

Evaluation Topics

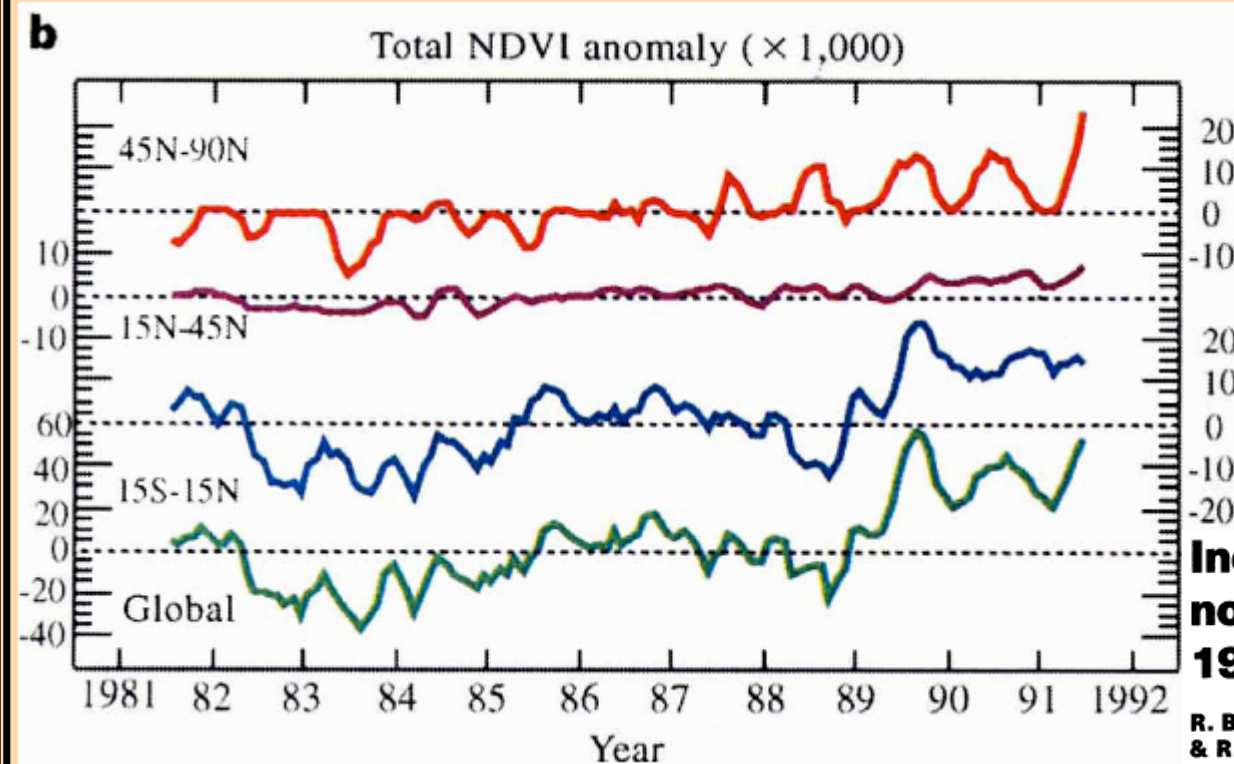
- The User perspective
 - Current applications implicitly assume some values for precision and accuracy
 - Impacts of errors on Level 2-4 variables and other modeled quantities
 - Errors cannot be determined in current data sets
 - What are the magnitudes of errors
 - What factors can lead to changes in error
- Error specification in LTDR – topics to be presented:
 - A framework for evaluation of data processing using AERONET data
 - Inter-comparison of widely-used data sets
 - Time-series
 - Phenology
 - African Monsoon Multidisciplinary Analyses (AMMA)

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Accuracy assumptions in selected studies

b, Monthly total anomalies of the above, expressed as departures from the 10-year record averages of monthly NDVI, summed over each latitudinal band¹⁴ for each month. The vertical scale of the global plot is twice that of individual latitudinal bands.



