Inverse modeling

Semi-analytical algorithms : sensitivity analysis of the values of the backscattering spectral dependency n and the a_nap&cdom slope S on two stations

Maéva DORON, Ocean Optics 2004

To begin with

- Roesler and Perry ’95 model of inverse modeling
- 3 basis vectors in input:

1. spectral slope of the absorption of NAP and CDOM S (DL);
2. spectral slope of backscattering n in nm^{-1};
3. spectral absorption of chlorophyll (normalized).

- 3 parameters in output :

1. chl in $mg.m^{-3}$;
2. a_cdom&nap (440nm) in m^{-1};
3. bb(440nm) in m^{-1}.

- Data from the second cruise: one station off the DMC dock and one station near the ocean.

Goal

- First idea
- Comparison of the data retrieved by the GSM model and the R&P95 model (hyperspectral & multispectral at 412, 442, 490, 510 and 555 nm);
- Sensitivity to S and n to the retrieved values
- Comparison of the sensitivities for the hyperspectral and the multispectral model

Original values

Station A – Off of DMC Dock

	a_phi	S	n/η	[chl],	ag(443) + anap(443)	bbp(443)
GSM – Maritorena et al. 2002	GSM 02	0.0206	1.0337	2.1328	0.2424	0.0203
Hyper RP	CR avg.	0.0145	0 1	0.1827	0.3732	0.0161 0.0045
Hyper RP	CR avg.	0.01 0.02	0 1	1.3146	0.2535 0.1169	0.0157 0.0069
RP @ GSM lambda	CR avg.	0.0145	0 1	1.02	0.306	0.045 -0.0167

Original values

Station B – SW of Pemaquid Pt.

	a_phi	S	n/ η	[chl],	ag(443) + anap(443)	bbp(443)
GSM – Maritorena et al. 2002	GSM 02	0.0206	1.0337	1.5502	0.1288	0.0039
Hyper RP	CR avg.	0.0145	0 1	0.8828	0.2158	0.0024 0.0024
Hyper RP	CR avg.	0.01 0.02	0 1	0.8571	0.0899 0.1352	0.0028 0.0024
RP @GSM lambda	CR avg.	0.0145	0 1	1.00	0.187	0.0032 0.0019

