CORRECTION OF THE ABOVE WATER RADIOMETRIC MEASUREMENTS FOR THE SKY DOME REFLECTION, ACCOUNTING FOR POLARIZATION

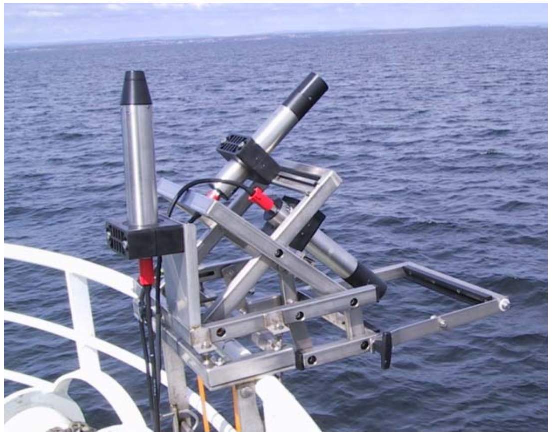
Richard Santer, Francis Zagolski,
Kathryn Barker, Jean-Paul Huot

Invest in our future

Context

- In the frame of the validation of the MERIS atmospheric correction above water
- Protocol for water-leaving measurement

$$L_w^{\uparrow} = L^{\uparrow} - R(\theta_v, w_s) \cdot L^{\downarrow} - L_G(w_s) \cdot \exp(-\tau / \mu_s)$$



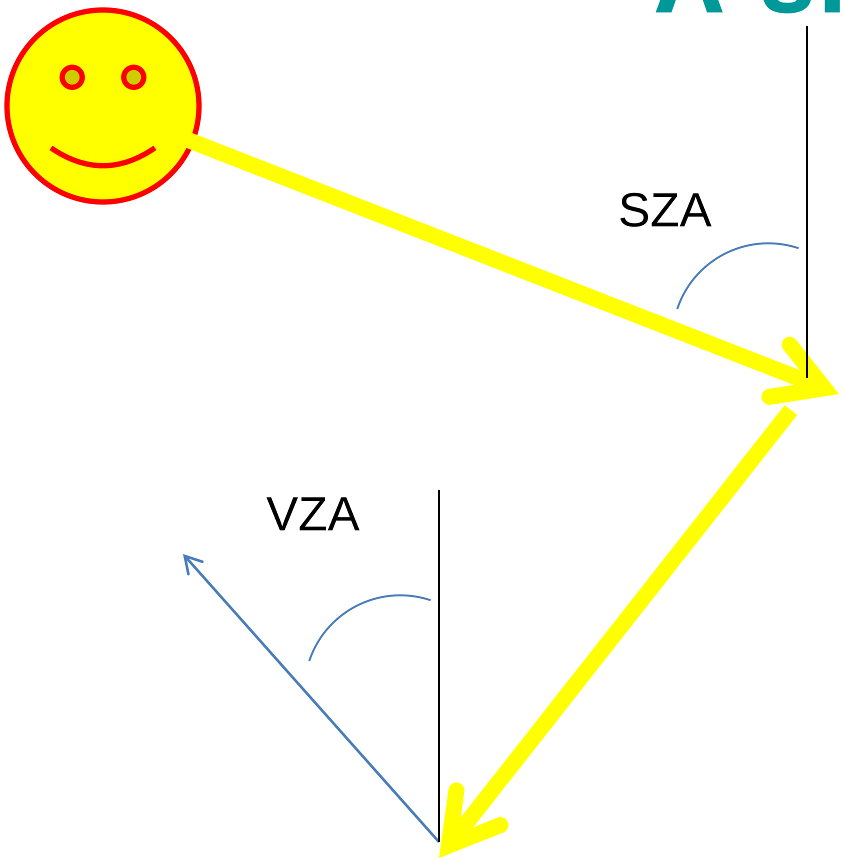
Outlines

- Fundamental equations
- Simulator and examples
- Application to MERMAID

Polarization & Intensity

- The polarization is needed to compute the intensity:
  - Nul in average
  - <u>Example</u>: *Rayleigh* polarisation and atmospheric reflectance
- The influence of the polarization on *I* is by default or by excess