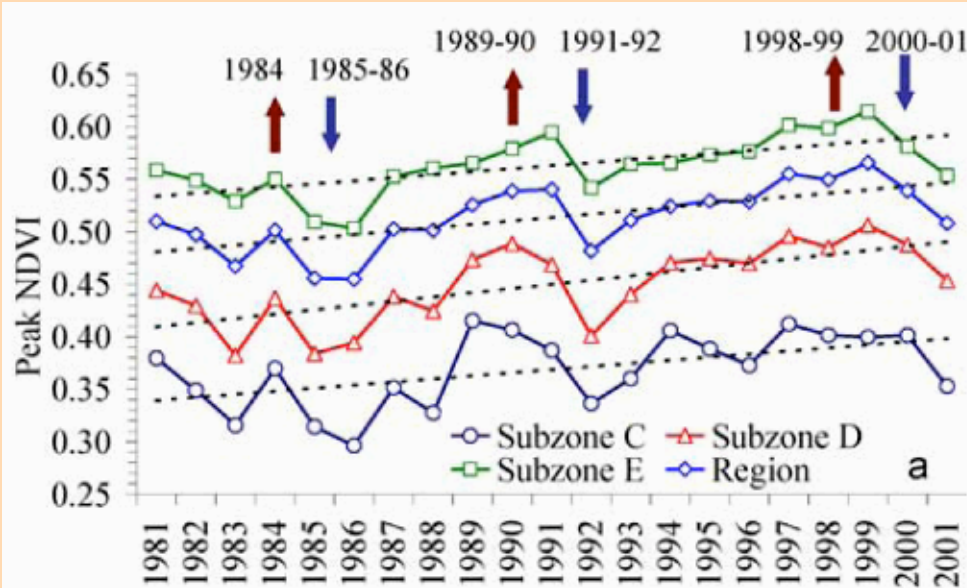
**Significant Δ NDVI
=0.03**

Increased plant growth in the northern high latitudes from 1981 to 1991

R. B. Myneni[†], C. D. Keeling[†], C. J. Tucker[‡], G. Asrar[§] & R. R. Nemani^{||}

Nature, 1997, 386, 698-702

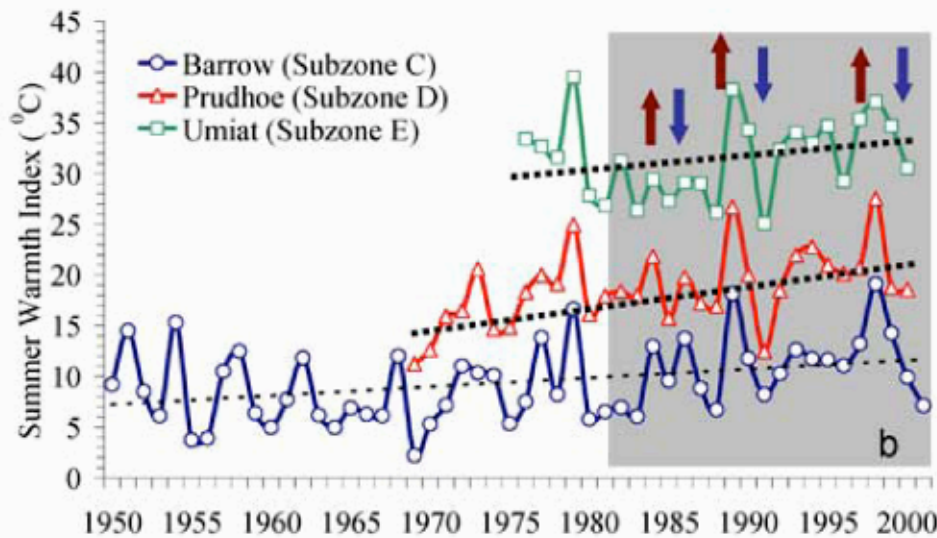
Accuracy assumptions in selected studies



Significant Δ NDVI
 $0.056 \pm 0.0032 - 0.082 \pm 0.028$

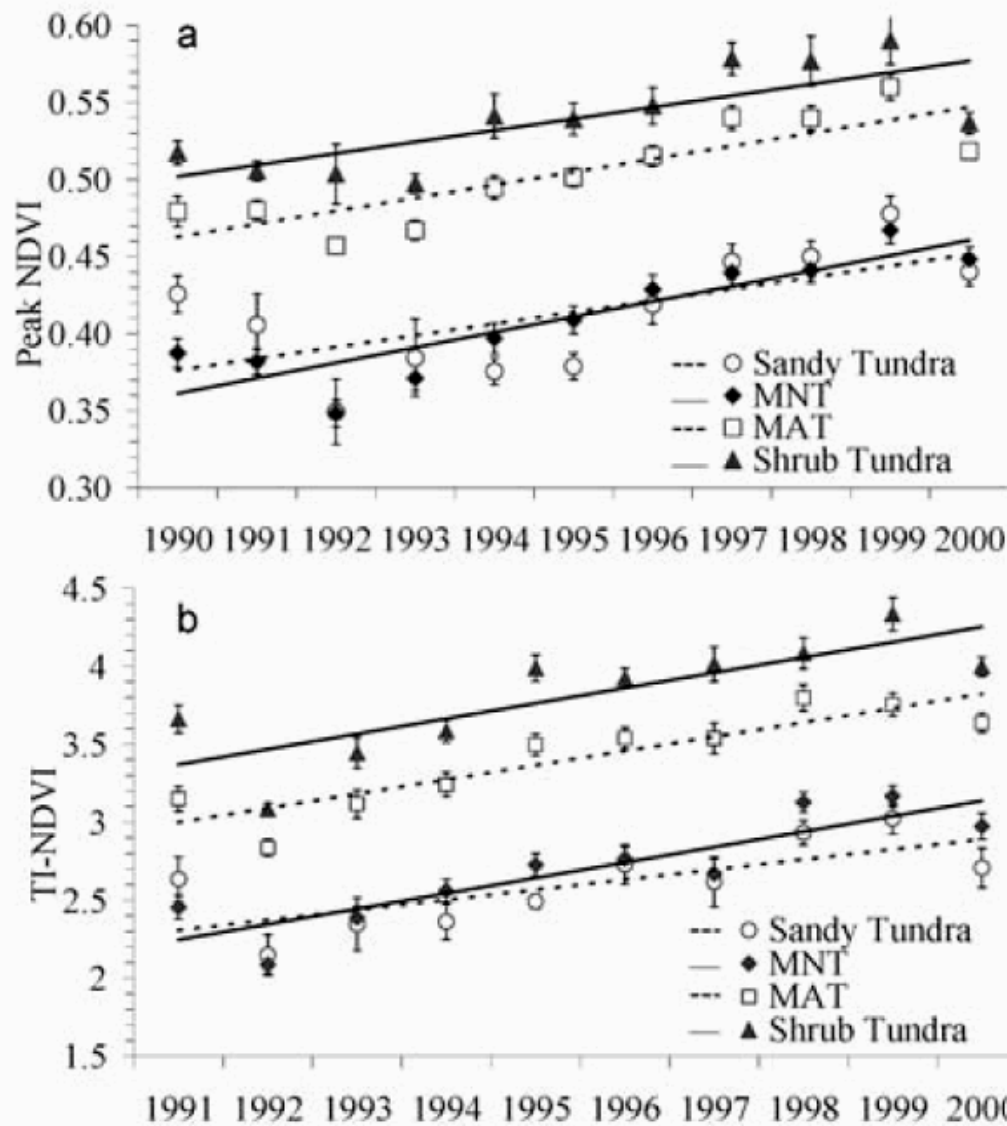
Time series of peak NDVI derived from 8-km resolution AVHRR data from 1981 to 2001 (a) and SWI over the past 22–50 years (b) among bioclimate subzones.