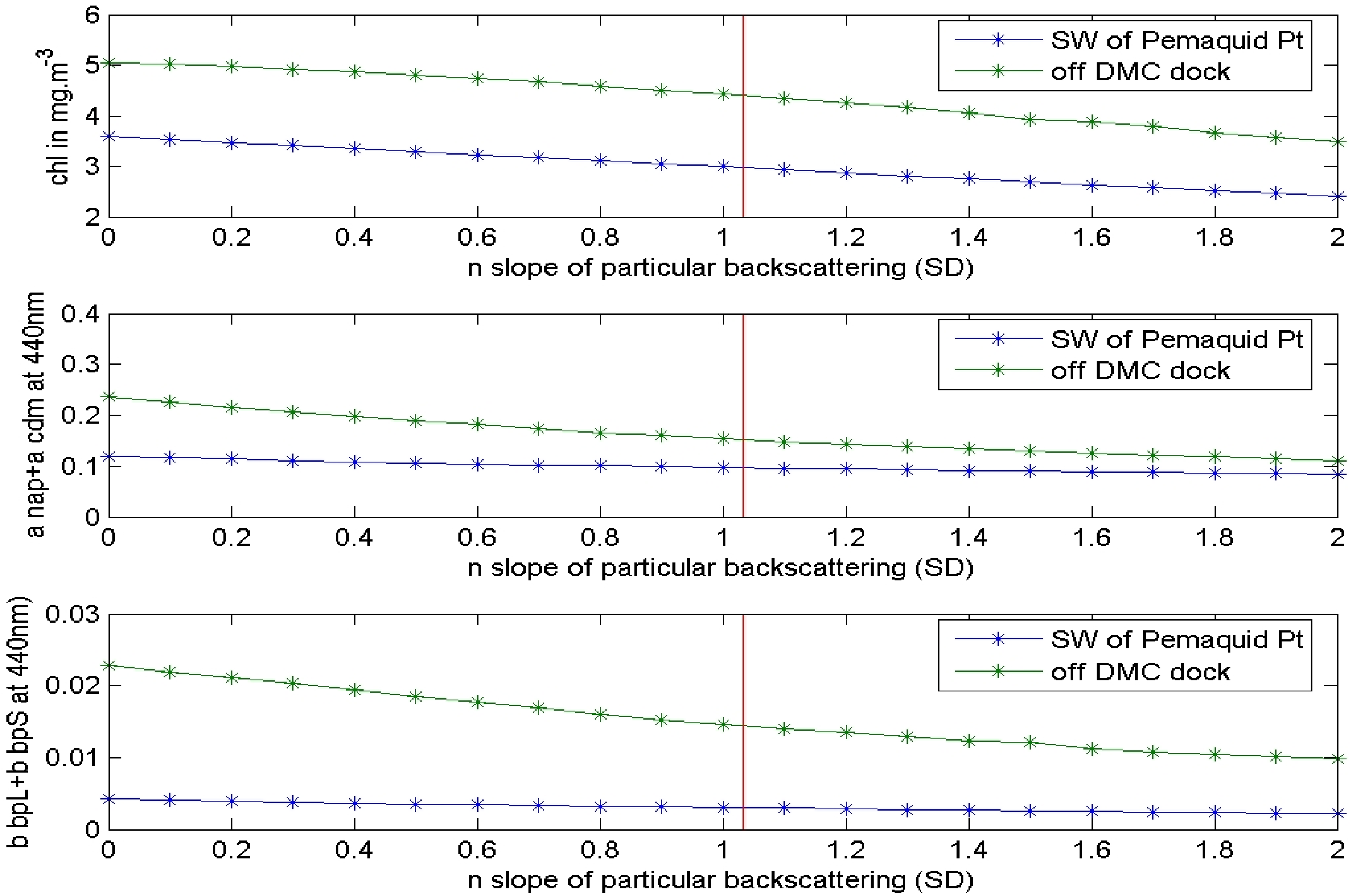
Sensitivity

- One spectral dependency n ,instead of 0 for large particles and 1 for small particles.
- Varying the n – values : from 0 to 2.
- Change the values of S : from 0.005 to 0.04 nm^{-1} :

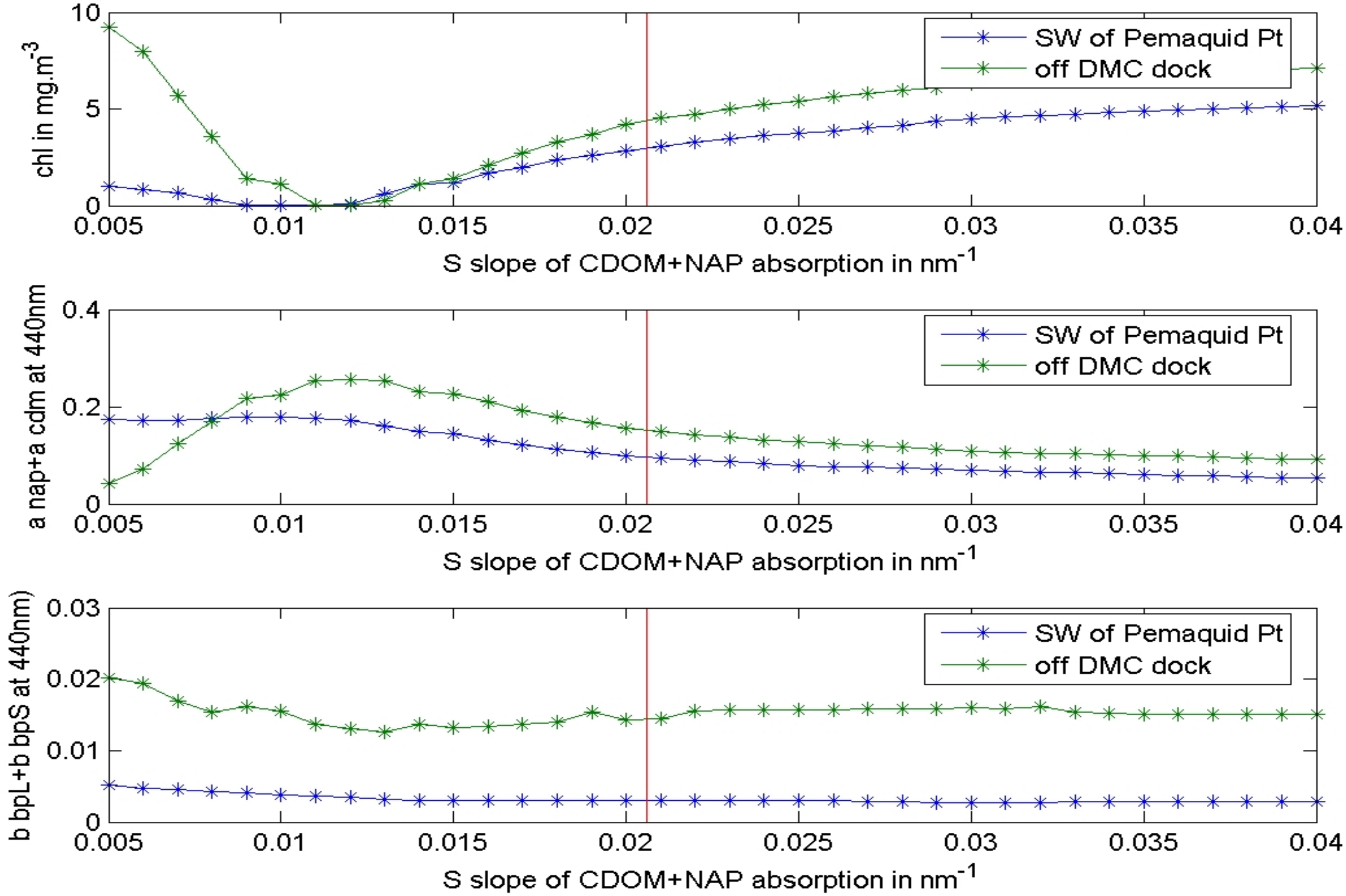
Realistic range of Scdom = 0.007–0.013nm^{-1}

