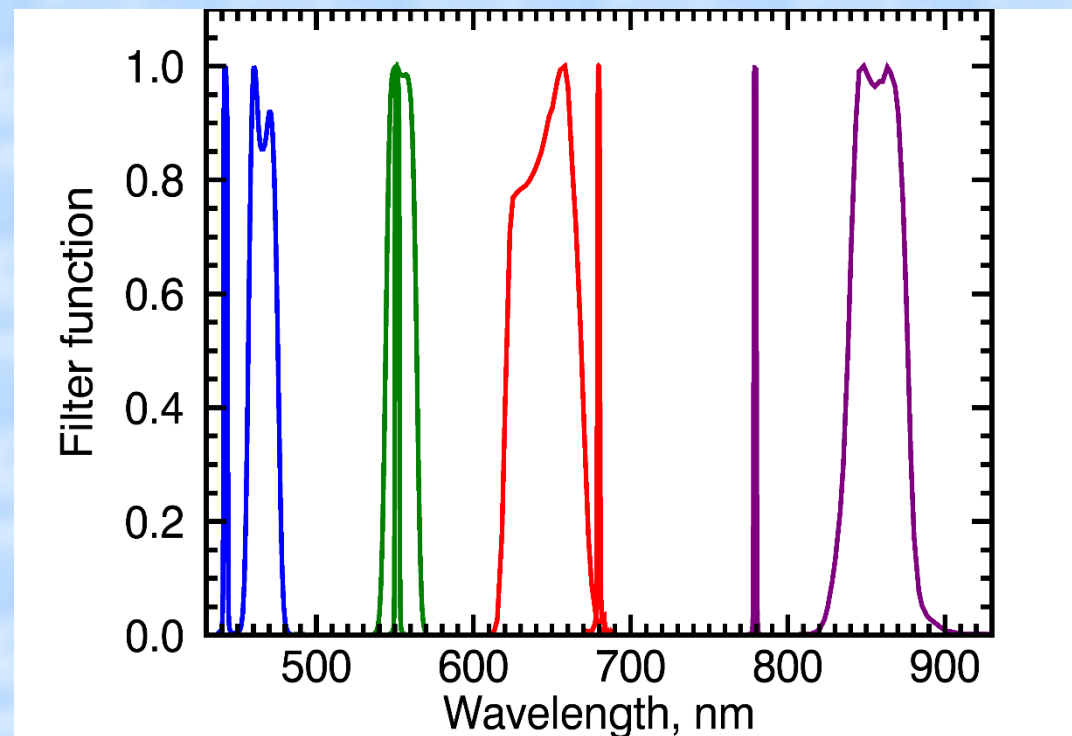# Calibration of the EPIC visible and NIR channels using MODIS data

Igor Geogdzhayev Alexander Marshak

- MODIS Aqua and Terra L1B 1km reflectances matching four EPIC visible and NIR channels:

EPIC channel (Full Width in nm)	MODIS Band (Bandwidth)
443±1 nm (3±0.6)	3 (459-479nm)
551±1 nm (3±0.6)	4 (545-565nm)
680±0.2 nm (3±0.6)	1 (620-670nm)
779.5±0.3 nm (2±0.4)	2 (841-876nm)

- data between June 2015 and February 2016 are used

Pixel matching

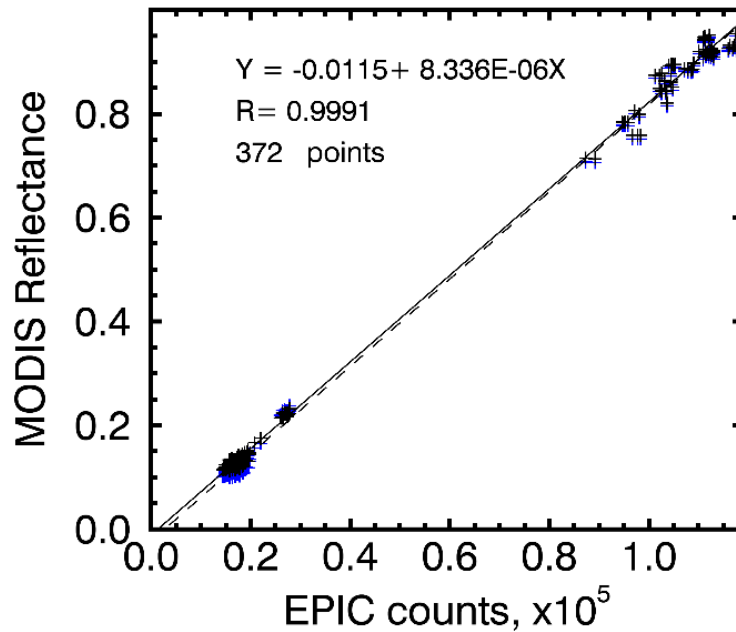For each EPIC image favorable MODIS pixels are identified:

- scattering angle should match to within 0.5 deg
- temporarily collocated to within 10min
- spatially collocated to within 25 km radius
- Solar zenith angle (SZA) is less than 60 deg
- relative standard deviation is found for each EPIC 5x5 pixel neighborhood and for collocated MODIS pixels
- standard deviation is used to select the most homogeneous scenes.

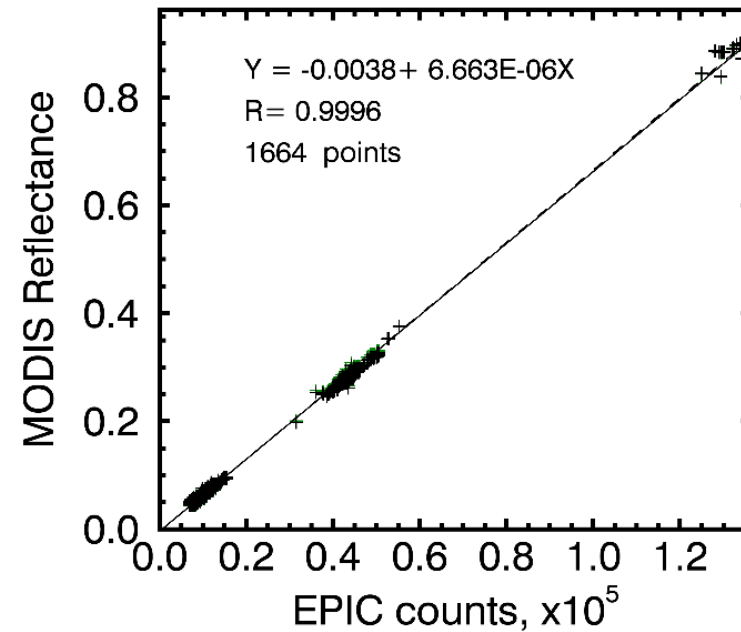**Two methods to determine calibration coefficients:**