Dashed lines are linear regressions. The shaded area highlights the period of SWI covered by NDVI data



From: Gensuo J. Jia¹, Howard E. Epstein and Donald A. Walker Greening of arctic Alaska, 1981–2001. GEOPHYSICAL RESEARCH LETTERS, VOL. 30, NO. 20, 2067, doi:10.1029/2003GL018268, 2003

Accuracy assumptions in selected studies



Time series of peak NDVI (a) and time integrated (TI)-NDVI (b) based on 1-km resolution AVHRR data among tundra vegetation types. Error bars represent plus/minus standard error.

Significant Δ NDVI = 0.061

From: Gensuo J. Jia¹, Howard E. Epstein and Donald A. Walker Greening of arctic Alaska, 1981–2001. GEOPHYSICAL RESEARCH LETTERS, VOL. 30, NO. 20, 2067, doi:10.1029/2003GL018268, 2003

Accuracy assumptions in selected studies

Significant Δ NDVI = 0.0012

Table 1 Change in NDVI per year from linear fits to base-case scenario data displayed in Fig. 2 (GIMMS data set, May–September annual averages, minimum NDVI threshold of 0.05). Percentage changes computed over entire relevant period (1982–91 or 1992–99). *Indicates significance at the 95% level. Note that trends below 35°N are significantly contaminated by solar zenith angle and therefore do not reflect actual vegetative changes

Period	Latitudes N	Δ NDVI/year			% NDVI change (entire period)		
		Global	Eurasia	North America	Global	Eurasia	North America
1982–91	5–15	0.0044*	0.0041*	0.0055	12.6*	12.1*	14.3
	15–25	0.0021	0.0016	0.0035	6.1	4.8	8.9
	25–35	0.0013*	0.0011	0.0020*	4.9*	4.4	5.9*
	35–45	0.0018*	0.0020*	0.0012*	5.7*	7.8*	2.9*
	45–55	0.0034*	0.0034*	0.0034*	8.7*	9.0*	8.0*
	55–65	0.0037*	0.0037*	0.0036*	9.4*	9.0*	10.5*
	65–75	0.0022*	0.0025*	0.0016*	7.4*	7.8*	6.5*
	45–75	0.0033*	0.0033*	0.0031*	8.7*	8.8*	8.6*
1992–99	5–15	0.0078	0.0079	0.0075	17.8	18.9	14.9
	15–25	0.0026	0.0029	0.0015	5.7	7.1	2.9
	25–35	0.0009	0.0013	–0.0001	2.6	4.0	–0.2
	35–45	0.0020*	0.0017*	0.0025*	4.9*	5.1*	4.6*
	45–55	0.0028*	0.0020*	0.0047*	5.5*	3.9*	8.7*
	55–65	0.0047*	0.0048*	0.0045*	9.4*	9.0*	10.4*
	65–75	0.0037*	0.0033*	0.0044*	9.7*	7.9*	14.9*
	45–75	0.0037*	0.0033*	0.0045*	7.6*	6.5*	10.1*

Global Change Biology (2003) 9, 1–15

Northern hemisphere photosynthetic trends 1982–99

DANIEL A. SLAYBACK*, JORGE E. PINZON*, SIETSE O. LOSI and COMPTON J. TUCKER*

Accuracy assumptions in selected studies

8% (**0.028 PgCyr⁻¹**) increase in North American NPP in 17 years

Variation of NDVI 0.02 (implicitly assumed in many studies)
translates to **1-2 PgCyr⁻¹**

Significant Δ NDVI = 0.00056

Hicke, Asner, Randerson, Tucker, Los, Birdsey, Jenkins, Field, and Holland, 2002. Satellite-derived increases in net primary-productivity across North America, 1982-1998. Geophysical Research Letters 29, 69-1 - 69-4.