A simple geometry



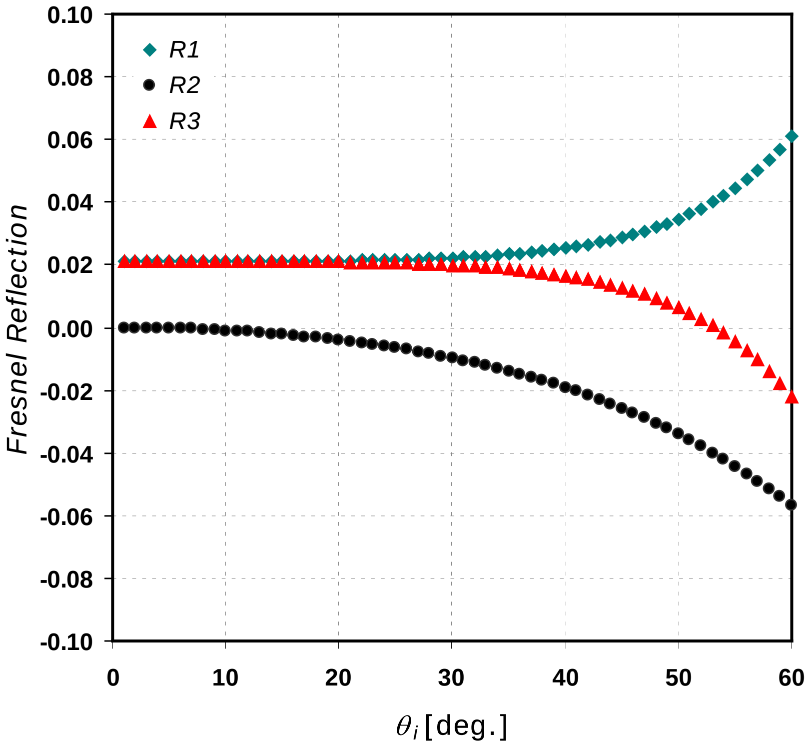
- Principal plane
- Specular case

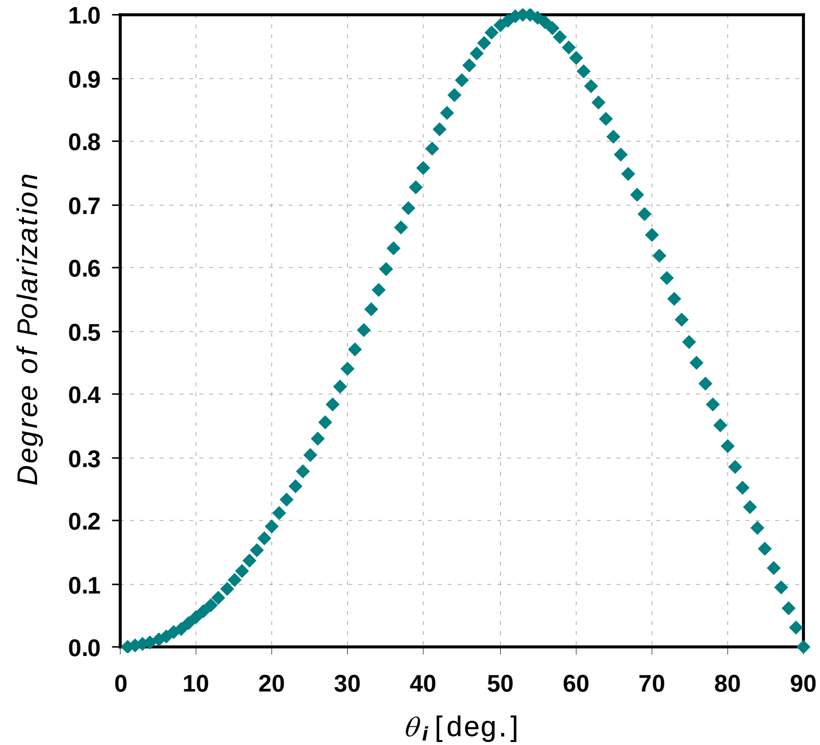
Fresnel & Polarization

$$r_{//} = -\frac{\tan(\theta_i - \theta_r)}{\tan(\theta_i + \theta_r)} \;,\; r_{\perp} = -\frac{\sin(\theta_i - \theta_r)}{\sin(\vartheta_i + \vartheta_r)}$$

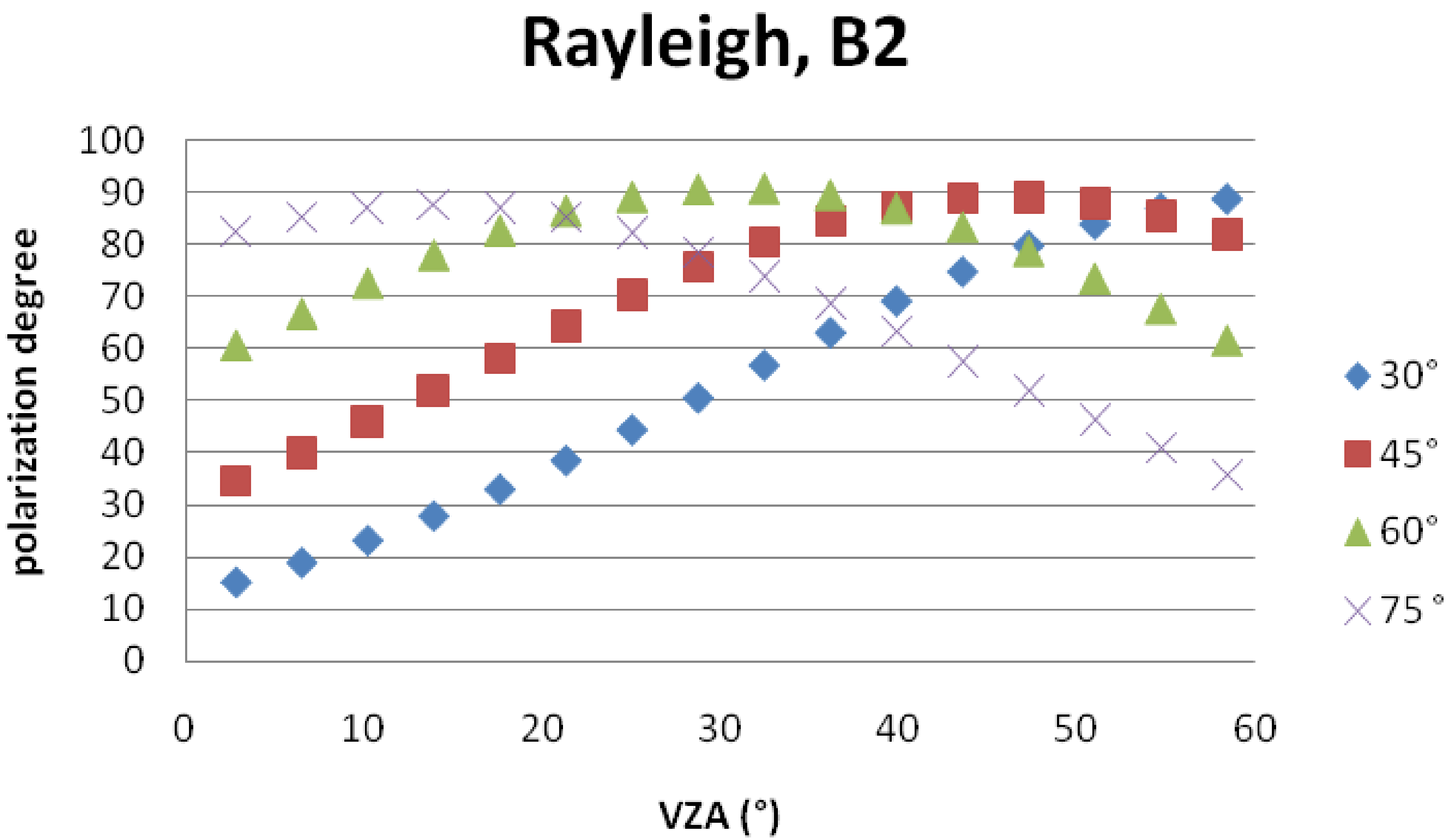
$$\sin(\theta_i) = n_w \sin(\theta_r)$$

$$\begin{cases} R_1 = (r_{//}^2 + r_{\perp}^2)/2 \\ R_2 = (r_{//}^2 - r_{\perp}^2)/2 \\ R_3 = r_{//} \cdot r_{\perp} \end{cases}$$