- linear regression between EPIC counts and MODIS reflectances
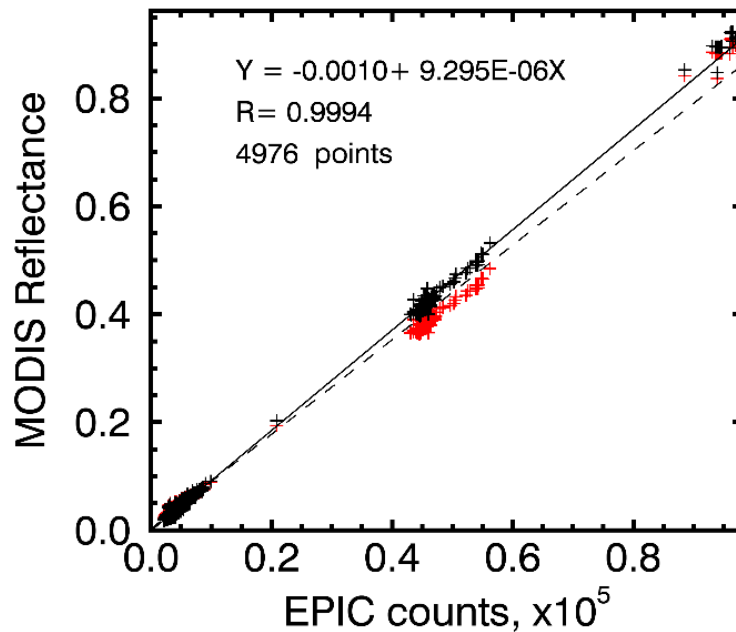- Mean MODIS/EPIC ratio for MODIS relectances greater than 0.6
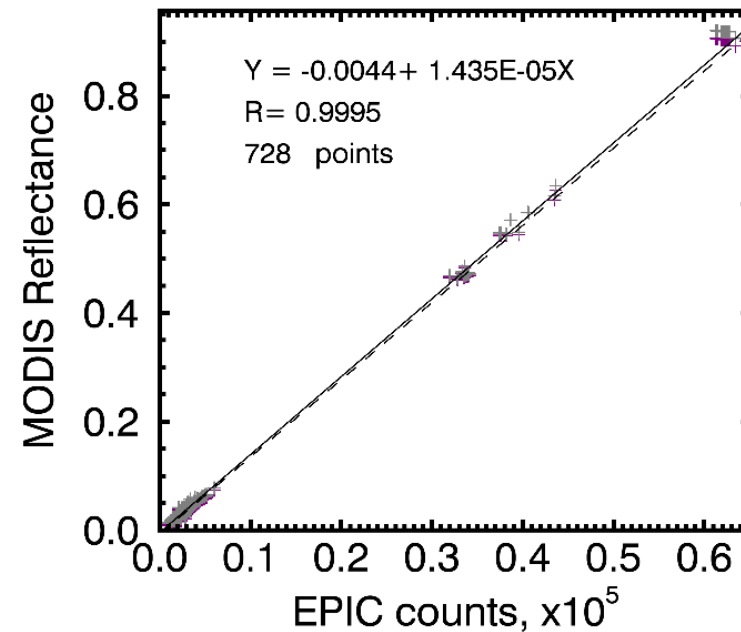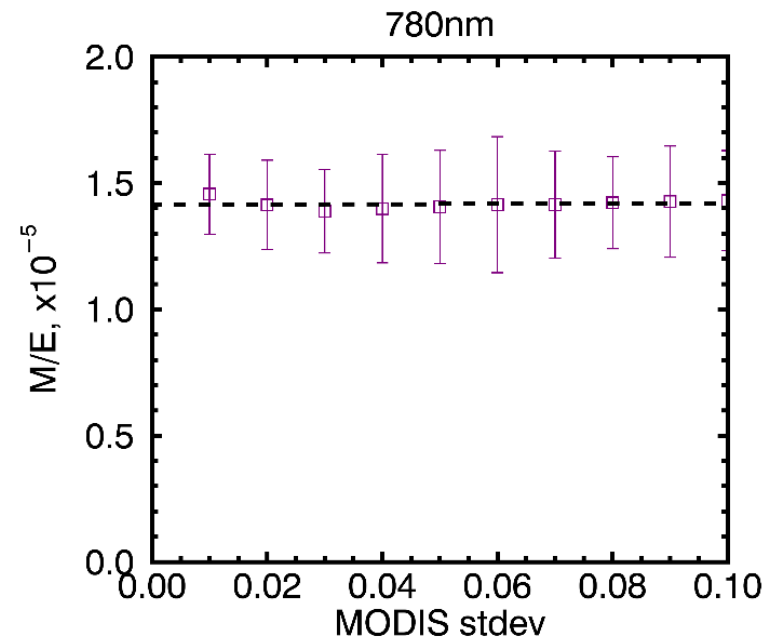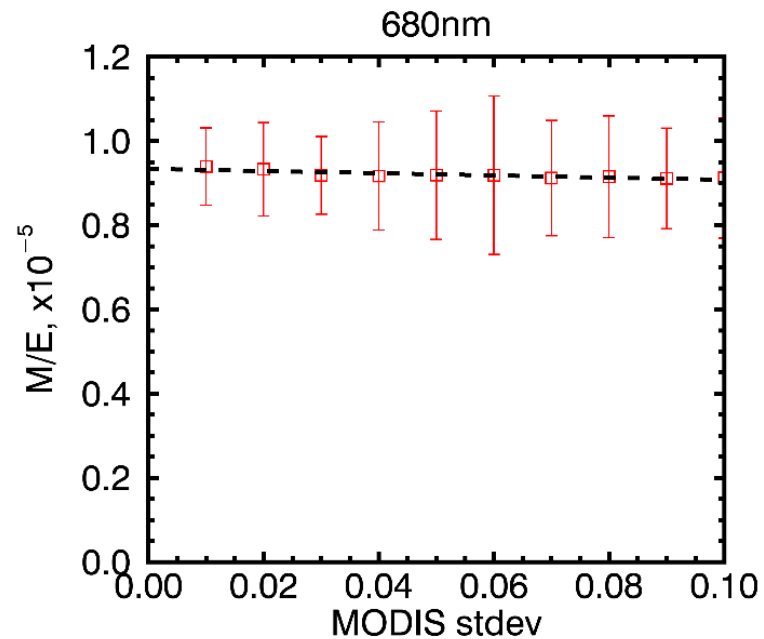
Regression analysis

