

How can we accelerate the GEO-CAPE mission?

**What else can we do to get GEO-CAPE flying
before we retire?**

Geo-CAPE Meeting, May 21-23, 2013

Elements to launch a satellite sensor:

The need:

Scientific need

Societal need

Technological readiness

Platform

Sensors

Algorithms

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The need:

Scientific need

How important are the questions?

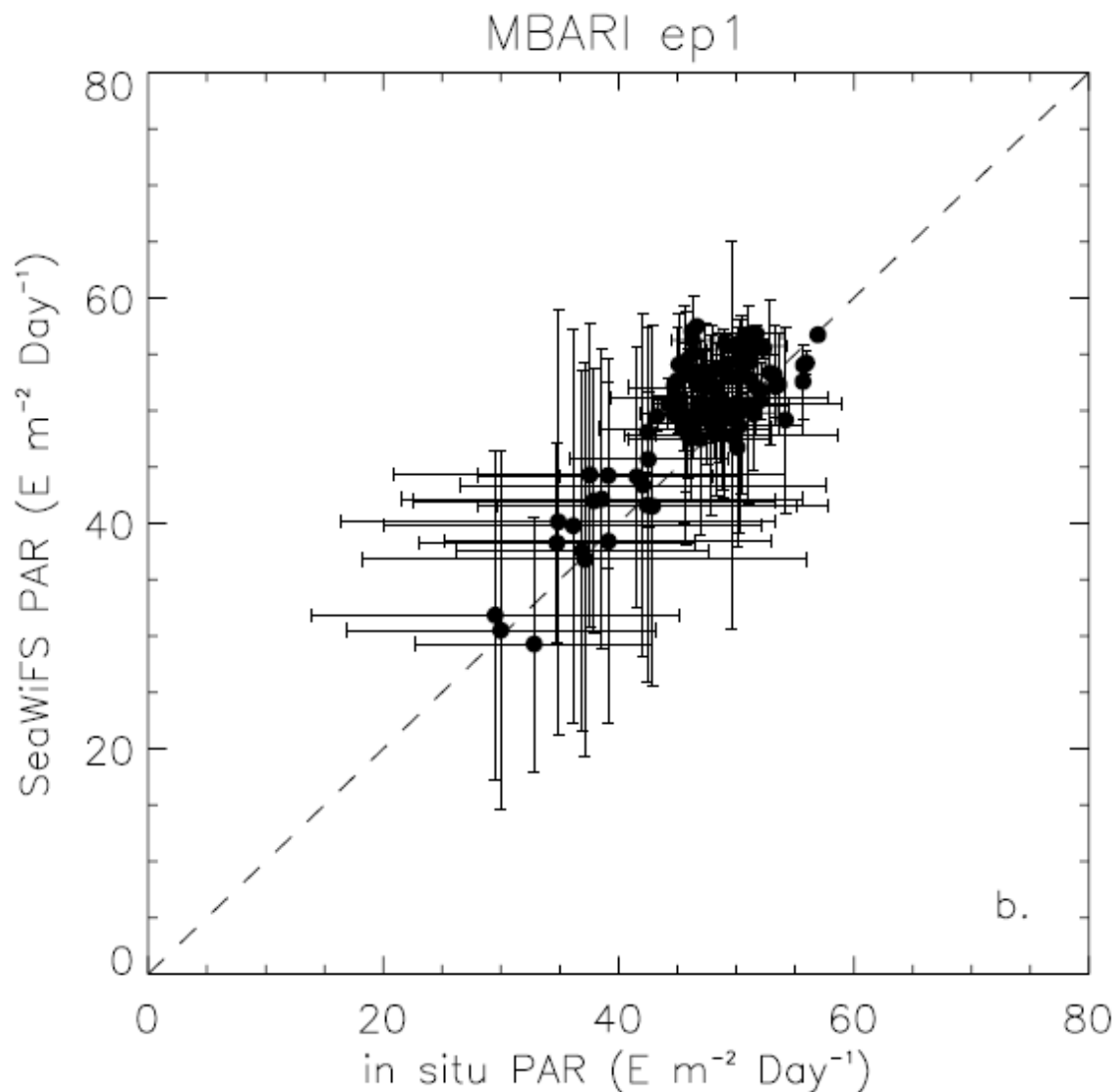
Could these questions be answered with other platforms?

