

Modelagem quantitativa em seguro agrícola pelo desenvolvimento de um sistema operacional para geração do índice de diferença de temperatura normalizado (NDTI) a partir de dados de satélite

Projeto PROCAD

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DETECÇÃO DE SECA

- ✓ **Definição de seca (Wilhite, 1993)**

TIPOS DE SECA

- ✓ **Seca meteorológica**
- ✓ **Seca hidrológica**
- ✓ **Seca socioeconômica**
- ✓ **Seca agrícola**

DECLARAÇÃO DE CES

Declaração de CES: identificação das áreas que devem receber suporte financeiro

Critério: científico e independente baseado no potencial do SR em monitorar seca meteorológica e seca agrícola

SR: OBSERVAÇÃO INSTANTÂNEA DO BES

$$R_n = \downarrow R_s - \uparrow R_s + \downarrow R_L - \uparrow R_L$$

$$R_n = \downarrow R_s (1 - \alpha) + \varepsilon_a \sigma T_a^4 - \varepsilon_s \sigma T_s^4$$

Na superfície R_n é particionado em

$$R_n = \lambda E + H + G$$

Relação entre R_n , T_s , e ET_a

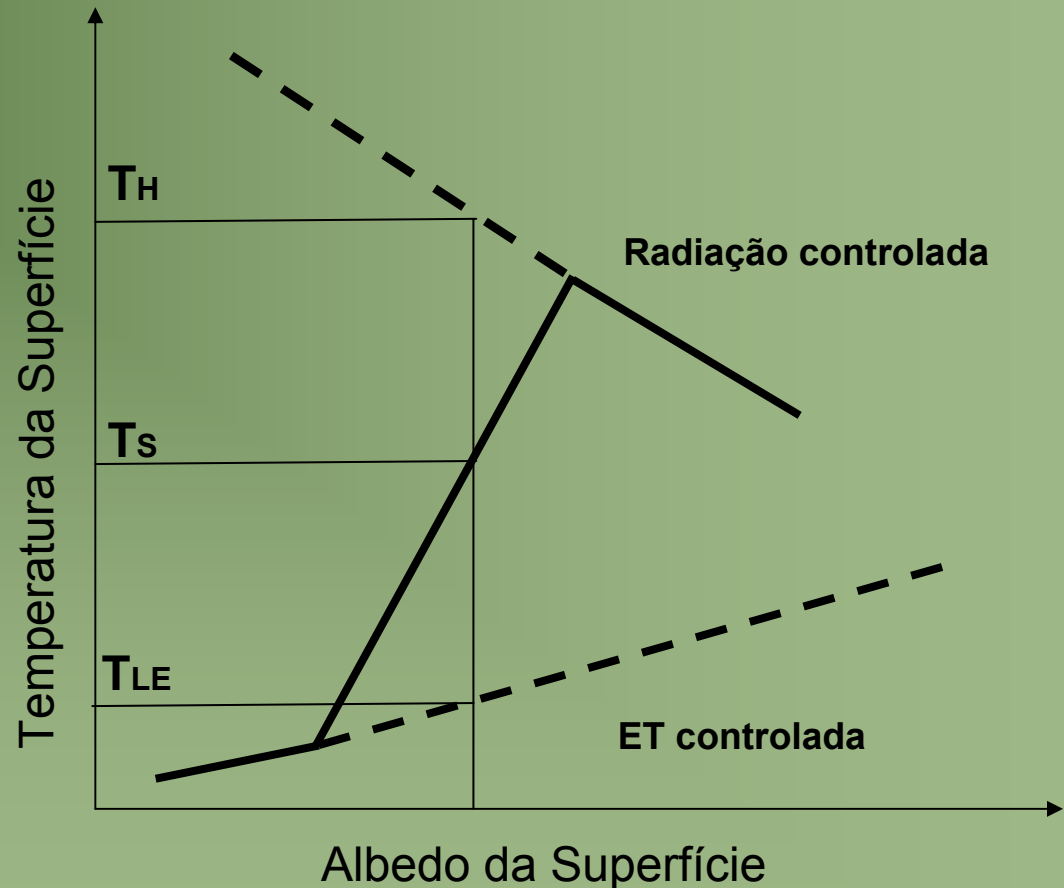
$$ET_a - R_n = A - B(T_s - T_a)$$

ÁGUA: EVAPOTRANSPIRAÇÃO

Método SR

Estimativa de Eta– Conceito de Fração Evaporativa e Rn

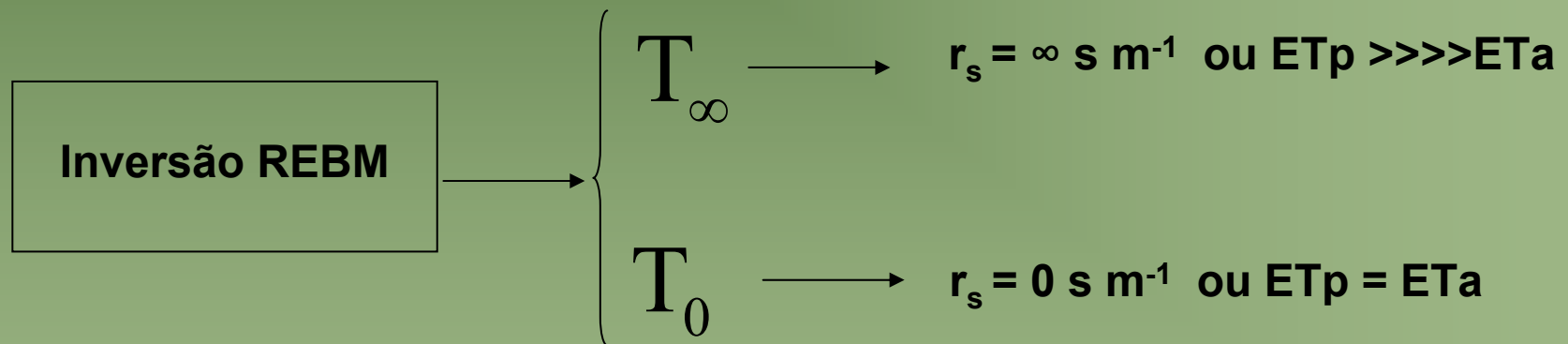
Albedo	$\alpha = 0.5 \rho_{\text{NIR}} + 0.5 \rho_{\text{RED}}$ AVHRR: ρ_{RED} and ρ_{NIR} are calculated using channel 1 (0.63 μm) and channel 2 (0.91 μm). DAIS: ρ_{RED} and ρ_{NIR} are calculated using channel 10 (0.66 μm) and channel 22 (0.87 μm).