Realistic range of Snap = 0.016–0.022nm^{-1}

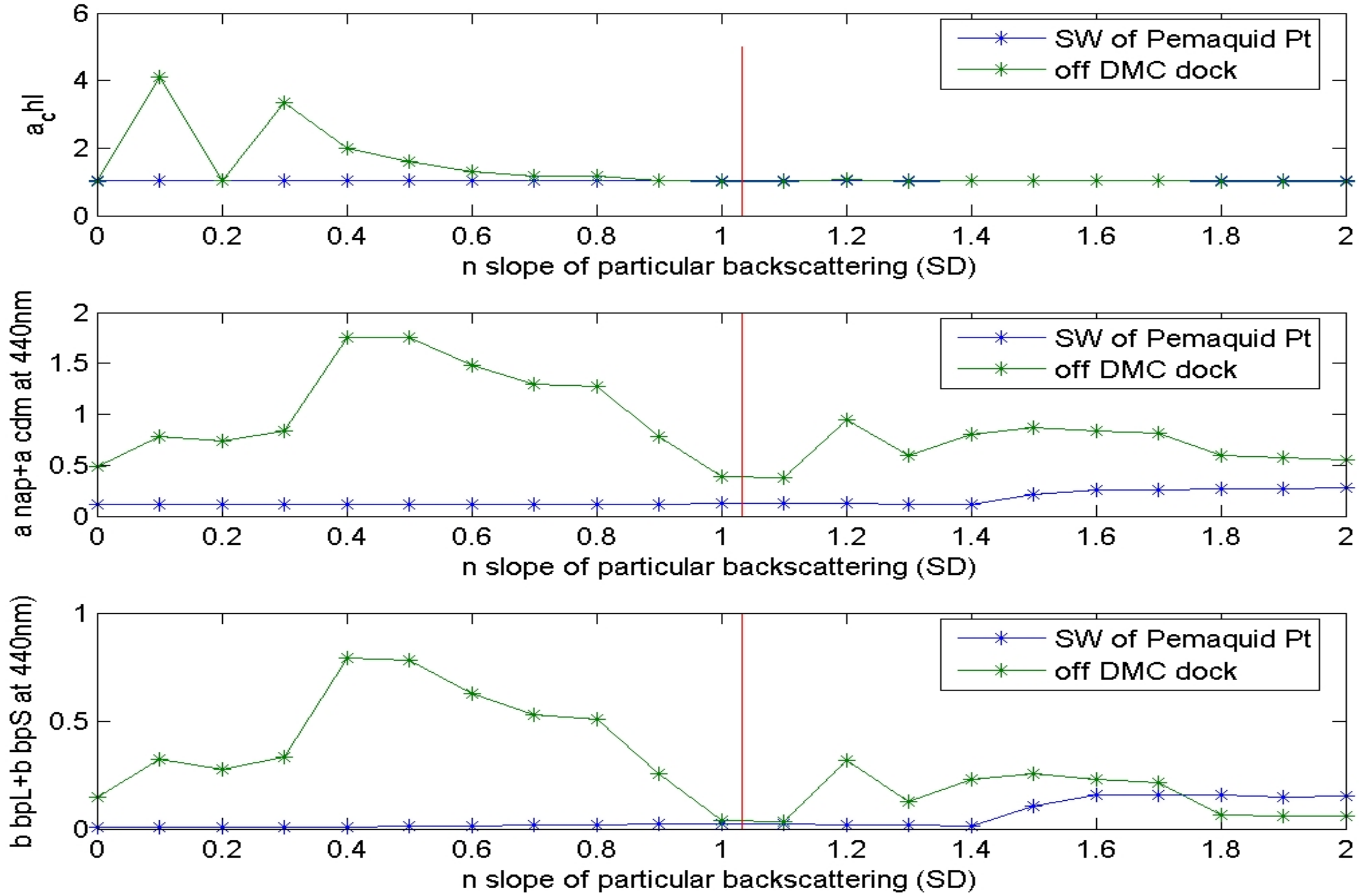
Sensitivity for the n(bb) slope - hyperspectral



