Oct 21, 2001
Sulfide eruption





Gulf of California
Apr 26, 2001
Phytoplankton
bloom



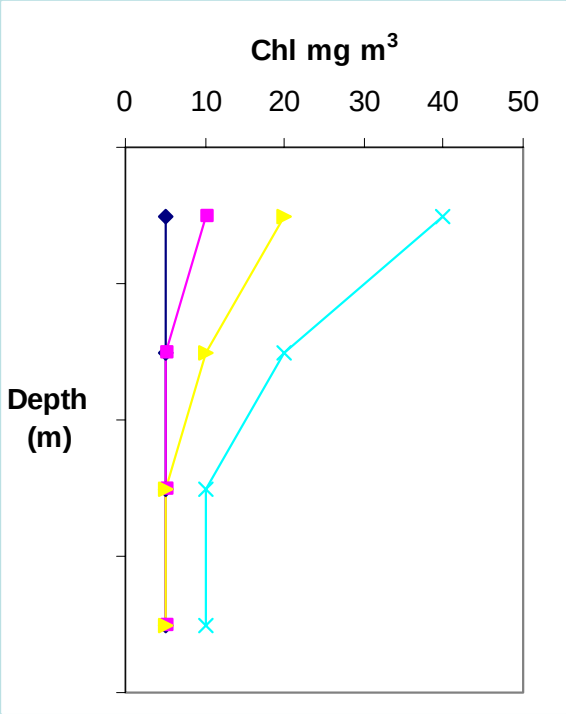


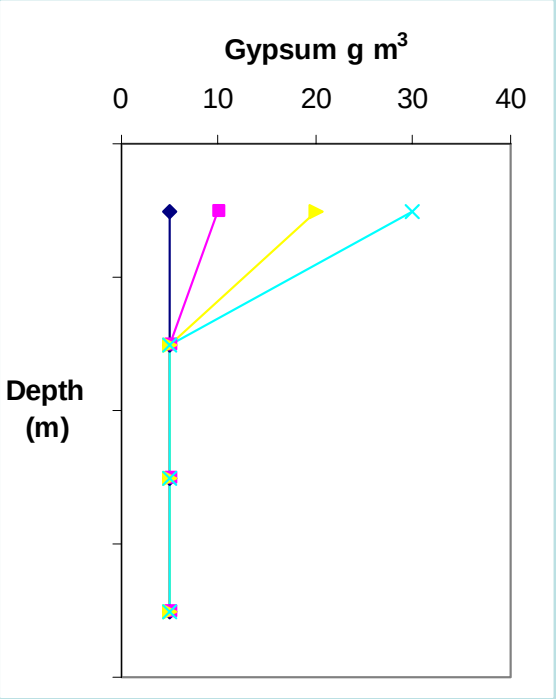
The parameters used in Hydrolight:

CDOM was varied for each run (values of 0.5, 1, 2, and 5 m^{-1} used).