Rayleigh Polarization



Scattering & Fresnel

			I Q U
R1	R2	0	
R2	R1	0	
0	0	R3	

In the principal plane:

Q = -(P x I)

U = 0

I_{ref}= (R1 x I) + (R2 x Q)

$$R^* = R \cdot \left[1 + \frac{R_{pol} \cdot I_{pol}}{R \cdot I} \right] = R \cdot (1 + P_F \cdot P_R)$$

Outlines

- Fundamental equations
- Simulator and examples

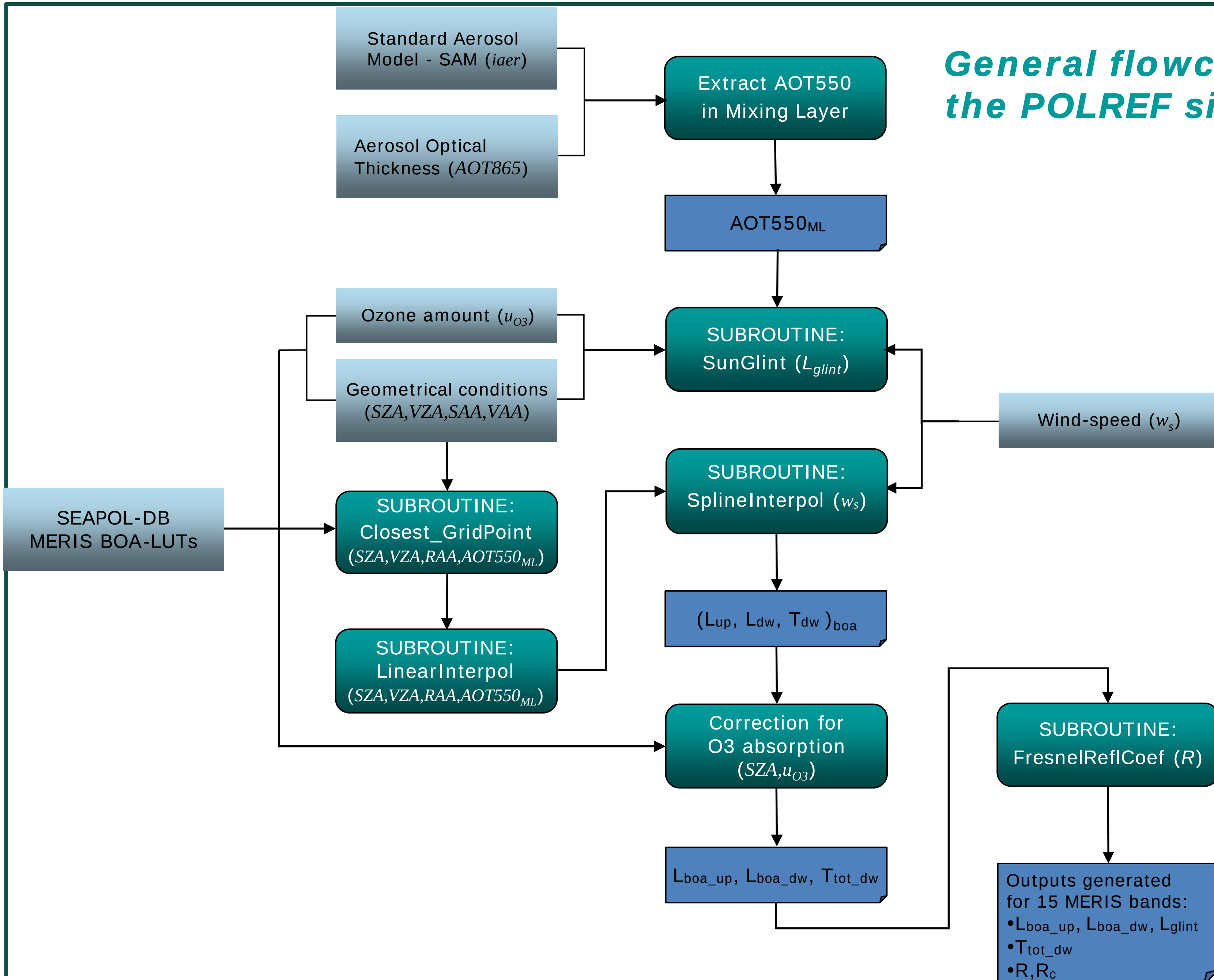
Poster session 1:

"POLREF - A New Simulator for Polarized Reflection Coefficients over Ocean"

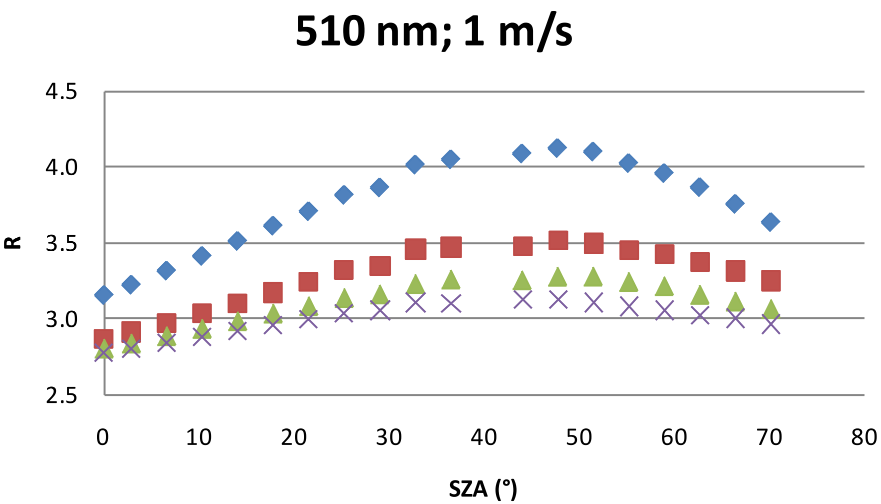
Francis Zagolski , Richard Santer , Kathryn Barker , and Jean-Paul Huot