Have we collected *compelling* info/doc/evidence to demonstrate the need for Geo?

Science Focus	Science Questions
Short-Term Processes	<p>1 How do short-term coastal and open ocean processes interact with and influence larger scale physical, biogeochemical and ecosystem dynamics? (OBB 1)</p>
Land-Ocean Exchange	<p>2 How are variations in exchanges across the land-ocean interface related to changes within the watershed, and how do such exchanges influence coastal and open ocean biogeochemistry and ecosystem dynamics? (OBB 1 & 2; CCSP 1 & 3)</p>
Impacts of Climate Change & Human Activity	<p>3 How are the productivity and biodiversity of coastal ecosystems changing, and how do these changes relate to natural and anthropogenic forcing, including local to regional impacts of climate variability? (OBB 1, 2 & 3; CCSP 1 & 3)</p>

Impacts of Airborne-Derived Fluxes	<p>4 How do airborne-derived fluxes from precipitation, fog and episodic events such as fires, dust storms & volcanoes affect the ecology and biogeochemistry of coastal and open ocean ecosystems? (OBB 1 & 2; CCSP 1)</p>
Episodic Events & Hazards	<p>5 How do episodic hazards, contaminant loadings, and alterations of habitats impact the biology and ecology of the coastal zone? (OBB 4)</p>

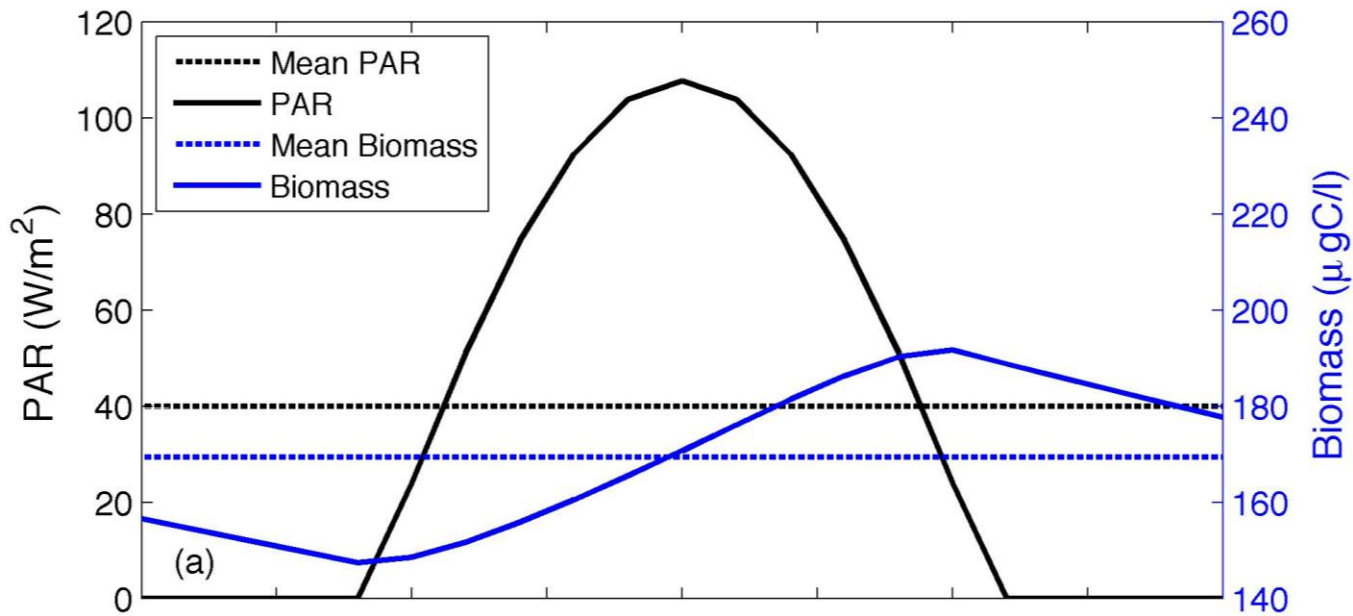
The daily PAR product



Is climatological
cloudiness parameter
good enough?