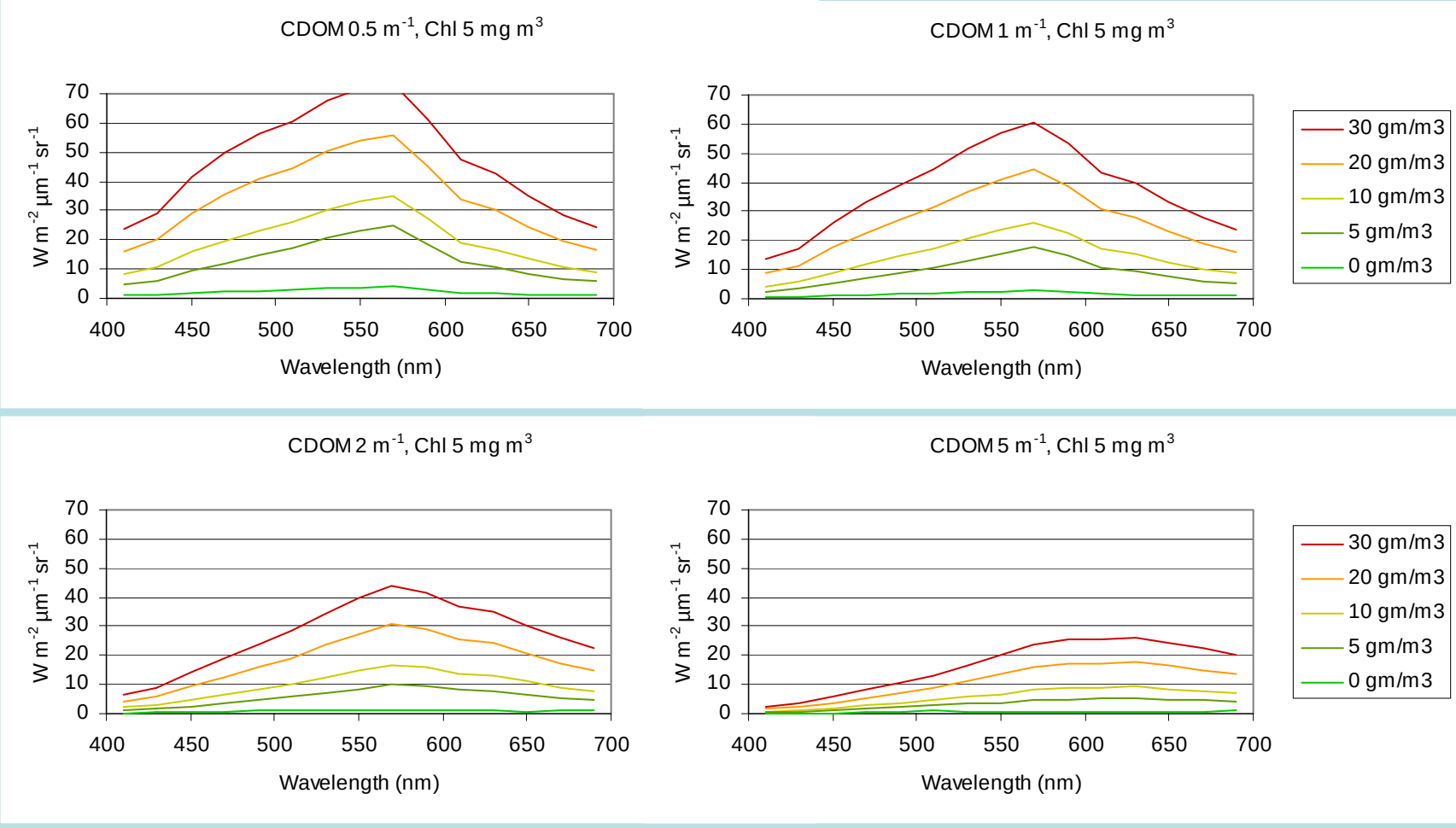
When running chlorophyll profiles it was assumed that there were no gypsum crystals.

When running gypsum profiles a constant profile of Chl = 5 mg m^3 was assumed.

