PDM MODULE

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INTRO

- Reflectance needs to be corrected for polarization effects
- Need two quantities *P* (degree of polarization) and χ (polarization angle) to correct for these effects
- The PDM Module uses empirical and theoretically computed P and χ values
  - Empirical values come from POLDER instrument on the PARASOL satellite (now defunct)
  - Theoretical values calculated by Adding-Doubling Radiative Transfer Model (ADRTM, from Wenbo)

MODULE INPUTS/OUTPUTS

Input:

SZA
VZA
RAZ (Detector AZ & Solar Az.?)
IGBP (Lat. & Long.?)
Cloud Fraction
Date (if needed)
COT/AOD
Wind Speed (IGBP =17 only)

Output:

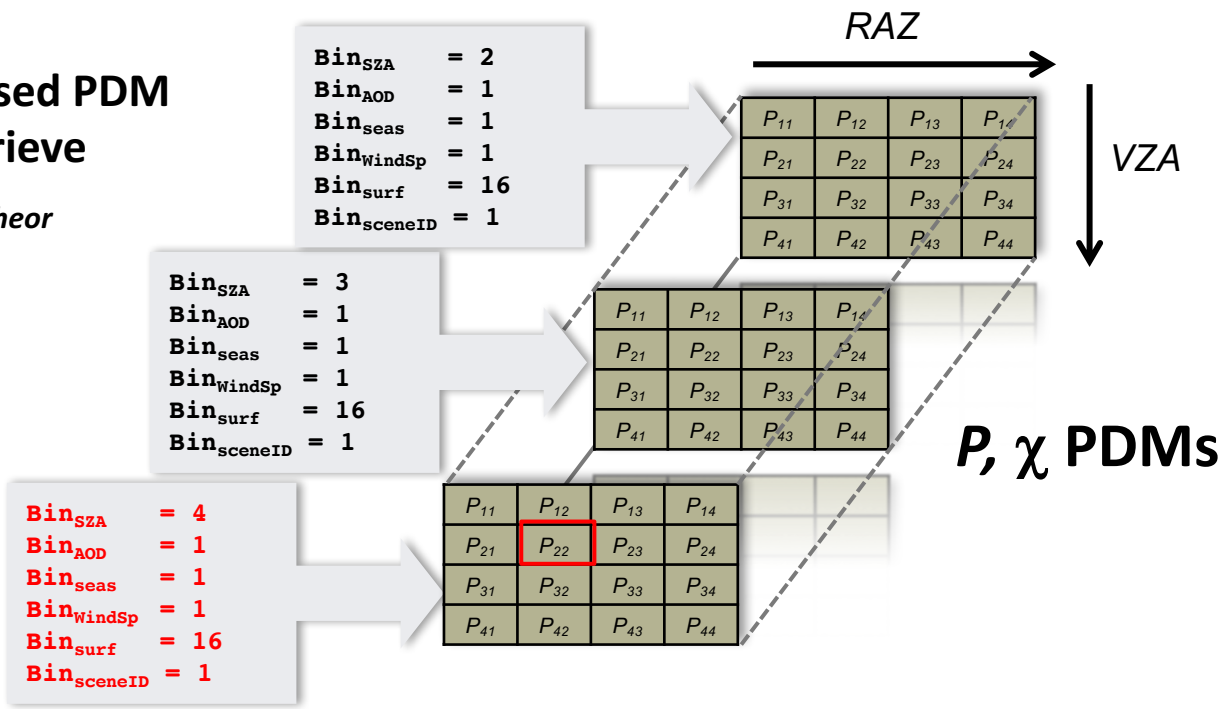
mean P (empirical)
σ^P (empirical)
mean χ (empirical)
$-\sigma^\chi$ (empirical)
P (theoretical)
χ (theoretical)
Confidence Flag

PDM STORAGE/RETRIEVAL

Dimension name	# of bins	binning
SZA	4	[10°, 20°), [20°, 30°), [30°, 40°), [40°, 50°), [50°, 60°),[60°,70°)
AOD	1, >1	[0, 0.4), [0.4,07),...
Seasons	5	[0,1,2,3,4]
Wind Sp. (if IGBP = 17)	4	[0, 3.5), [3.5, 5), [5, 7.5), [7.5,10)
Surf Types	16	IGBP=1,2,..,17
Scene IDs	4	Clear (0), Water cloud (1), Ice Cloud (2) , Mixed (999)