Emissivity	AVHRR: Land surface emissivity estimated from NOAA–AVHRR data using the NDVI Thresholds method (Sobrino & Raissouni, 2000). DAIS: Land surface emissivity estimated from DAIS data using the NEM (Normalized Emissivity Method) developed by Gillespie (1985) (Sobrino et al., 2002).
Surface temperature	AVHRR: $T_S = T_4 + 1.40(T_4 - T_5) + 0.32(T_4 - T_5)^2 + 0.83 + (57 - 5W)(1 - \epsilon) - (161 - 30W)\Delta\epsilon$ T_4 and T_5 are the at-sensor or brightness temperature (In K) for NOAA–AVHRR thermal channels 4 (10.3–11.3 μm) and 5 (11.5–12.5 μm). DAIS: $T_S = T_{77} + 2.082(T_{77} - T_{78}) + 0.033(T_{77} - T_{78})^2 + 56.672(1 - \epsilon) - 109.429\Delta\epsilon - 0.06$ T_{77} and T_{78} are the at-sensor or brightness temperature (in K) for DAIS thermal channels 77 (11.266 μm) and 78 (11.997 μm).
Net radiation flux	$R_n = (1 - \alpha)R_{c\lambda\downarrow} + \epsilon R_{g\lambda\downarrow} - \epsilon\sigma T_S^4$ AVHRR: $R_{c\lambda\downarrow} = \tau_T S$, τ_T is the total transmissivity, S is the solar constant. $\epsilon R_{g\lambda\downarrow} \approx C\epsilon\sigma T_S^4$ (Hurtado & Sobrino, 2001) DAIS: $R_{c\lambda\downarrow}$ and $R_{g\lambda\downarrow}$, are the incoming shortwave and longwave radiation, respectively; obtained from meteorological data.
Soil heat flux	$G = R_n 0.5 \exp(-2.13 \text{MSAVI})$
Evaporative fraction	$A = \frac{T_H - T_S}{T_H - T_{LE}}$
Heat latent flux	$\text{LET} = A(R_n - G)$
Daily ET	$\text{ET}_d = \frac{AC_{di}}{L} R_n$