How big is the impact?

(Frouin et al 2003)



(Lee et al 2012)

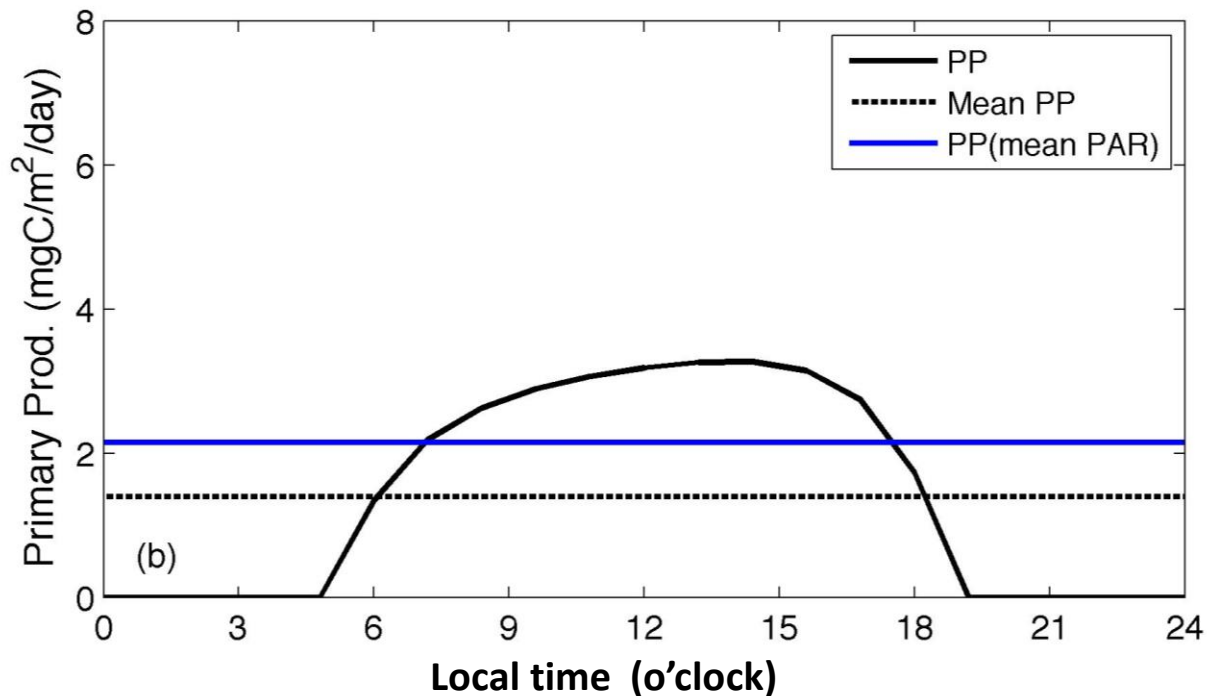


Fig. 3. (a) Diurnal pattern of both biomass and PAR, respectively; dash lines indicate their daily means. (b) Diurnal primary production (black line), and the modeled daily total PP using both mean biomass and mean PAR (represented by the red solid line) or using diurnal varying biomass and diurnal varying PAR (represented by the dot black line). In this case, $P_{\max} = 1.0 \text{ day}^{-1}$.

The need:

Societal need

Can an ocean forecast system improve people's life?

Could it be demonstrated?