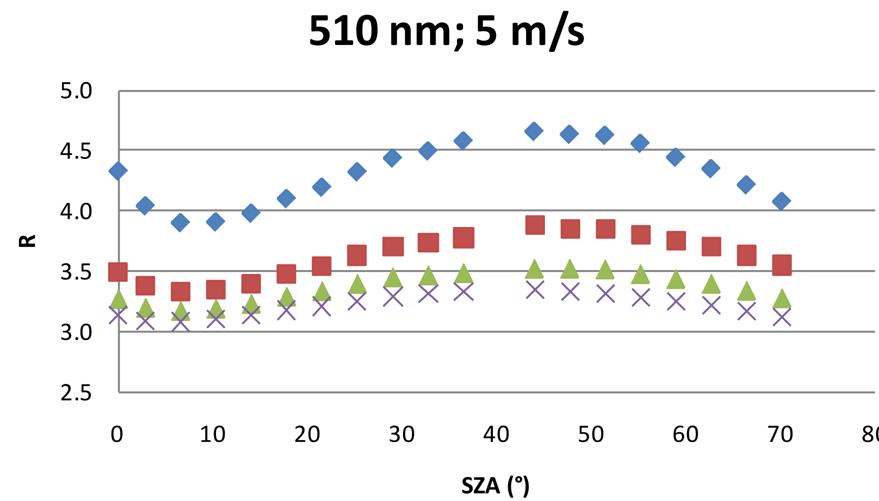
- Application to MERMAID

General flowchart of the POLREF simulator

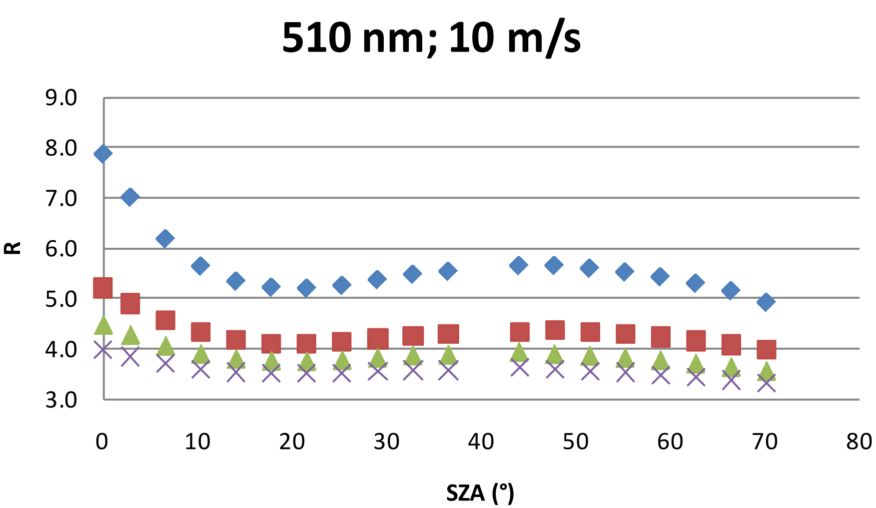


Reflection Coefficient & Wind-Speed



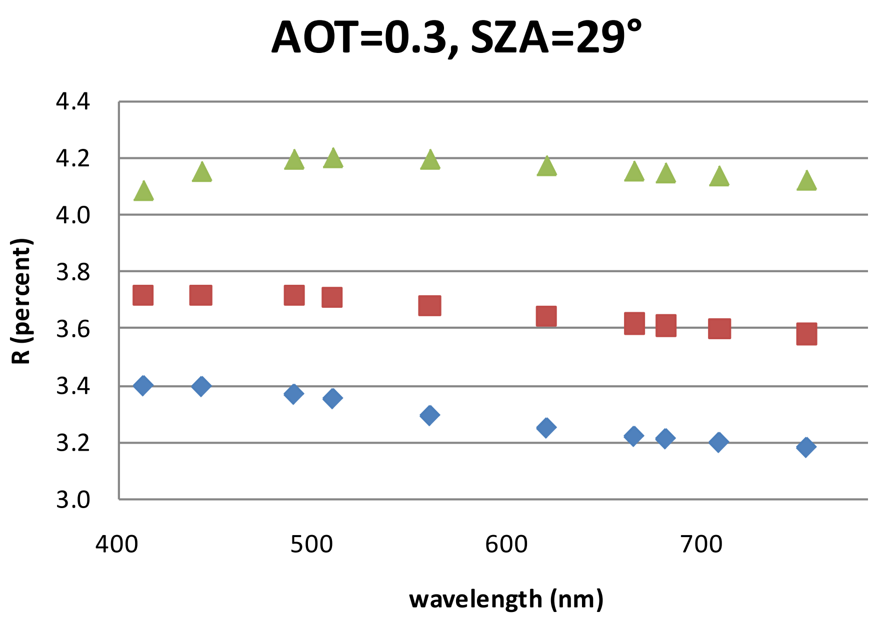


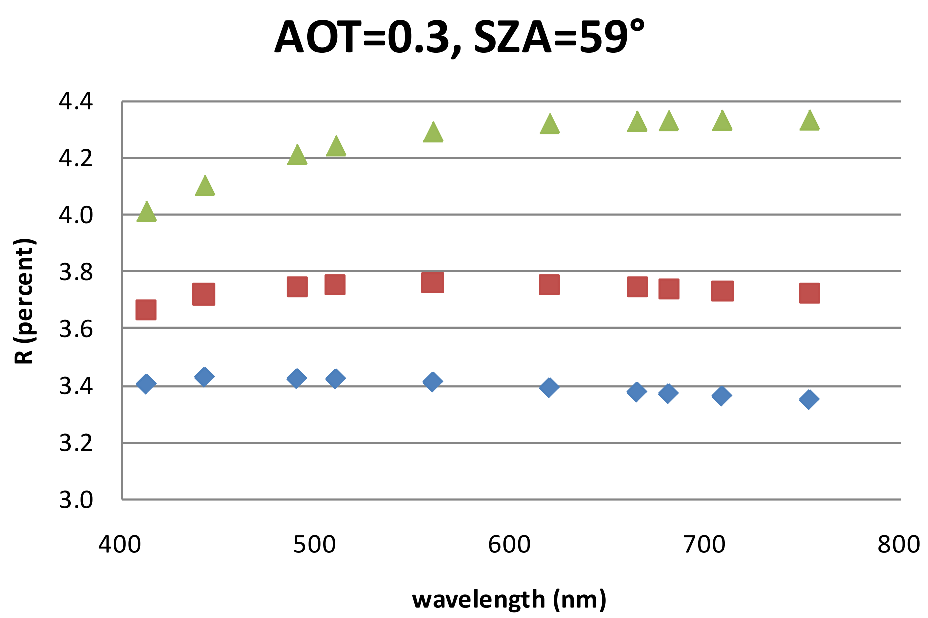
Reflection coefficient at 520 nm versus the solar zenith angle. Rayleigh (blue diamond), M3 with AOT at 550 nm of 0.3 (red square), 0.6 (green triangle) and 0.9 (blue cross)