EPIC 443nm vs MODIS CH 3

$Y = -0.0115 + 8.336E-06X$
$R = 0.9991$
372 points

EPIC 551nm vs MODIS CH 4

$Y = -0.0038 + 6.663E-06X$
$R = 0.9996$
1664 points

EPIC 680nm vs MODIS CH 1

$Y = -0.0010 + 9.295E-06X$
$R = 0.9994$
4976 points

EPIC 780nm vs MODIS CH 2

$Y = -0.0044 + 1.435E-05X$
$R = 0.9995$
728 points

MODIS/EPIC ratio estimates
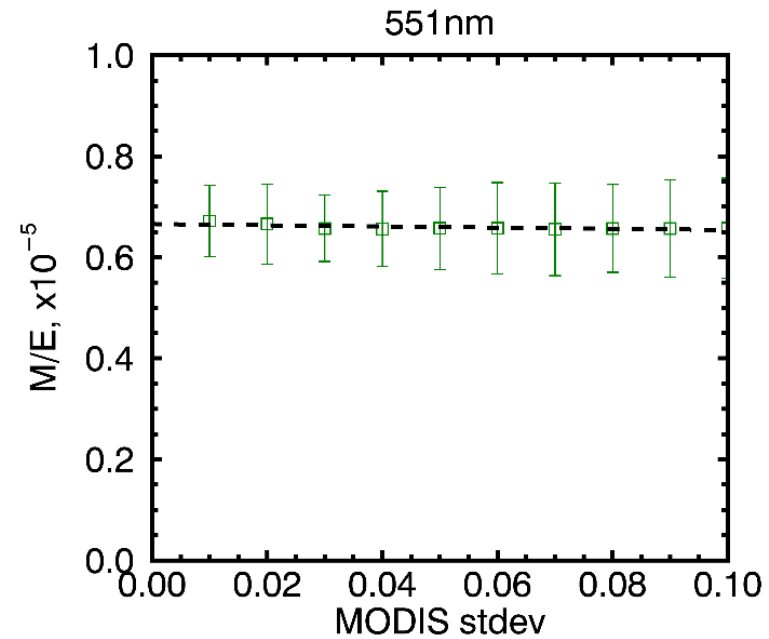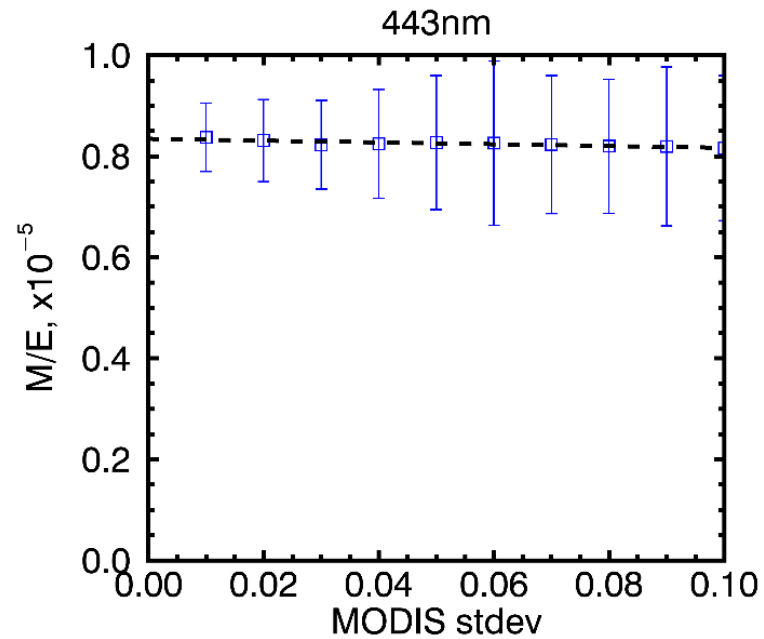
The effect of straylight correction

Compared to the initial release of the EPIC data the second release includes a number of improvements, including a straylight correction algorithm which is based on laboratory measurements and in-flight lunar observations).