Technological readiness

Platform

Sensors

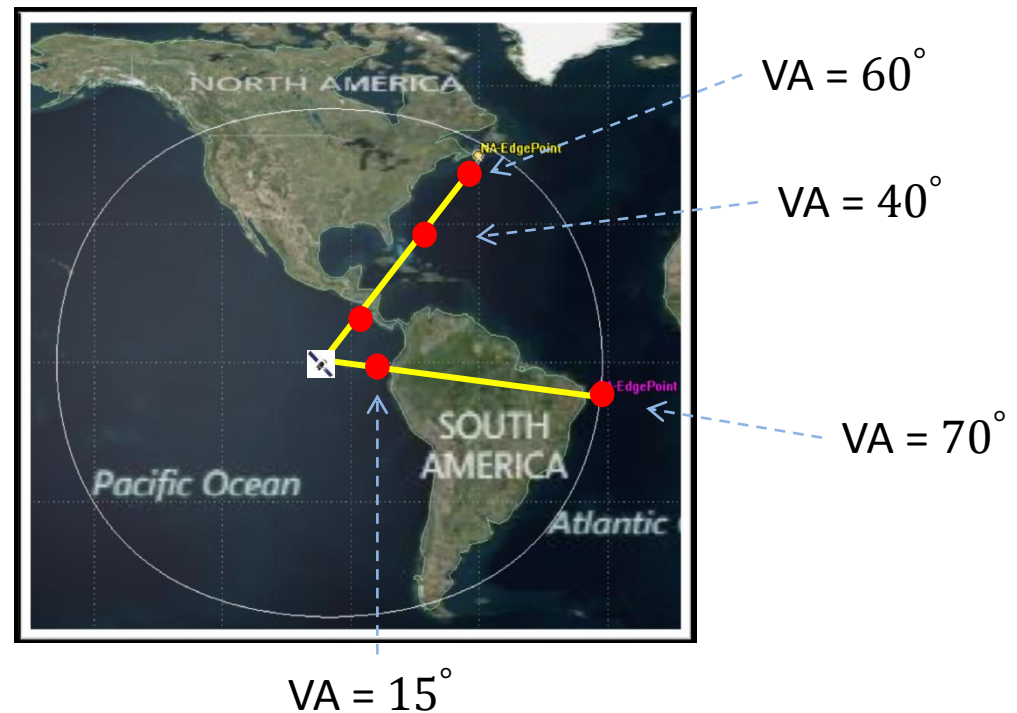
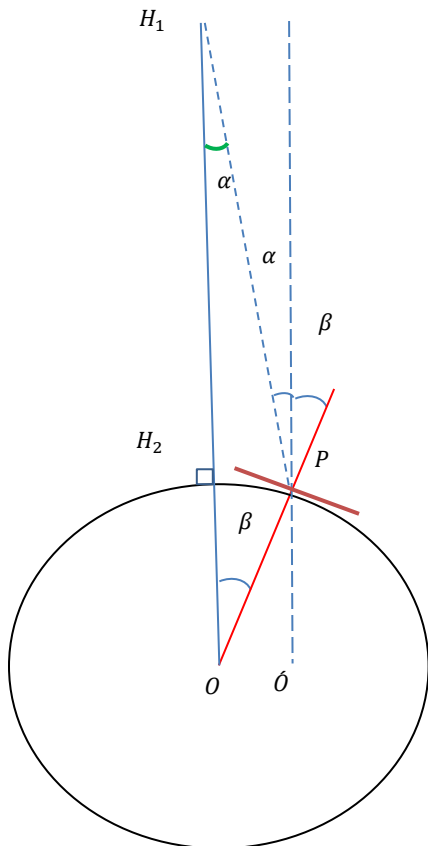
Algorithms

Something about sensor:

Can current sensor specs detect diurnal change?

Approach: Geometric Configuration

- View Angle: $VA = \beta + \alpha$



(Pahlevan et al 2013)

