Comparison of Different Sensor Bands and their Prediction of Chlorophyll-a

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Forward Model

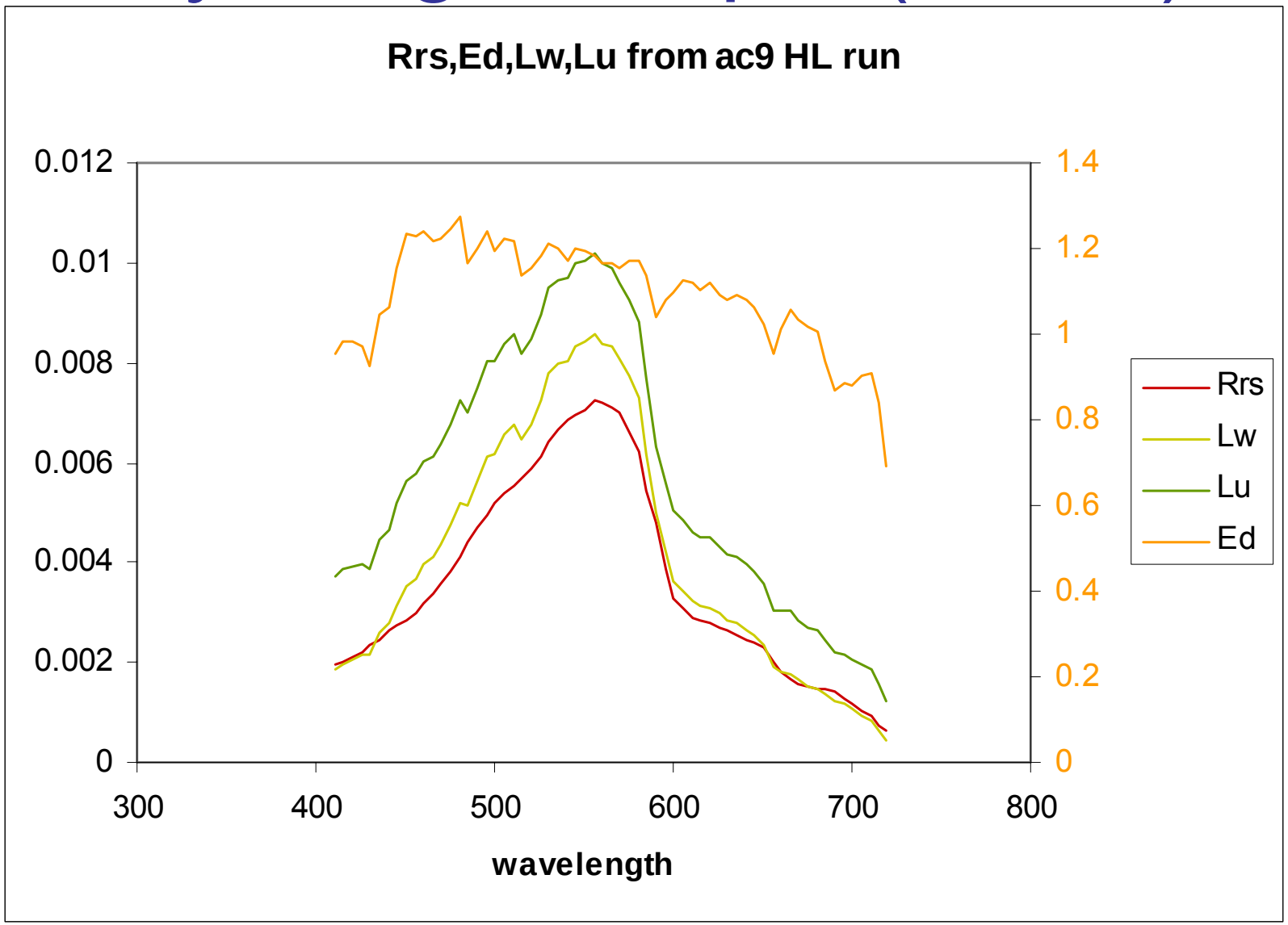
- Data from AC9 – July 22, 2004 Cruise, Station 1
- Temperature, Salinity and Spectrally varying corrections applied on total and filtered data
- Absorption and Scattering coefficients fed into Hydrolight along with ancillary weather and locational data

Other forward models …

Simulate bands from different sensors (hyperspectral to multispectral) for the same cruise conditions to measure Rrs:

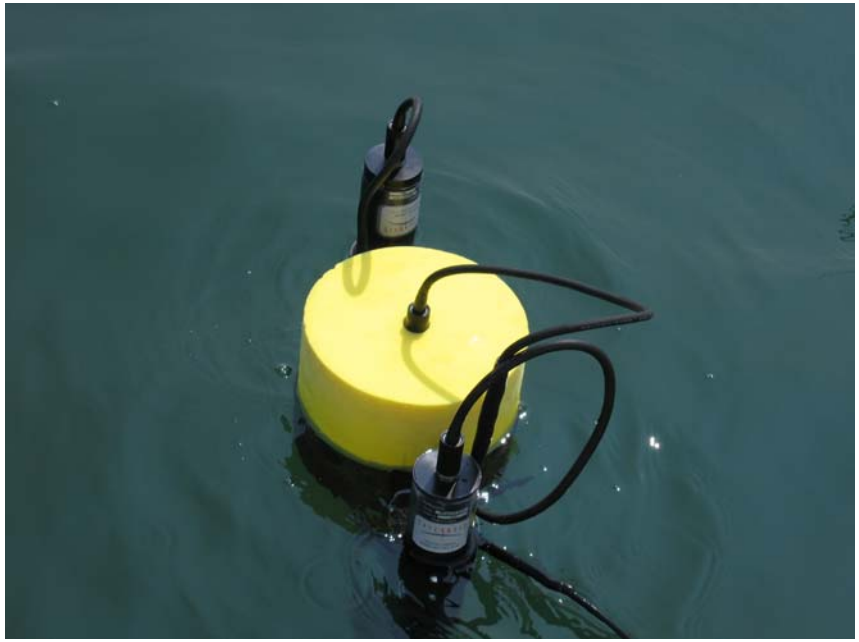
1) SeaWiFS – Sea – viewing Wide Field of View Sensor
2) MERIS – Medium Resolution Imaging Spectrometer
3) MODIS – Moderate Resolution Imaging Spectroradiometer
4) OCM – Ocean Colour Monitor
5) TM - Thematic Mapper
6) ASTER – Advanced Spaceborne Thermal Emission and Reflection Radiometer

Hydrolight Output (AOPs)