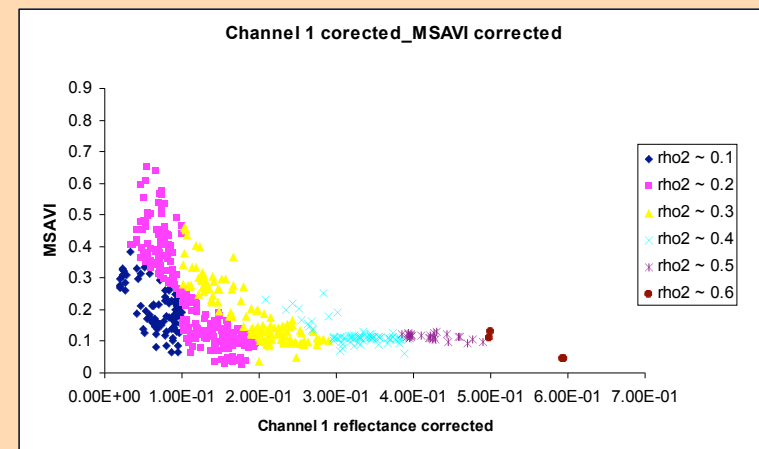
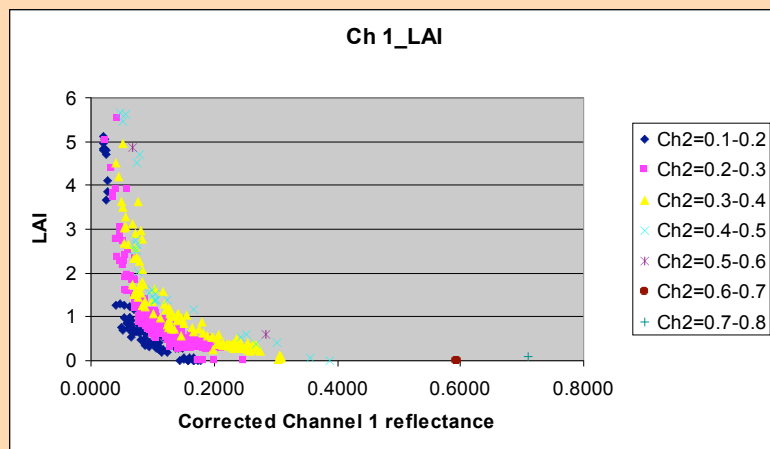
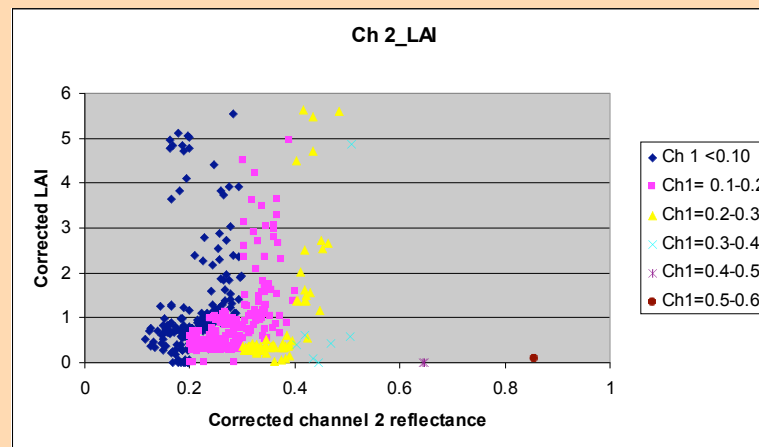
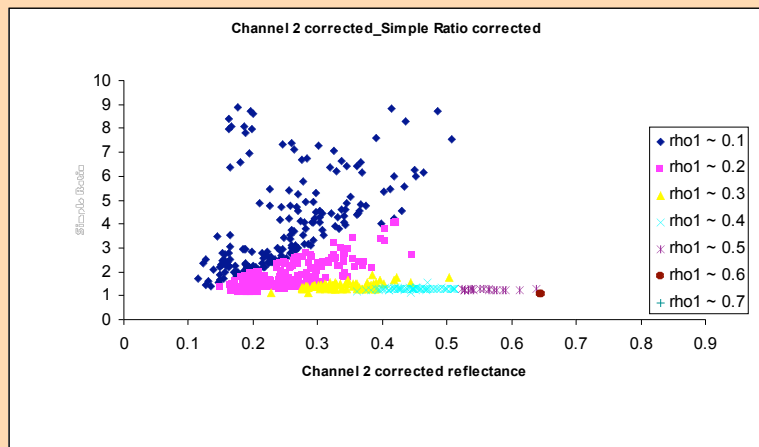
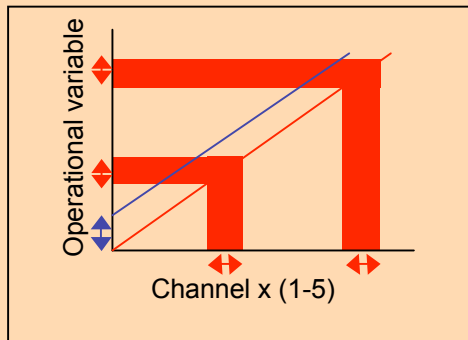
2. Impacts of errors on variables and modeled quantities

- Assess products in terms of impacts on operational applications
- Many applications use model outputs
 - Variables at levels (2) – 3, 4
 - Sometimes using multiple data from same satellite instrument
 - Often use other satellite and non-satellite data sets
- Errors increasingly unlikely to be additive or multiplicative as model complexity increases