w(m/s)	1	5	10
R	2.60	2.84	3.29

Reflection Coefficient & SZA

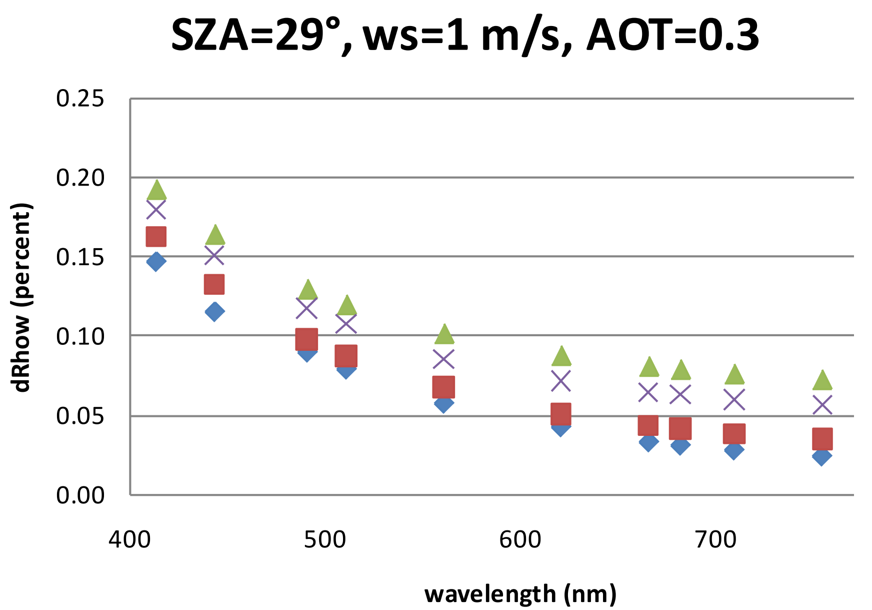


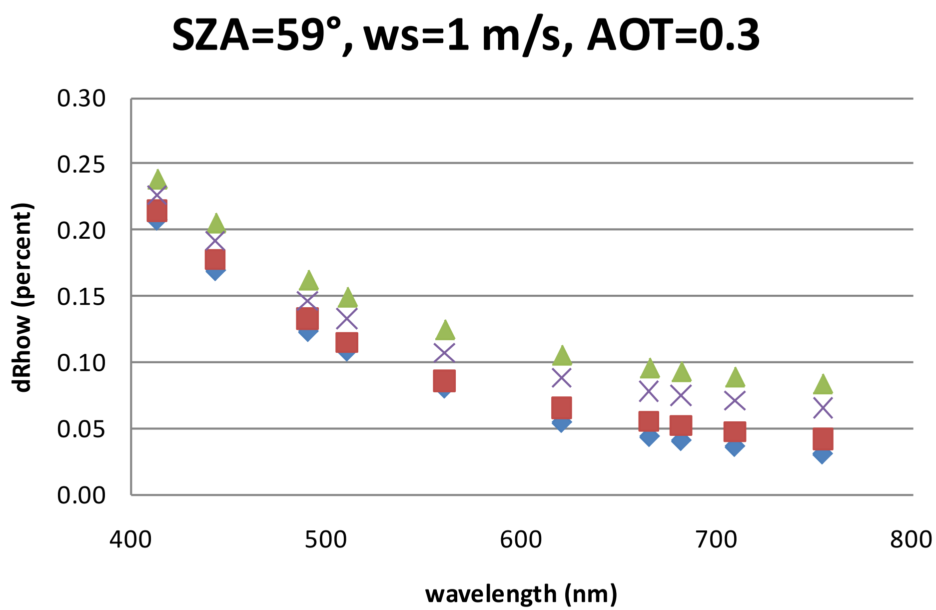


w(m/s)	1	5	10
R	2.60	2.84	3.29

M3 with AOT=0.3 at 550 nm: Spectral dependence of the reflection coefficient at 2 SZA for three wind speeds: 1 m/s (blue diamond), 5 m/s (red square) and 10 m/s (green triangle)