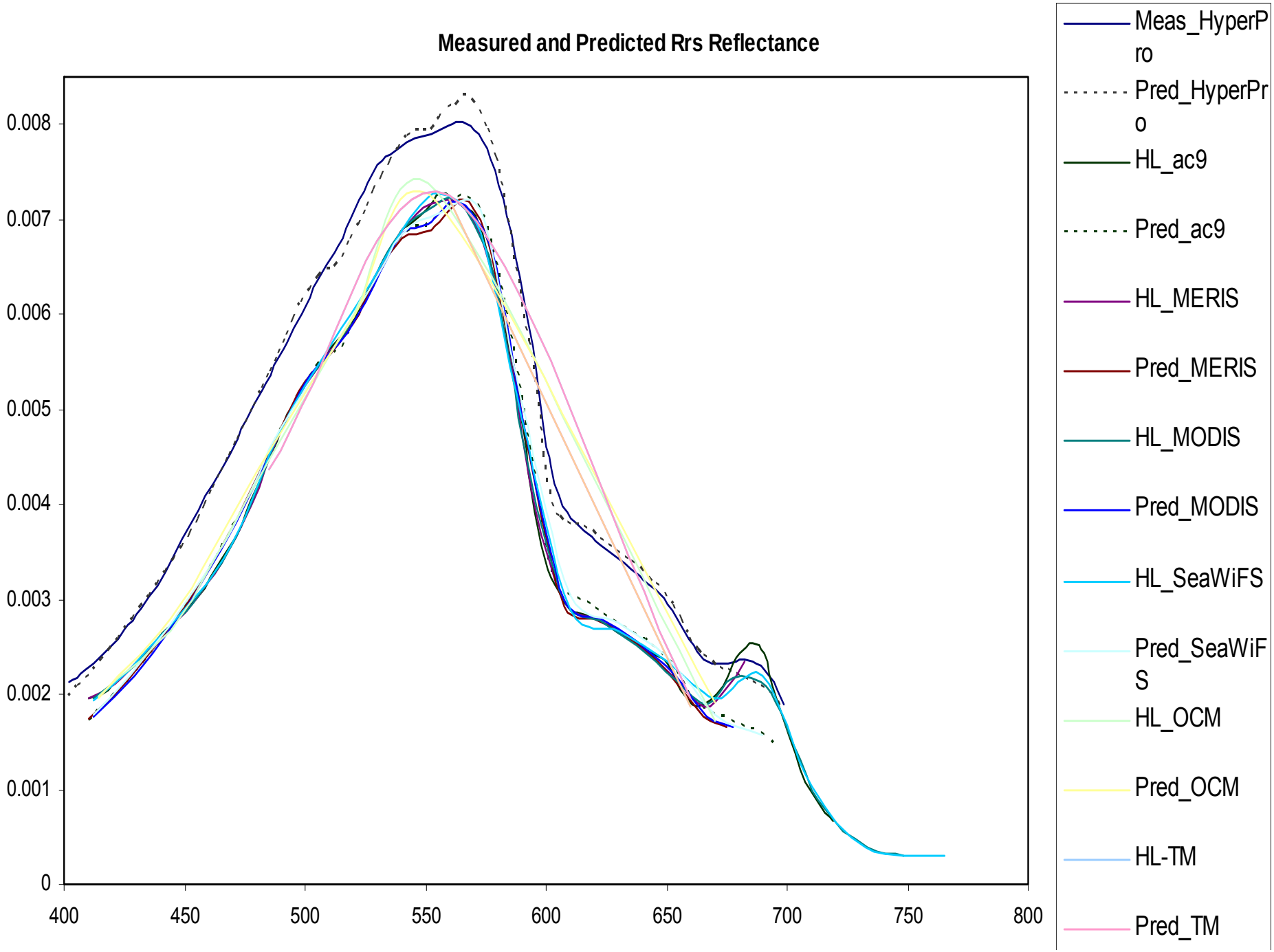
Inverse Model

- Model: Roesler-Perry 1995 semi-analytic model
- Inputs: Rrs from the previous 7 HL runs
- Rrs from Satlantic HyperPro
- Empirical ocean color algorithms



Roesler-Perry, 1995, JGR

- $R_{rs} = 0.85 (b_{bw} + C_{bpl}*b_{bpl}^{*} + C_{bps}*b_{bps}^{*})/$
  $(a_w + C_{\Phi}*a_{\Phi} + C_{nap}*a_{nap}^{*} + C_{cdm}*a_{cdm}^{*} +$
  $b_{bw} + C_{bpl}*b_{bpl}^{*} + C_{bps}*b_{bps}^{*})$
- Lee's basis vectors
- b_{bpl} and b_{bps} – parameterize using power law
- a_{cdm} and a_{nap} – parameterize using exponential function


Measured and Predicted Rrs Reflectance
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
400
450
500
550
600
650
700
750
800
Meas_HyperPro
Pred_HyperPro
HL_ac9
Pred_ac9
HL_MERIS
Pred_MERIS
HL_MODIS
Pred_MODIS
HL_SeaWiFS
Pred_SeaWiFS
HL_OCM
Pred_OCM
HL-TM
Pred_TM

Chlorophyll from Derived a_Φ Spectra

Chl in $mg/m^3 = a_\Phi(676)/0.0145$

Model		Rrs spectra source	Chl Value (mg/m3)
Lab Measurements			4.05
Semi_Analytical	Roesler and Perry	Hyperpro	2.828
Semi_Analytical	Roesler and Perry	ac9	2.483
Semi_Analytical	Roesler and Perry	MERIS	2.841
Semi_Analytical	Roesler and Perry	MODIS	2.683
Semi_Analytical	Roesler and Perry	SeaWiFS	2.703
Semi_Analytical	Roesler and Perry	OCM	4.4483
Semi_Analytical	Roesler and Perry	TM	3.007
Semi_Analytical	Roesler and Perry	ASTER	3.179

Model		Rrs spectra source	Chl Value (mg/m3)
Empirical	OC4V4	Hyperpro	4.1062
Empirical	OC3M	Hyperpro	5.5446
Empirical	OC4V4	ac9	5.3243
Empirical	OC3M	ac9	6.5448
Empirical	OC4V4	MERIS	5.1424
Empirical	OC3M	MERIS	6.4389
Empirical	OC4V4	MODIS	6.9774
Empirical	OC3M	MODIS	8.6084
Empirical	OC4V4	SeaWiFS	5.2943
Empirical	OC3M	SeaWiFS	6.7359
Empirical	OC4V4	OCM	4.3727
Empirical	OC3M	OCM	8.2503
Empirical	OC4V4	TM	8.8423
Empirical	OC3M	TM	13.2122
Empirical	OC4V4	ASTER	
Empirical	OC3M	ASTER	

Discussion and Conclusion

- Accuracy of HyperPro data
- Semi-analytical algorithms work better than empirical algorithms
- Empirical algorithms overestimate Chlorophyll
- OC4 and OC3M are best suited for the so-called ocean color sensors only.
- They work best for SeaWiFS, MODIS and MERIS
- Separate algorithms need to be devised for predicting IOPs of inland water bodies like lakes
- More algal genera may be included in the analysis

Acknowledgements

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Thank You !!!