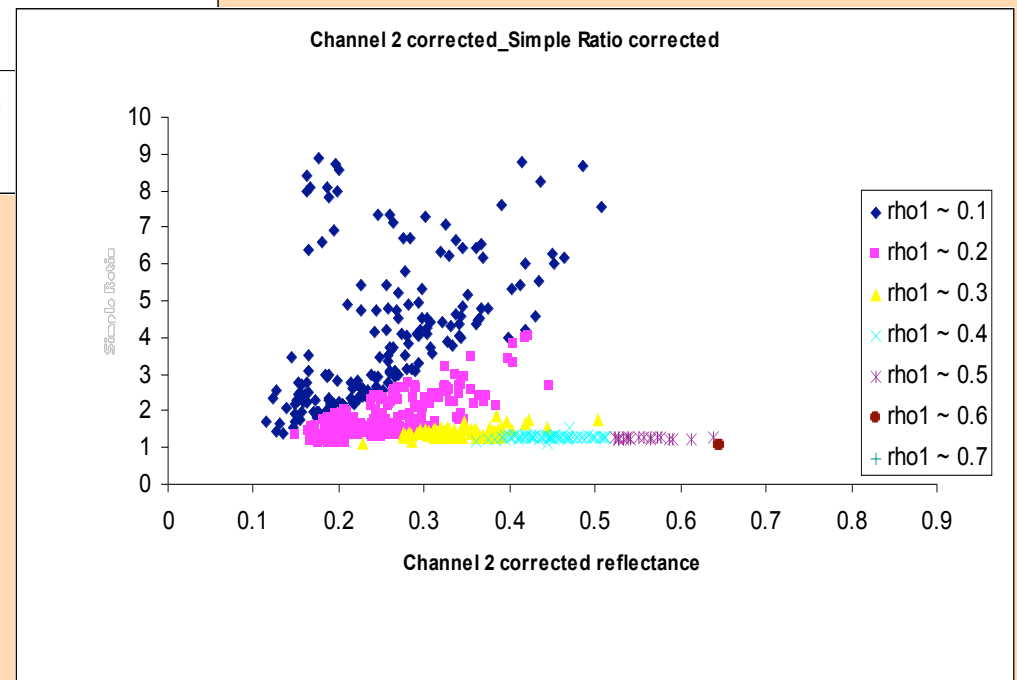
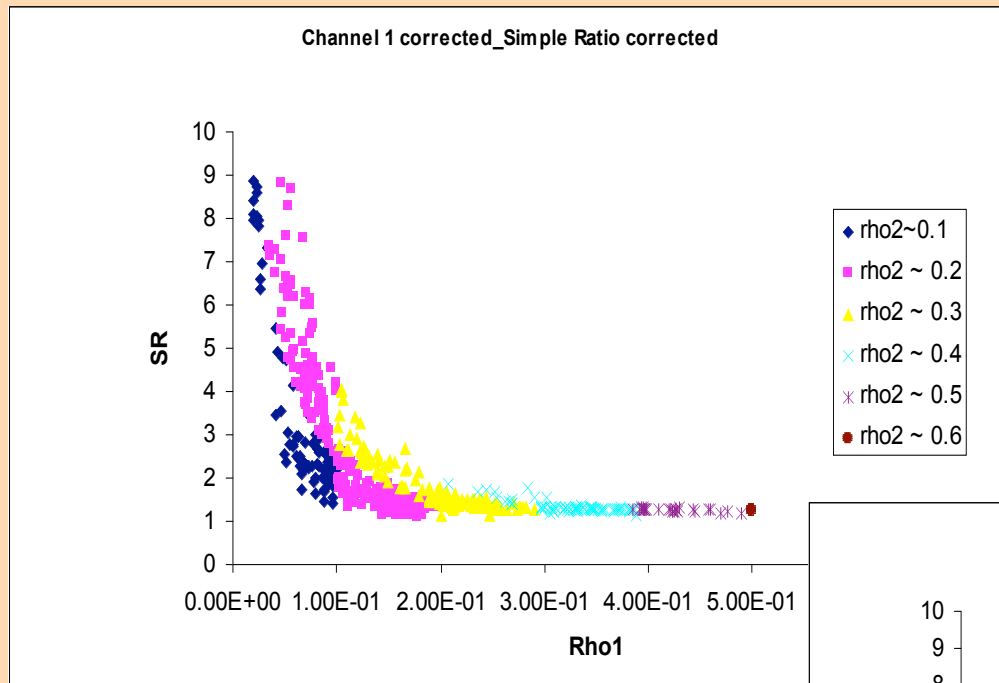
Analysis of impacts on AVHRR products at AERONET sites in 1999

- Effects of error in channels 1 & 2 on:
 - Vis, LAI, FPAR
- Analyses also required of effects on:
 - BRDF at selected AERONET and BigFoot sites
 - GPP and Respiration at BigFoot sites
 - Phenology and Burned Area
 - Surface temperature
 - Water vapor
- MODIS algorithms used for illustration