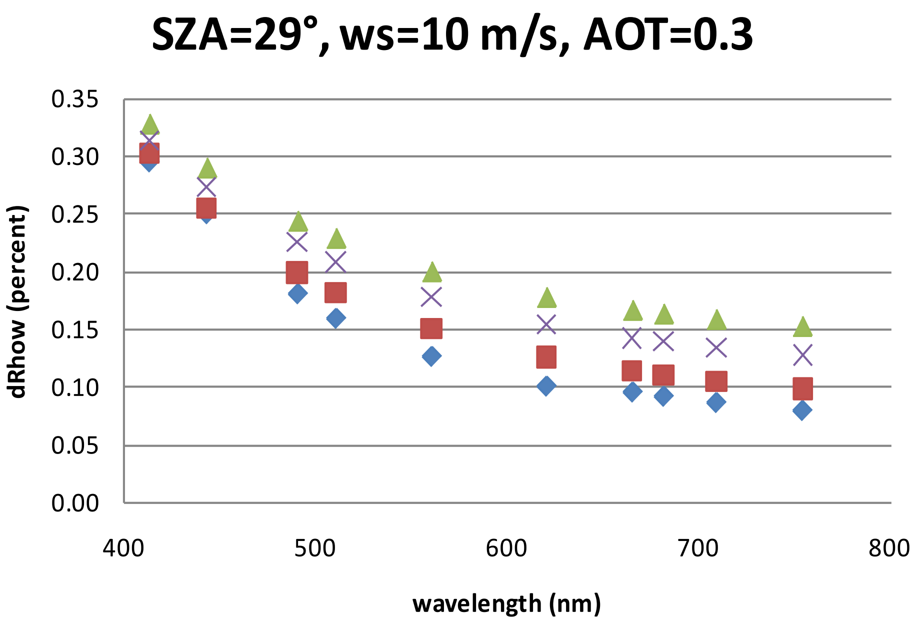
Influence of the Aerosol Model

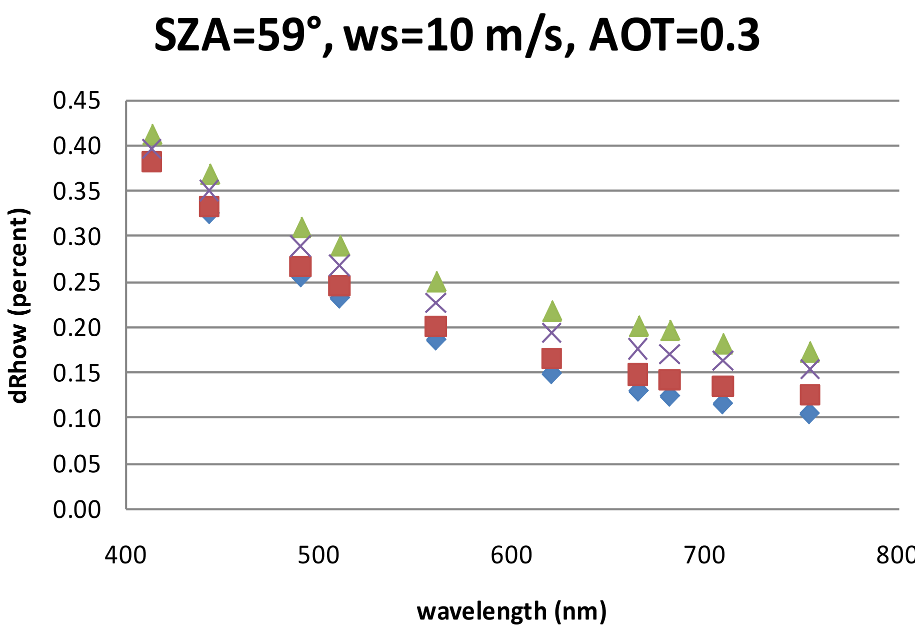




Wind speed of 1 m/s. Absolute bias on the water reflectance for two solar zenith angles versus the wavelength: The AOT at 550 nm is for M1 (blue diamond), M2 (red square), M3 (blue cross) and M4 (green triangle).

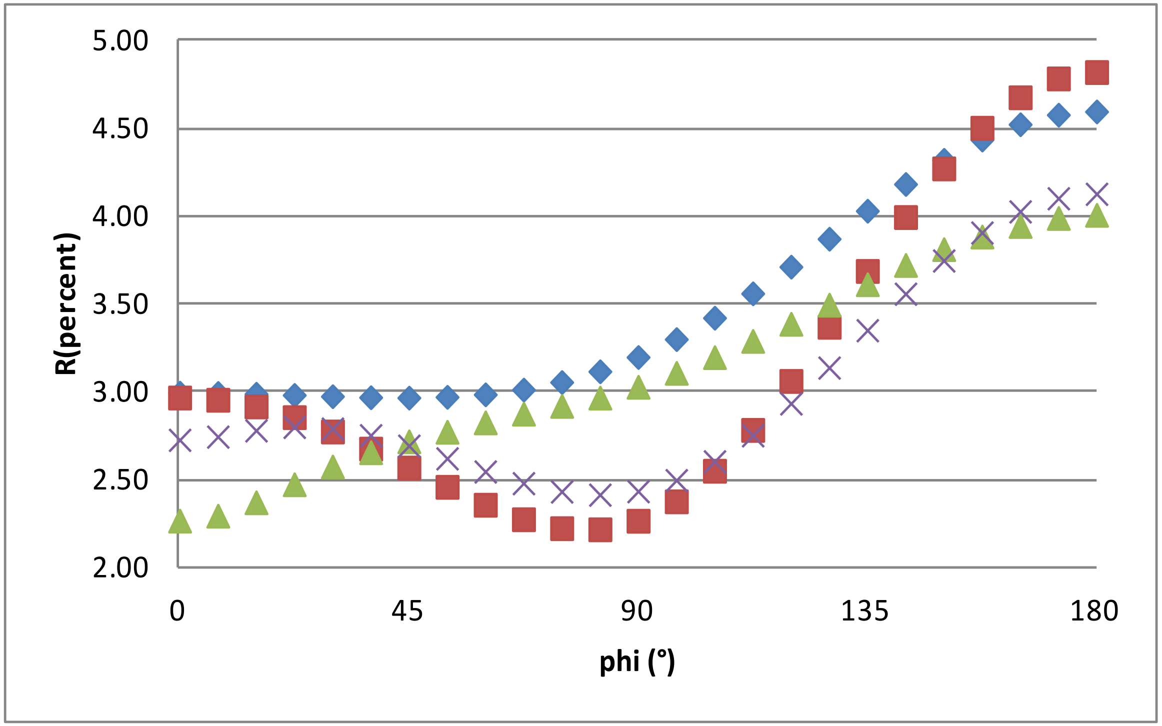
Influence of the Aerosol Model





Wind speed of 10 m/s. Absolute bias on the water reflectance for two solar zenith angles versus the wavelength: The AOT at 550 nm is for M1 (blue diamond), M2 (red square), M3 (blue cross) and M4 (green triangle).