The effect of straylight correction on the calibration coefficients is a reduction of both the slope and the intercept of the fit
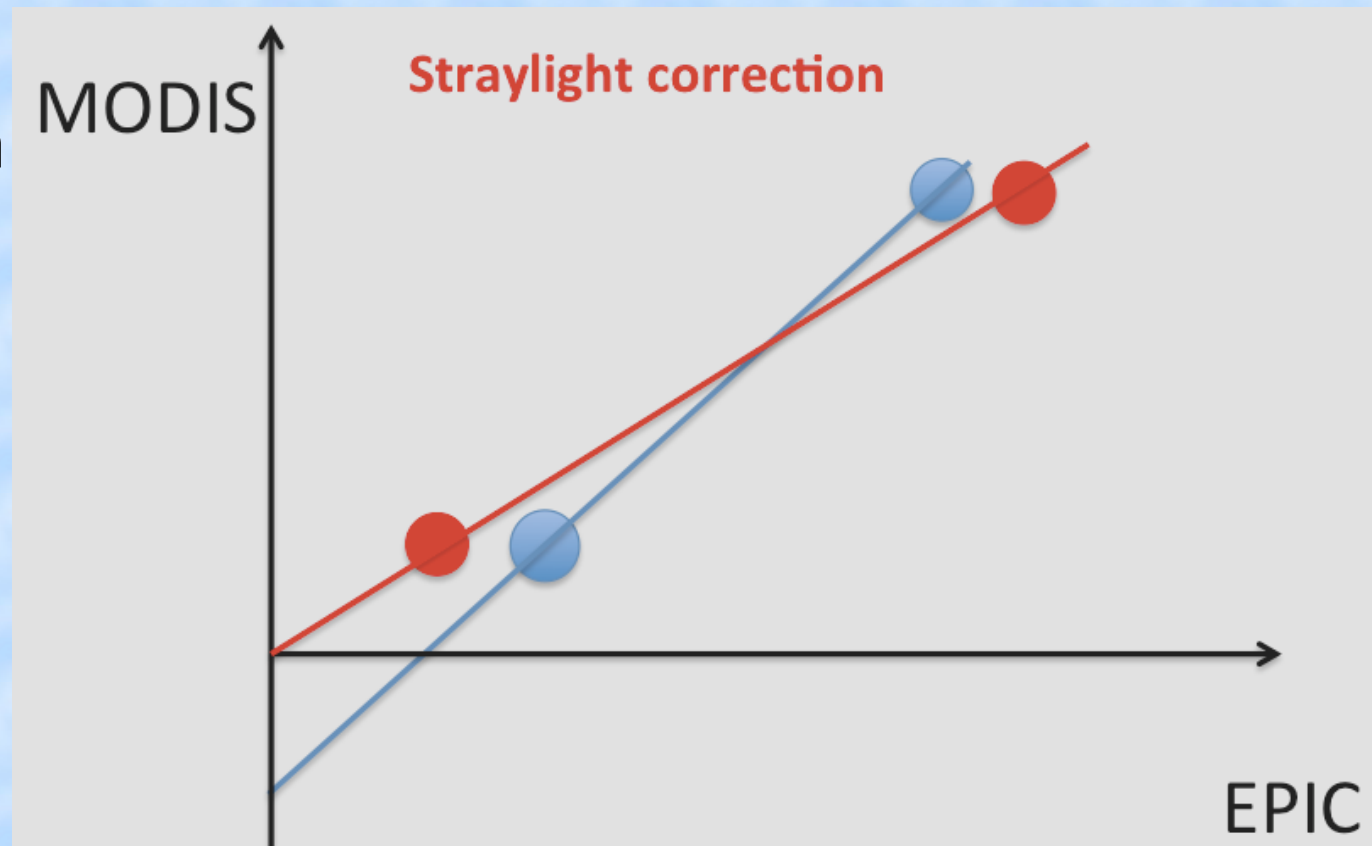
Spectral Correction

To compensate for the differences in the position and spectral width of the corresponding EPIC and MODIS channels In version 2 calibration we employed spectral band adjustment factors (SBAFs) which convert MODIS reflectance values to equivalent EPIC reflectance for various surface types.

These factors were obtained from https://cloudsgate2.larc.nasa.gov/cgi-bin/site/showdoc?mnemonic=SBAF

and employ the analysis of the SCHIAMACHY hyperspectral data for various surface targets to account for the differences in MODIS and EPIC spectral response functions (Scarino et al., 2016).