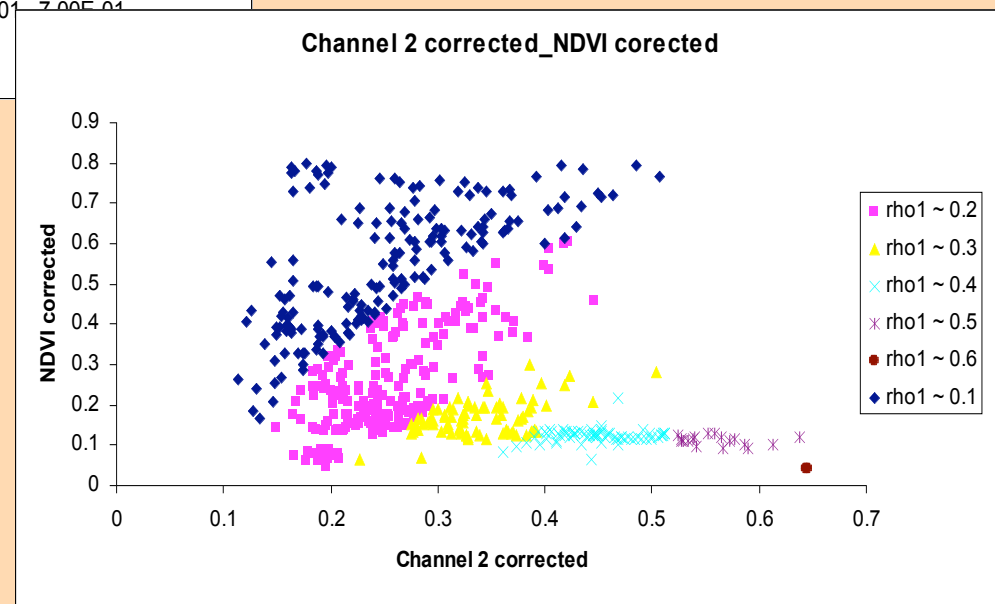
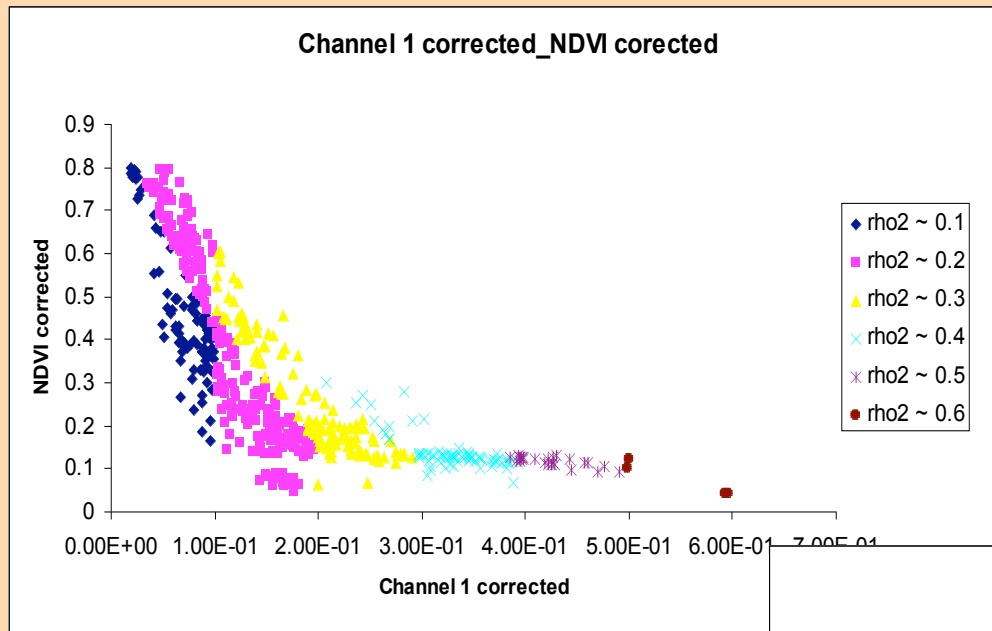
Error types



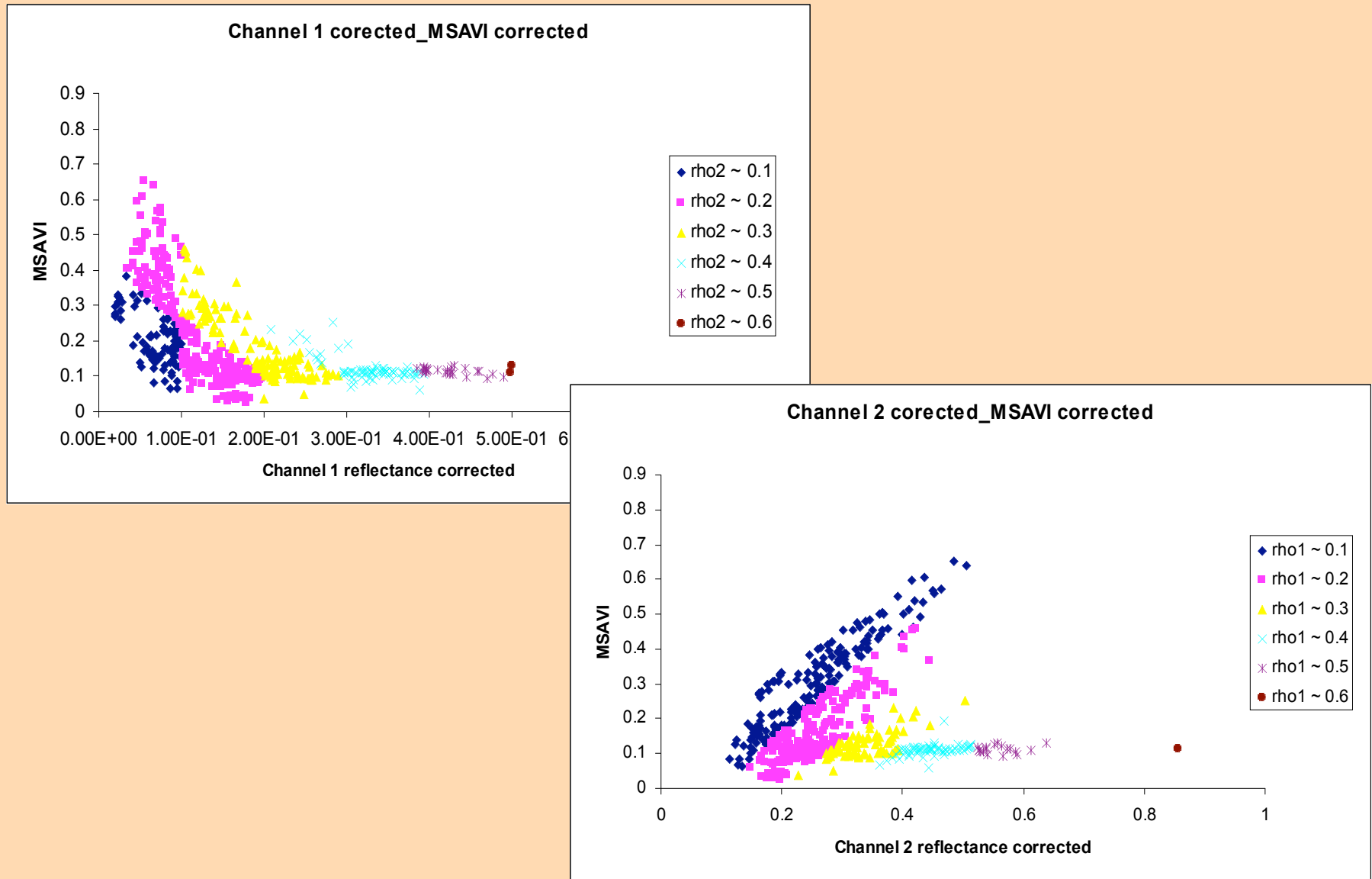
Simple Ratio– effects of error in channels 1 & 2