BASE FÍSICA DO NDTI

Monitoramento da disponibilidade de umidade (Du)

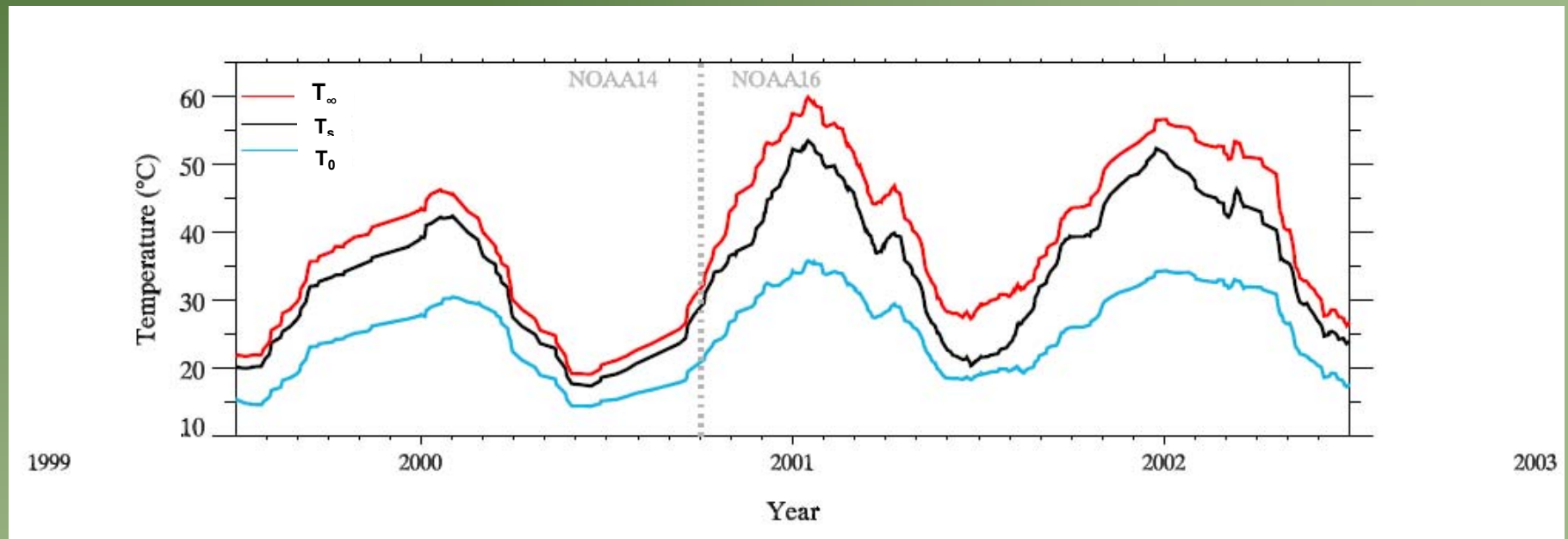
$$\text{NDTI} = \frac{T_{\infty} - T_s}{T_{\infty} - T_0}$$