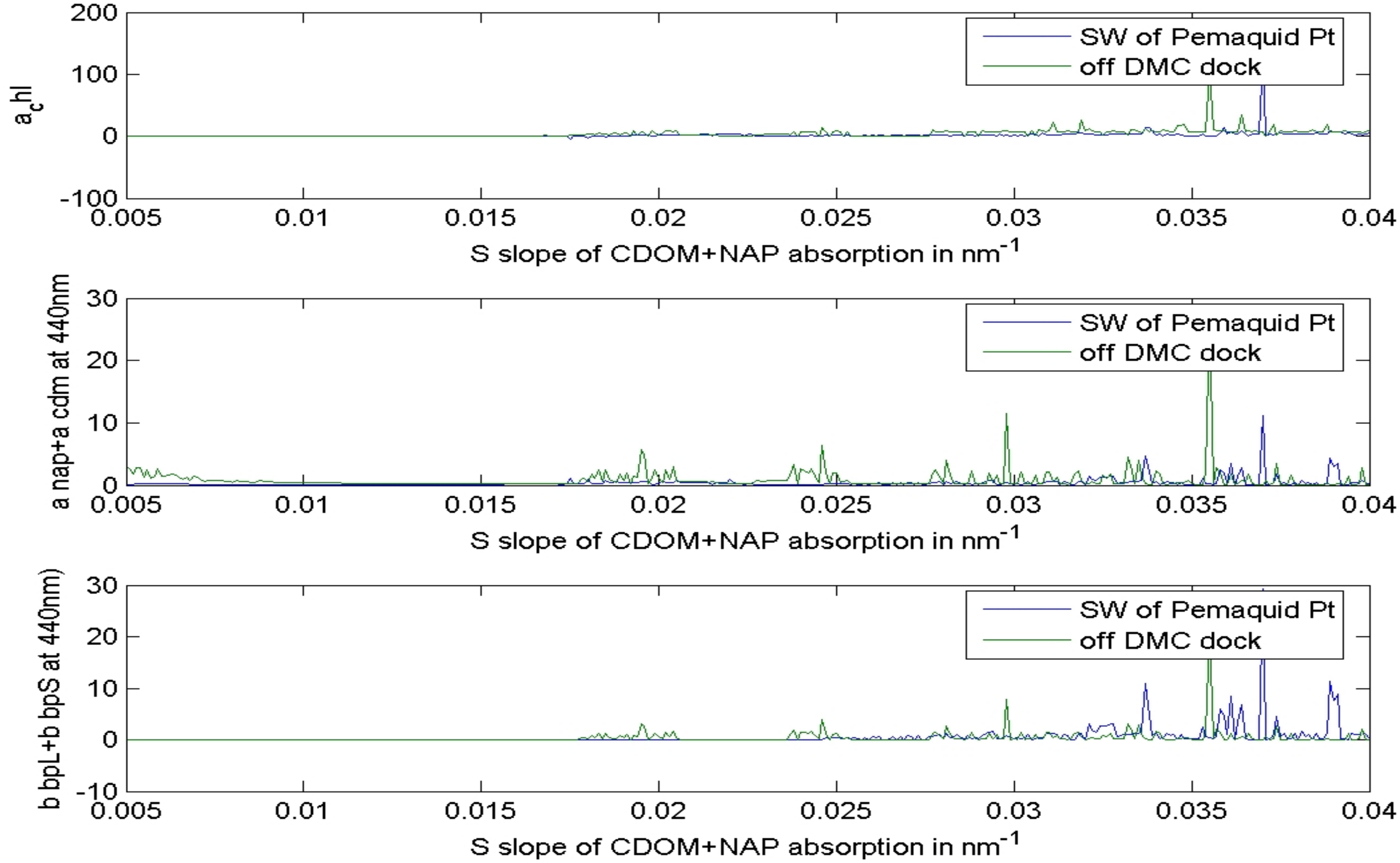
Sensitivity for the S(cdom&nap) slope - hyperspectral