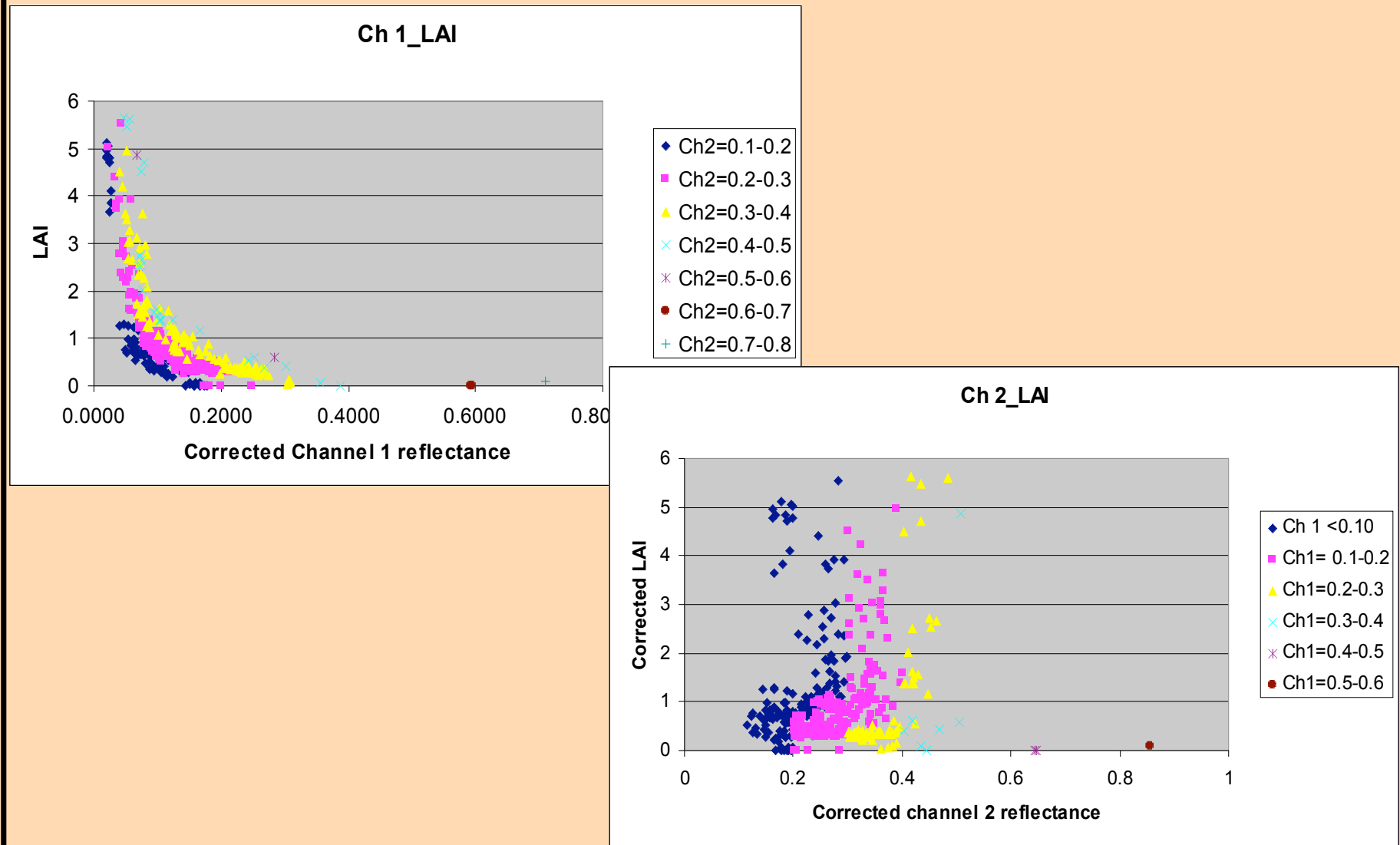
NDVI – effects of error in channels 1 & 2