T_s \longrightarrow Produto LST, método SW

INTERPRETAÇÃO FÍSICA DO NDTI

Temperaturas superior e inferior fisicamente (REBM) limitadas para uma dada condicao meteorologica e R_n



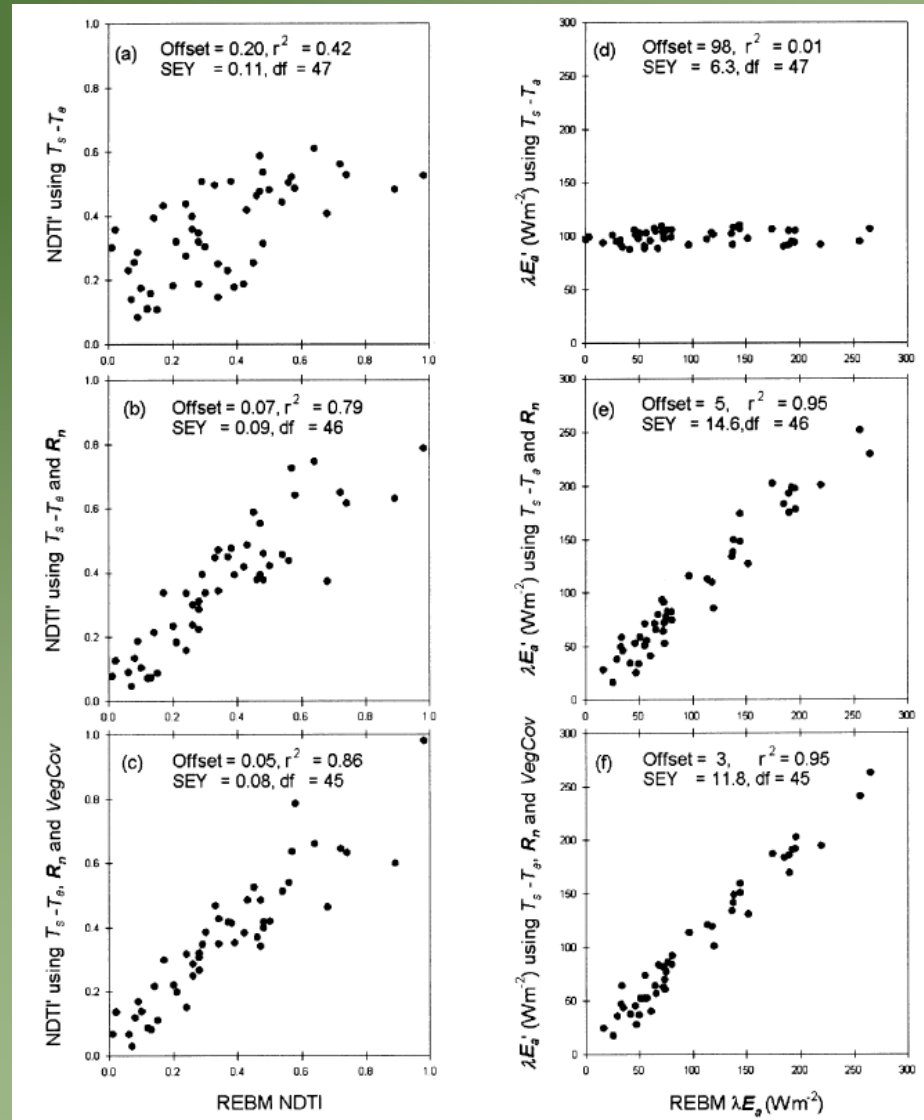
NDTI – SELEÇÃO DE COVARIÁVEIS ESPACIAIS

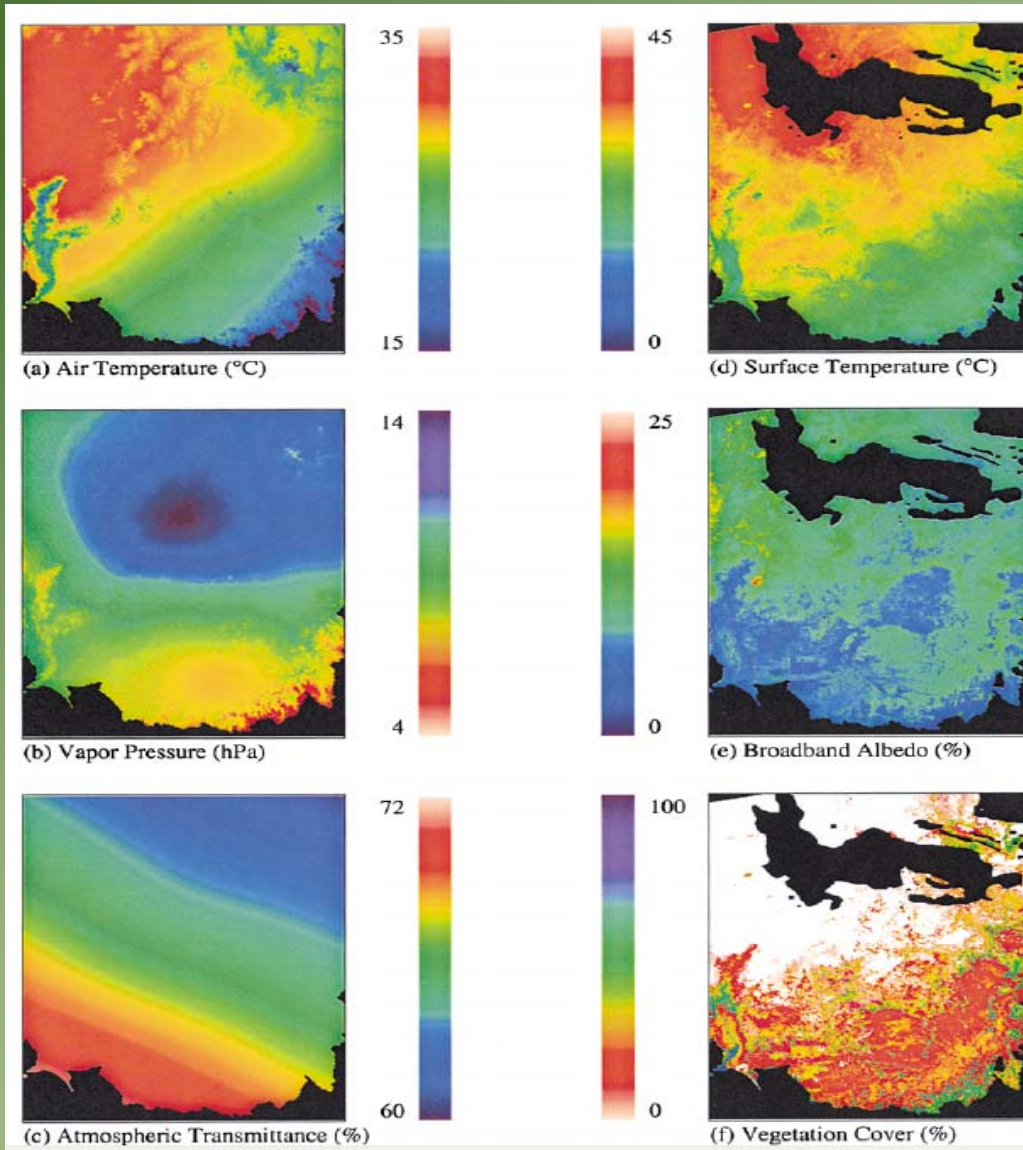
Murray–Darling Basin (1.1 million km²)