Ver 1 vs Ver 2 Calibration

Version 1		
EPIC Channel	Calibration coefficients	M/E / Reg. diff. (%)
443 nm	8.80E-6	2.79
551 nm	6.90E-6	1.98
680 nm	1.00E-5	1.01
780 nm	1.50E-5	0.41
Version 2		
443 nm	8.34E-06	0.1
551 nm	6.66E-06	0.5
680 nm	9.30E-06	0.5
780 nm	1.435E-05	1.4
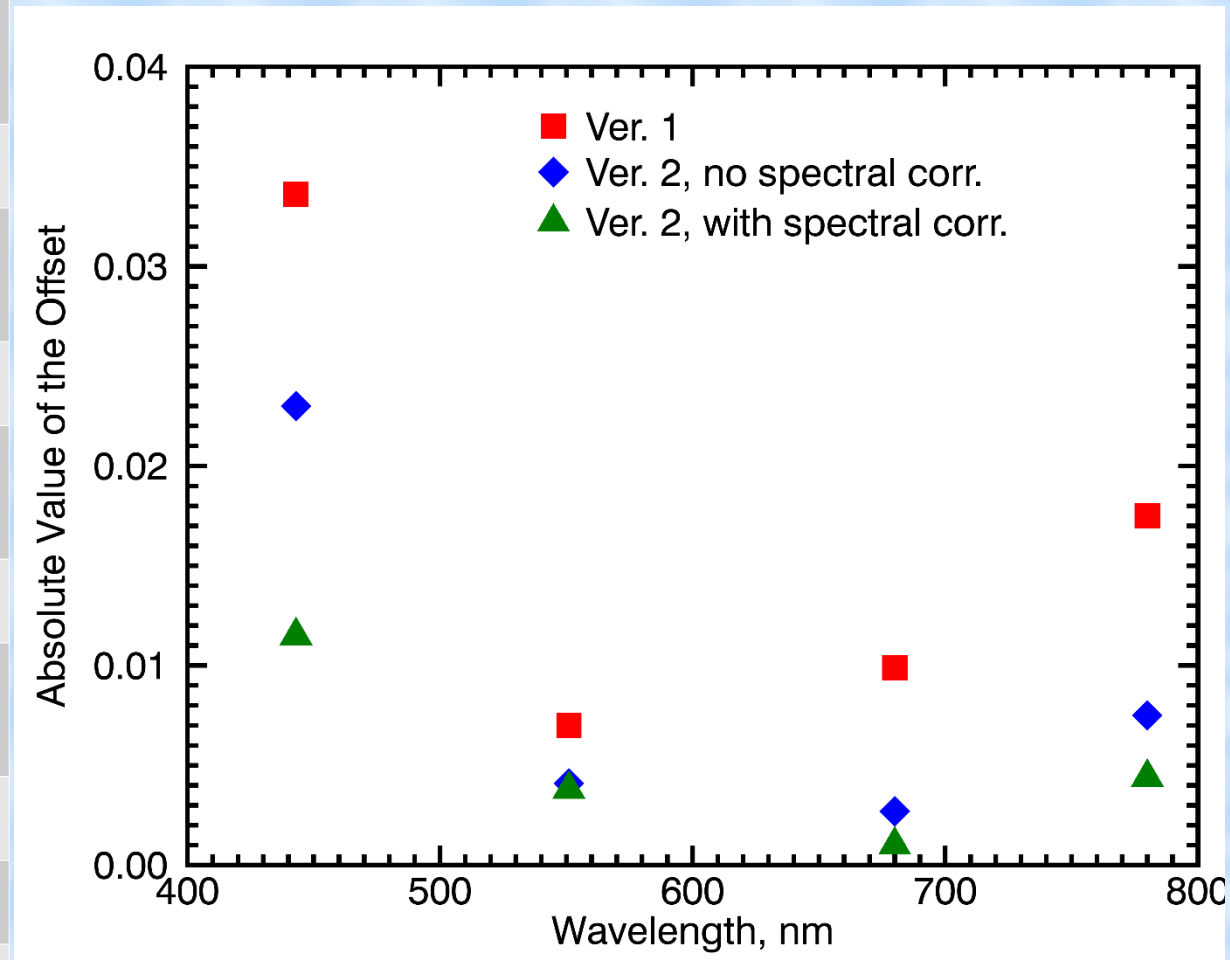
Seasonal dependence
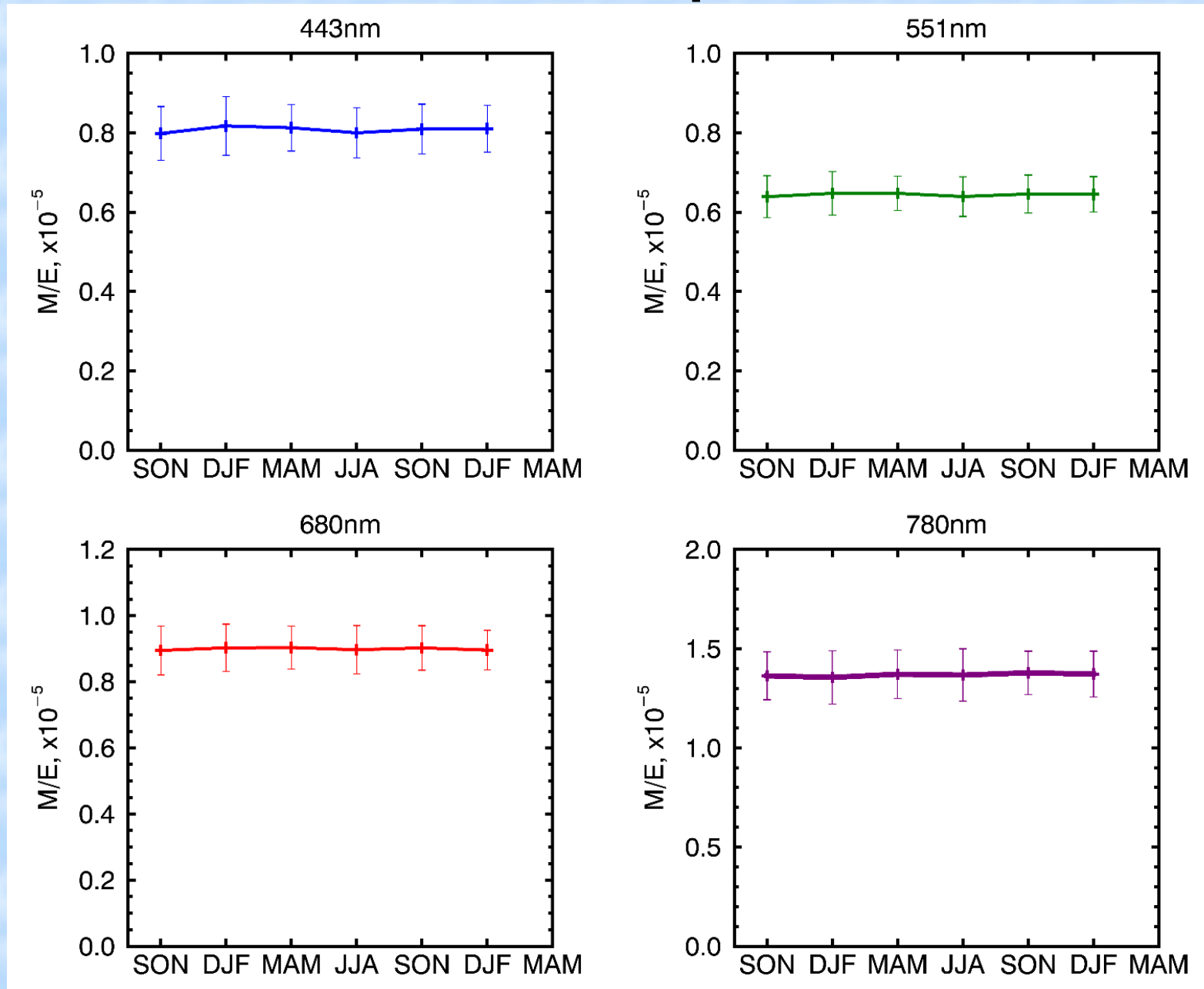
Seasonal dependence of the M/E ratios for relative stddev < 5%

MODIS - ROLO comparison

- agree to within approximately 10%
- ROLO coefficients being systematically lower.
- In absolute terms the 4 non-absorbing channels are in a better agreement than the two O2 absorbing channels (688nm and 764nm)
- Good agreement in relative spectral terms (about 3%)