Approach: Metric

- Given the SNR for a typical radiance (SNR_{typ}), SNR at time t_1

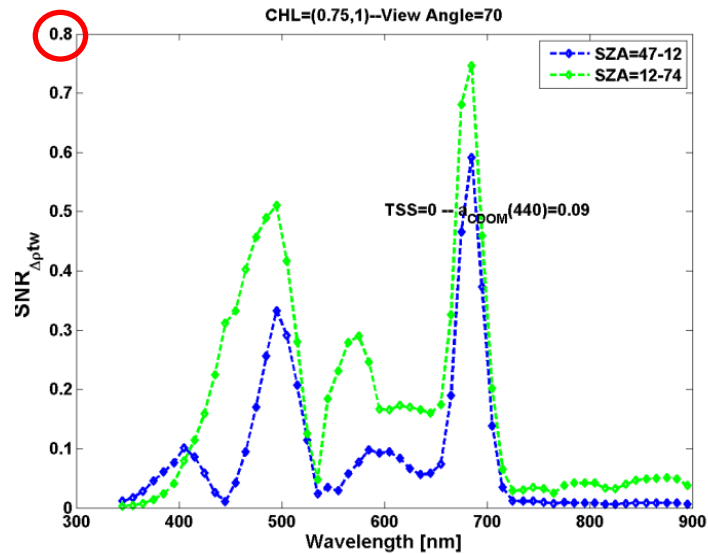
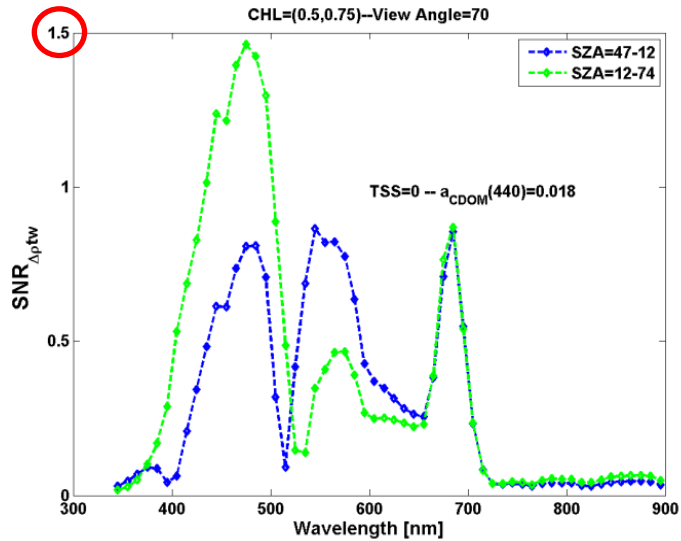
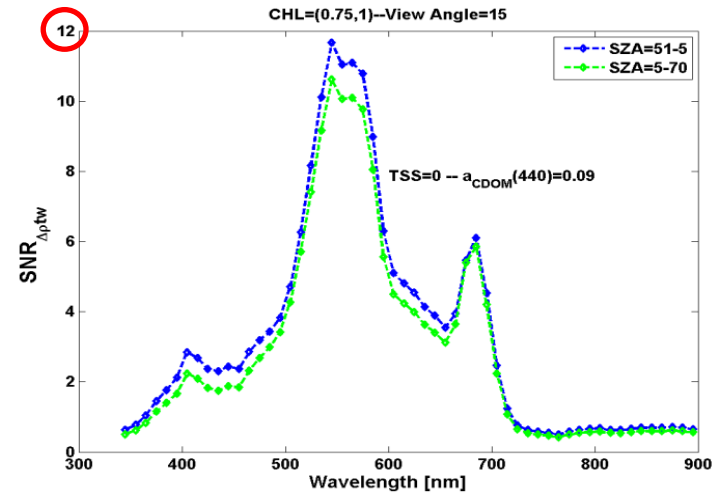
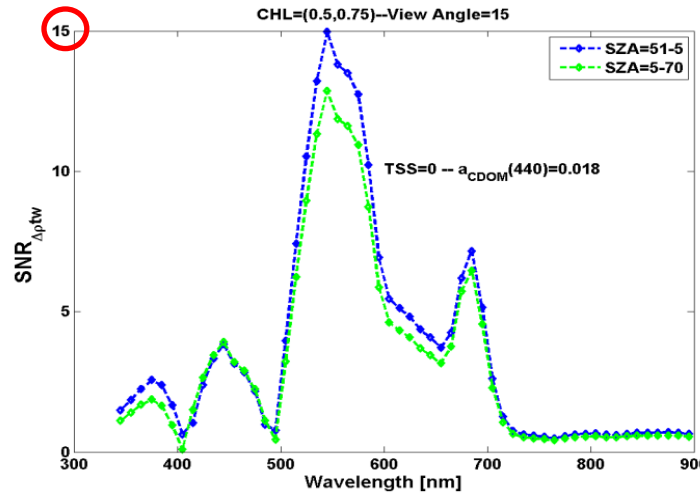
$$SNR^{(t_1)} = SNR_{typ} \sqrt{\frac{L_t^{(t_1)}}{L_{typ}}} \longrightarrow N^{(t_1)} = \frac{L_t^{(t_1)}}{SNR^{(t_1)}} \quad [W/(m^2 sr \mu m)]$$