Influence of the azimuth (VZA=40°)



412 nm, wind speed of 7.2 m/s.
Pure molecular atmosphere at SZA=30 º (diamond) and 60 º (square)
M4, AOT560=0.3) at SZA=30 º (triangle) and 60 º (cross)

w(m/s)	1	5	10
R	2.60	2.84	3.29

Outlines

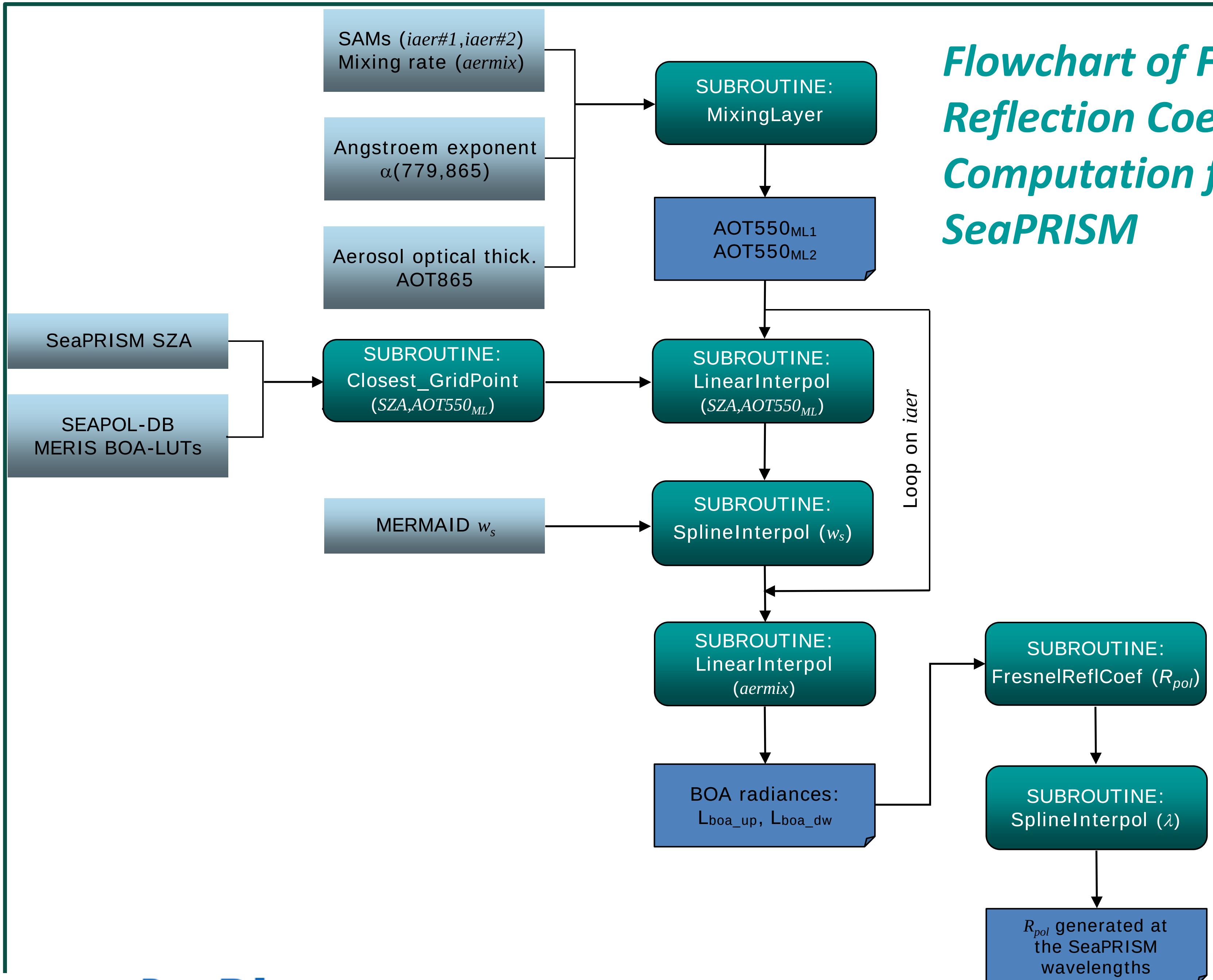
- Fundamental equations
- Simulator and examples
- Application to MERMAID

<u>Poster session 2</u>:

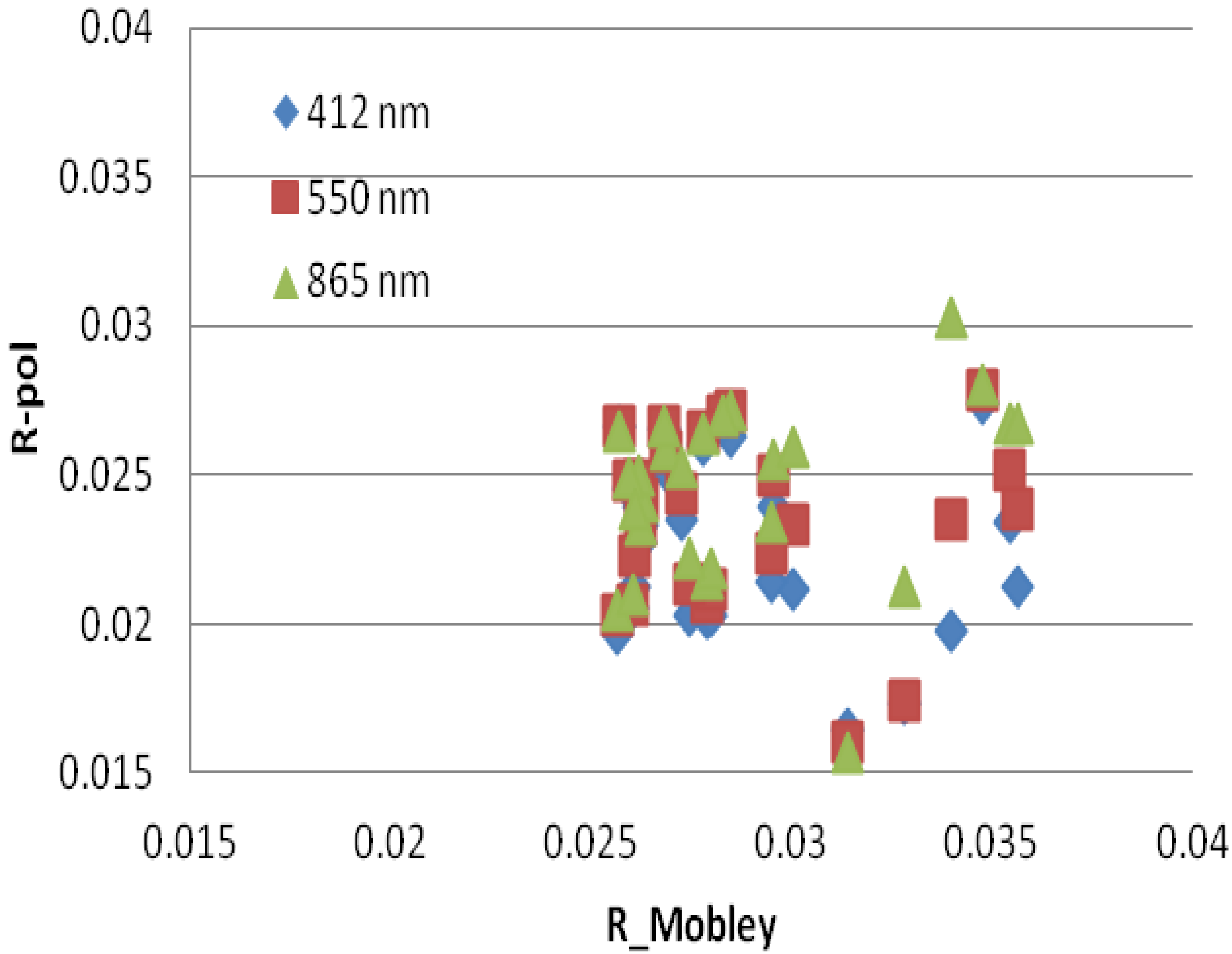
"Sky Dome Correction For SeaPRISM and TriOS Above Water Radiometric Measurements in MERMAID"