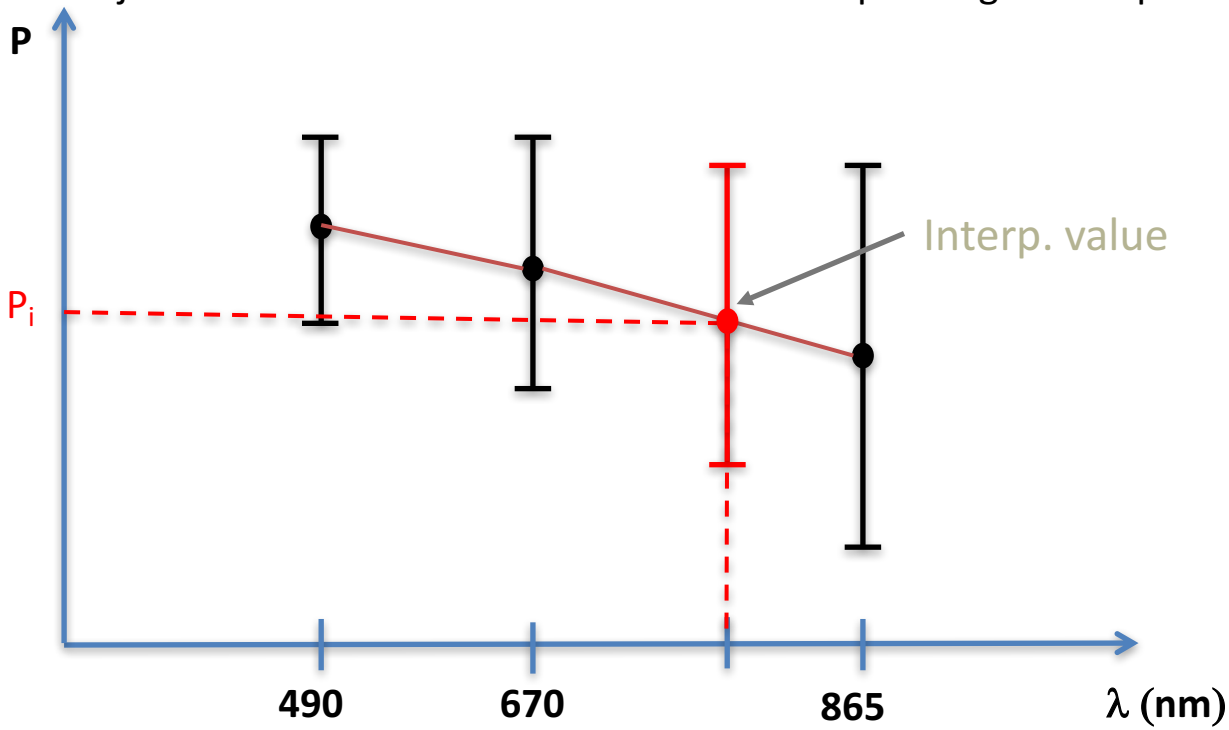
HDF5/NetCDF(?)-based PDM lookup tables to retrieve

P, σ_p, χ, σ_χ, P_{theor}, χ_{theor}



EMPIRICAL PDM INTERPOLATION

- Use **linear interpolation** to find mean values between 490 and 670 nm, and 670 and 865 nm
- Use 2 lookup tables corresponding to adjacent bands to retrieve $P_1(\sigma_{p1})$ and $P_2(\sigma_{p2})$ (or $\chi_1(\sigma_{\chi 1})$ and $\chi_2(\sigma_{\chi 2})$)
- Average the adjacent variances to find the std. dev. corresponding to interpolated value



THEORETICAL P AND χ AND CONFIDENCE FLAG

- Theoretical P and χ per-bin values from ADRTM also recorded in lookup tables
- Confidence flag to indicate how many std. deviations is theoretical value away from empirical mean
  - I.e., if with $P_{theor} < 1\sigma$ away from mean $P_{empirical}$ => confidence flag = 0. If $1\sigma < P_{theor} < 2\sigma$ away from $P_{empirical}$ => confidence flag = 1, etc.

IMPLEMENTATION

- Have already implemented a (C++) module to retrieve empirical P and χ for IGBP = 17
- Interpolation between wavelengths is working (results presented at last fall's SDT)
- Lookup tables in HDF4 at the moment (can be changed to HDF5 or NetCDF)