$$N_{ave} = \left((N_{\rho}^{(t_1)})^2 + (N_{\rho}^{(t_2)})^2 \right)^{0.5} \longleftarrow N_{\rho}^{(t_1)} = \frac{\pi N^{(t_1)}}{E_s \cos(SZA)} \quad [\%]$$

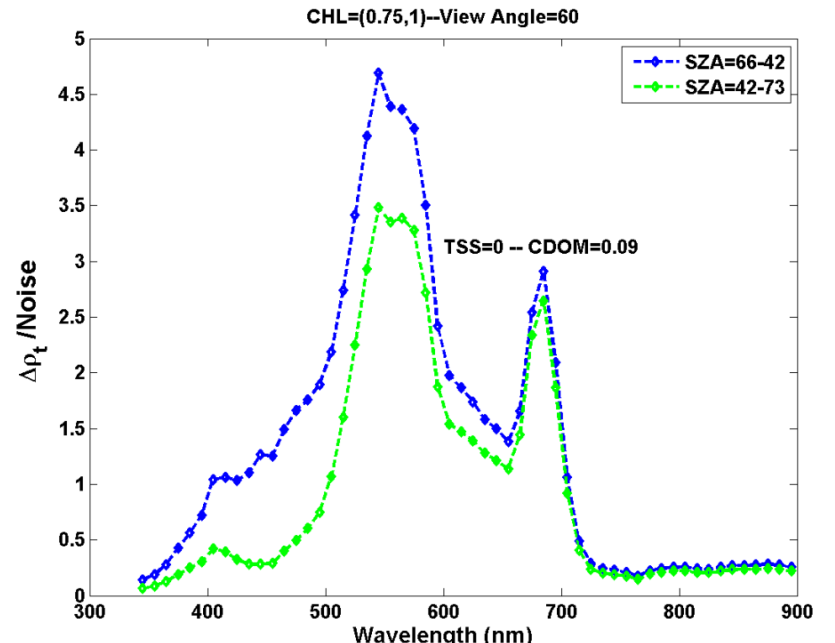
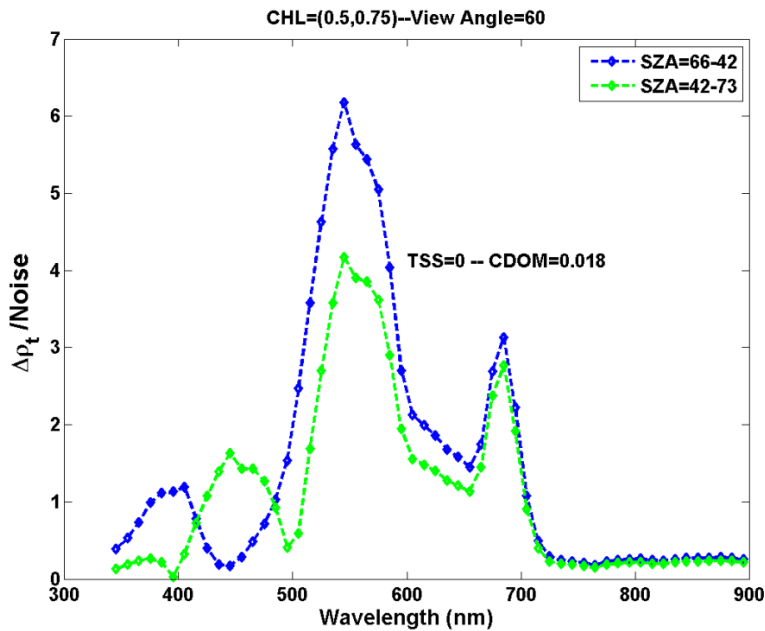
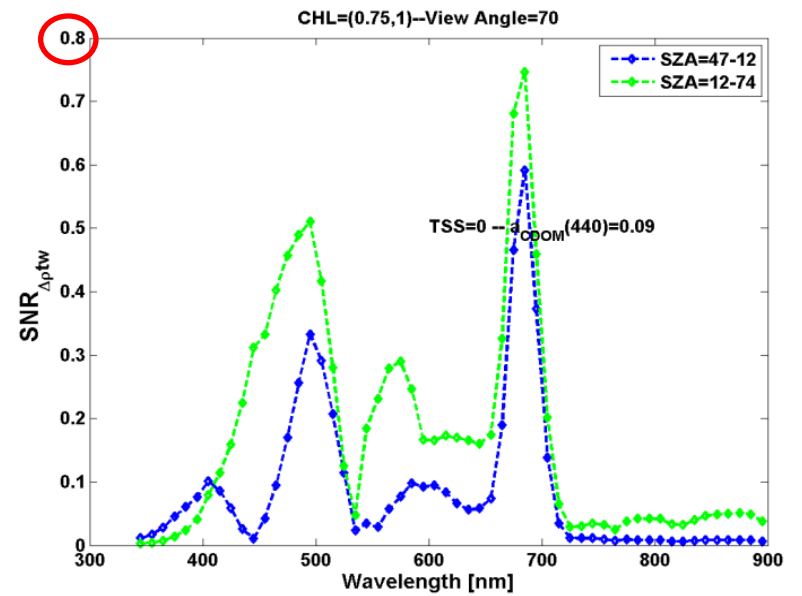
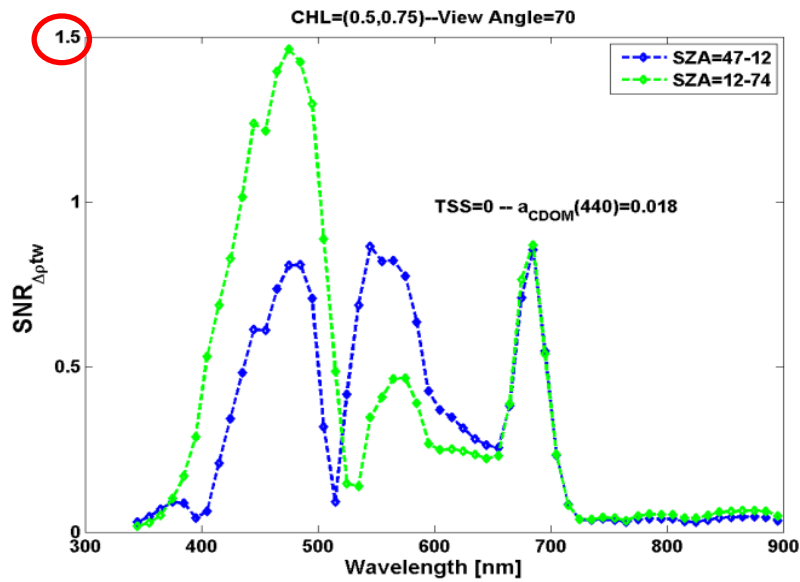
$$SNR_{\Delta\rho} = \frac{|\Delta\rho|}{N_{ave}} = \frac{|\rho^{(t_1)} - \rho^{(t_2)}|}{N_{ave}}$$

**Relative magnitude of signal
(change) to noise**

Results: $VA = 15^\circ$ Vs. $VA = 70^\circ$



Results: $VA = 70^\circ$ Vs. $VA = 60^\circ$



Technological readiness

Algorithms

Mature algorithm to correct path radiance in the UV?

Algorithm to retrieve critical information of constituents?

How large are the uncertainties of the final products?

Develop activities to highlight the need and demonstrate technological readiness