MSAVI – effects of error in channels 1 & 2

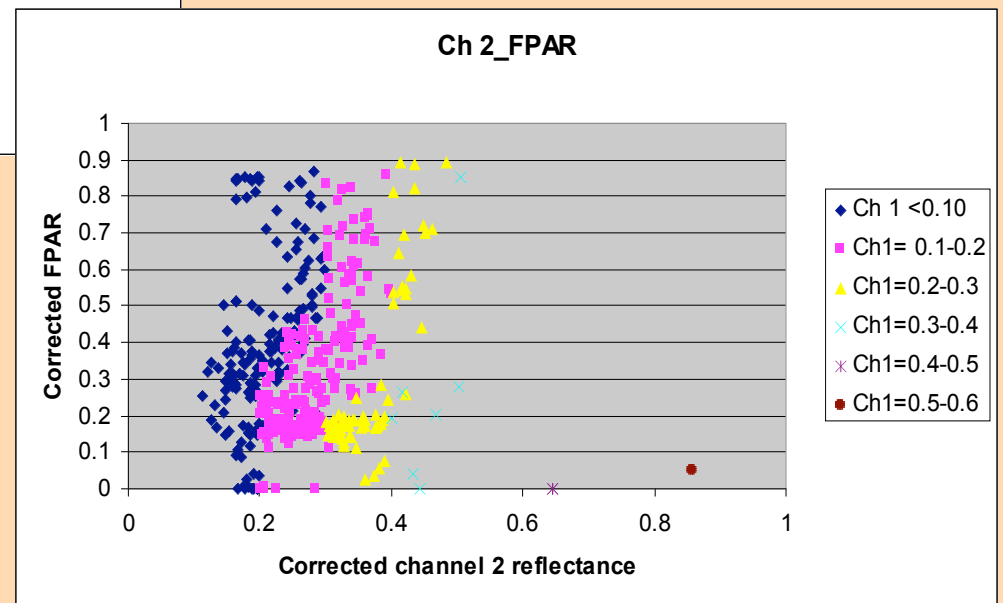
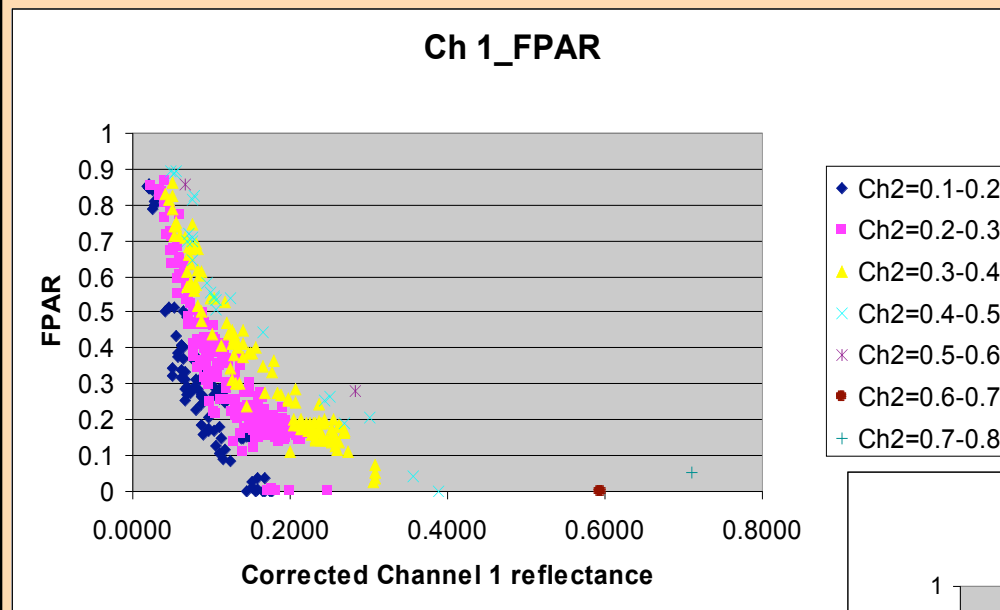


MODIS LAI algorithm applied to AVHRR – effects of error in channels 1 & 2



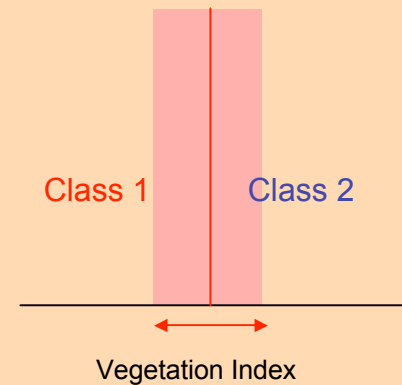
MODIS FPAR algorithm applied to AVHRR

– effects of error in channels 1 & 2

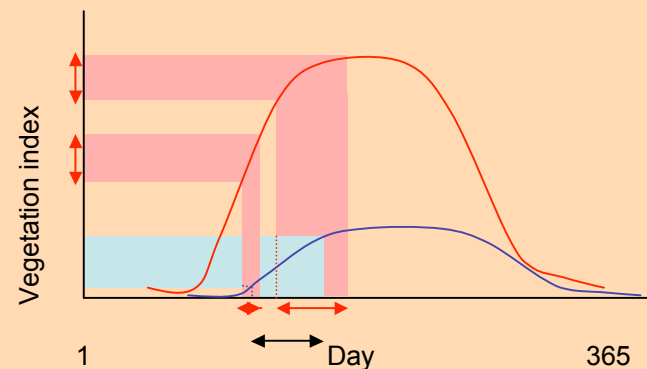


Effects of error on algorithms with thresholds

- Land cover classification (categorical and continuous), burned area etc. use decision trees – threshold values



- Algorithms for phenology subject to errors in the date at which a value, determined by the seasonal course of the VI, is reached (within and between sites)



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