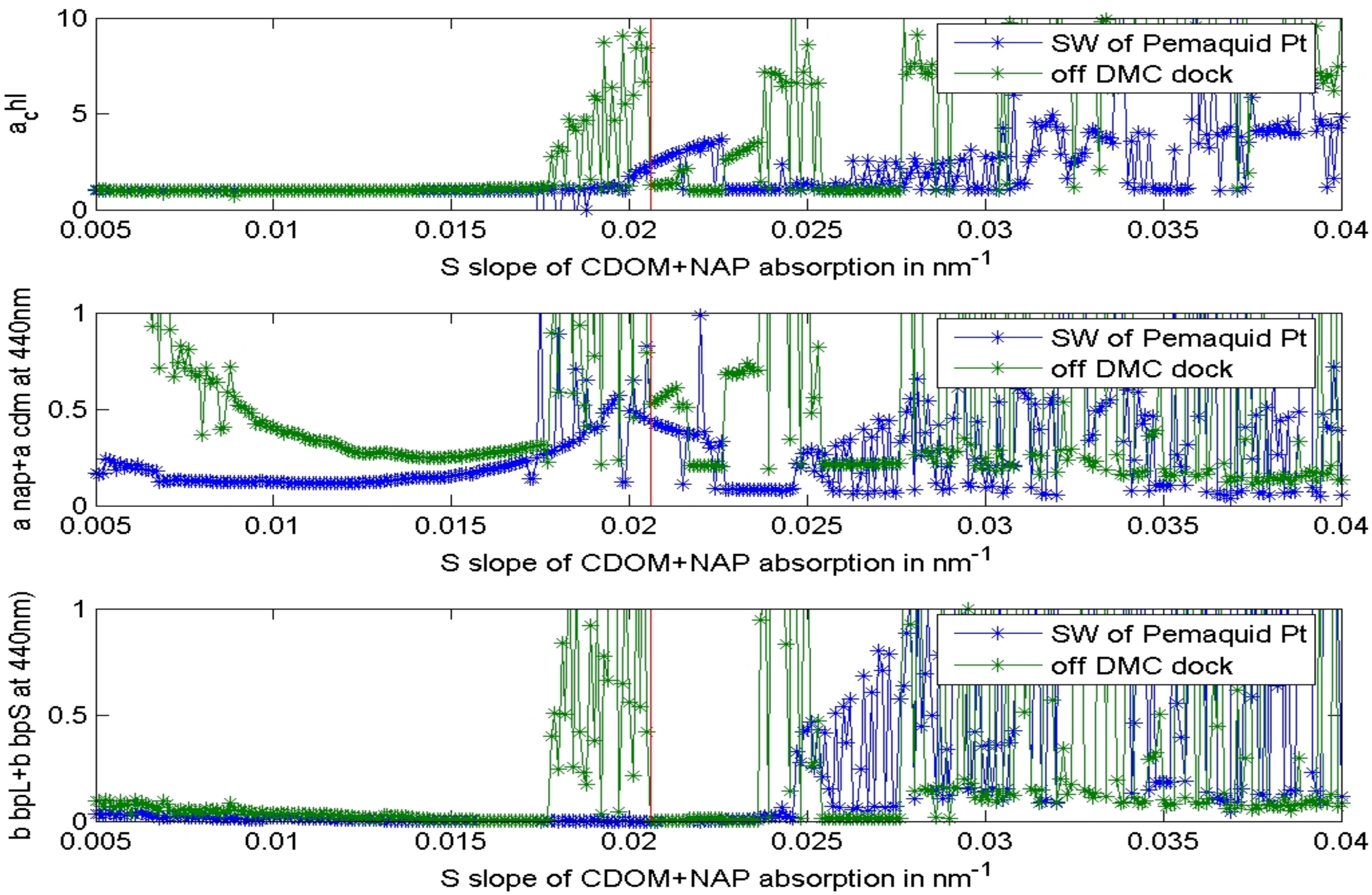
Sensitivity for the n(bb) dependency - multispectral



Sensitivity for the S(cdom&nap) slope - multispectral



Sensitivity for the S(cdom&nap) slope – multispectral- different scales



Discussion

- This was a first qualitative approach.
- The results are encouraging because for realistic values of S are not erratic.
- Any idea about how to test the robustness of the algorithm with multispectral data?