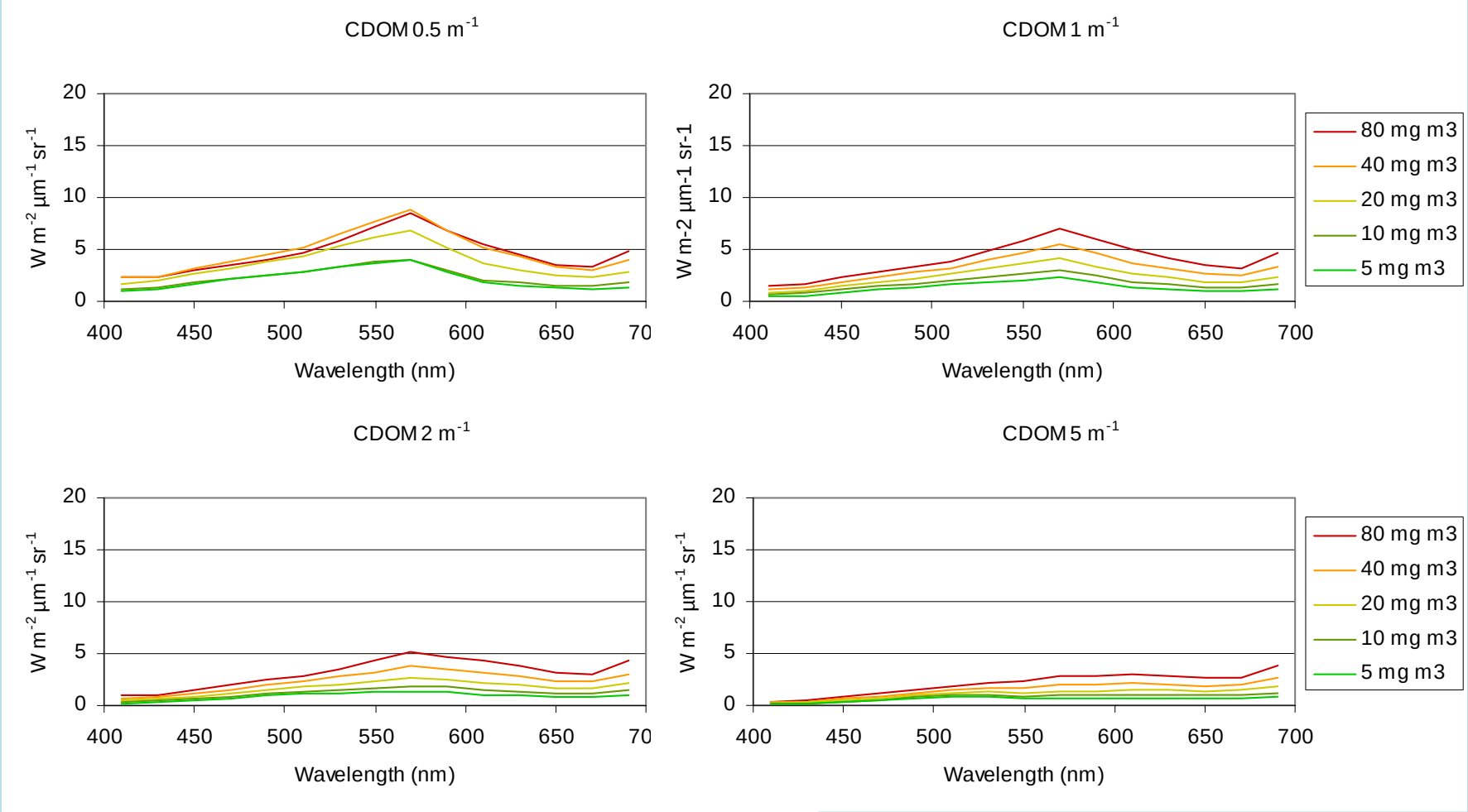




Water-leaving radiances for various gypsum loads, assuming a constant chlorophyll of 5 mg m^{-3}



Water-leaving radiances for various chlorophyll loads, assuming no gypsum crystals.



Actual surface chlorophyll input into Hydrolight

5 mg/m^3

Gypsum load

CDOM	m^{-1}	30 gm/m^3	20 gm/m^3	10 gm/m^3	5 gm/m^3	0 gm/m^3
0.5	Oc4v4	4.2	4.6	5.8	7.5	7.1
0.5	chlor_a_2	4.4	5.0	6.7	9.4	8.4
1	Oc4v4	5.7	6.5	8.1	10.7	8.2
1	chlor_a_2	6.7	7.8	10.5	15.0	10.9
2	Oc4v4	8.2	9.2	11.1	13.5	6.8
2	chlor_a_2	11.3	13.1	16.1	20.2	10.3
5	Oc4v4	12.7	13.4	13.0	12.2	3.1
5	chlor_a_2	20.2	21.2	20.7	20.1	6.2

Surface chlorophyll

CDOM	m^{-1}	80 mg/m^3	40 mg/m^3	20 mg/m^3	10 mg/m^3	5 mg/m^3
0.5	Oc4v4	13.9	11.4	9.1	7.2	6.6
0.5	chlor_a_2	16.0	13.2	10.5	8.2	7.7
1	Oc4v4	14.0	11.9	9.8	8.0	7.5
1	chlor_a_2	17.2	14.8	12.5	10.3	10.0
2	Oc4v4	13.5	11.6	9.6	7.8	6.8
2	chlor_a_2	17.9	15.9	13.7	11.4	10.3
5	Oc4v4	10.8	8.3	6.3	4.5	3.1
5	chlor_a_2	16.4	13.7	10.9	8.3	6.2

Conclusions

- It appears that the water-leaving radiances for the Salton Sea are very bright in the green, just as were those derived from Hydrolight simulations using high mineral concentrations at the surface and low chlorophyll concentrations.
- Water-leaving radiances of algal blooms, up to 80 mg m^{-3}, are far lower in magnitude.
- It seems likely that highly backscattering precipitating crystals formed during sulfide eruptions are causing the bright “green tides” at the Sea.