Kathryn Barker, Francis Zagolski, Richard Santer, C. Kent , Jean-Paul Huot, Giuseppe Zibordi, Kevin Ruddick.

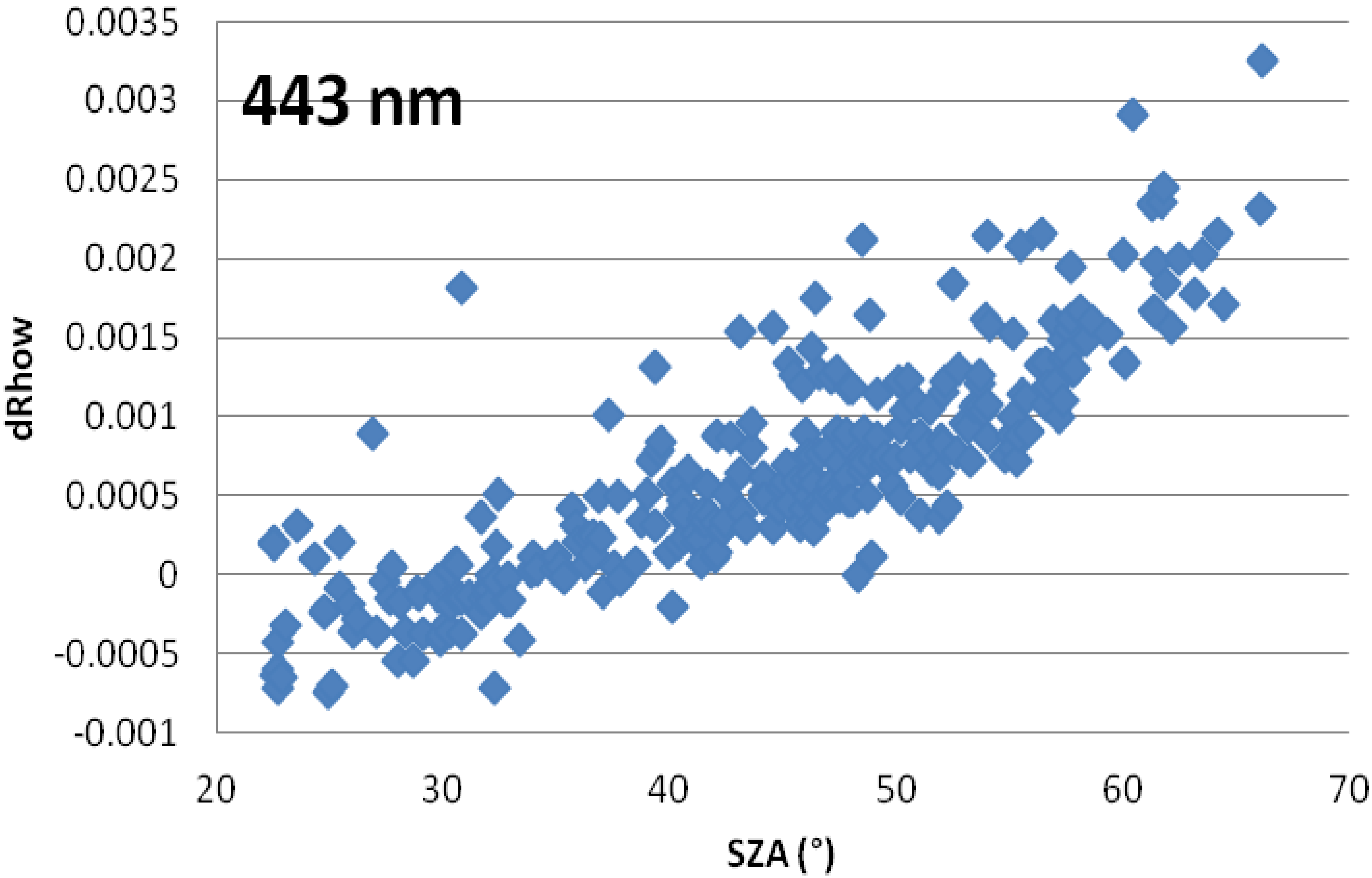
Flowchart of Fresnel Reflection Coefficient Computation for SeaPRISM



Comparison with Mobley



Impact on Rhow



Conclusion

- Need to compute I by accounting for the polarization
- Find the best geometry of observation to minimize the impact

  or take advantage of it (SIMBADA)
- Correct for accounting for the polarization