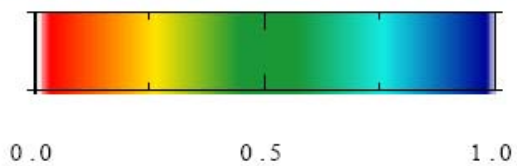
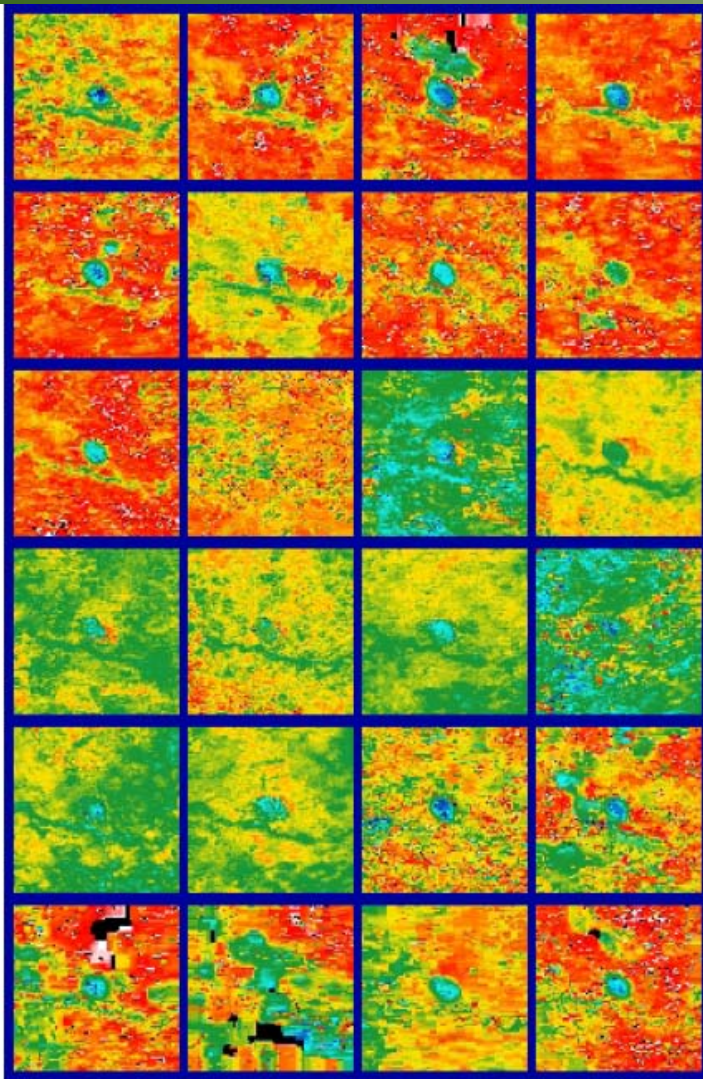
Regression results, coefficient of determination (r^2), standard error of the estimate of Y on X (SEY) and degrees of freedom (df), using REBM NDTI or REBM λE_a as the dependent variable and the potential covariate(s) as the independent variable(s)

Independent variable(s)	Dependent variable					
	REBM NDTI			REBM λE_a		
	r^2	SEY	df	r^2	SEY	df
$T_s - T_a$.42	0.17	47	.01	67.1	47
R_n	.00	0.23	47	.38	53.0	47
VegCov	.31	0.19	47	.21	59.7	47
$T_s - T_a$ and R_n	.79	0.11	46	.95	15.4	46
$T_s - T_a$ and VegCov	.60	0.14	46	.21	60.3	46
$T_s - T_a$, R_n and VegCov	.85	0.09	45	.97	12.5	45

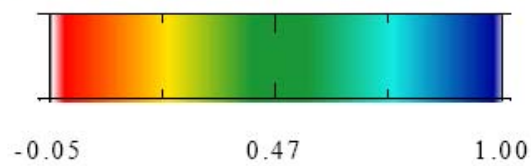
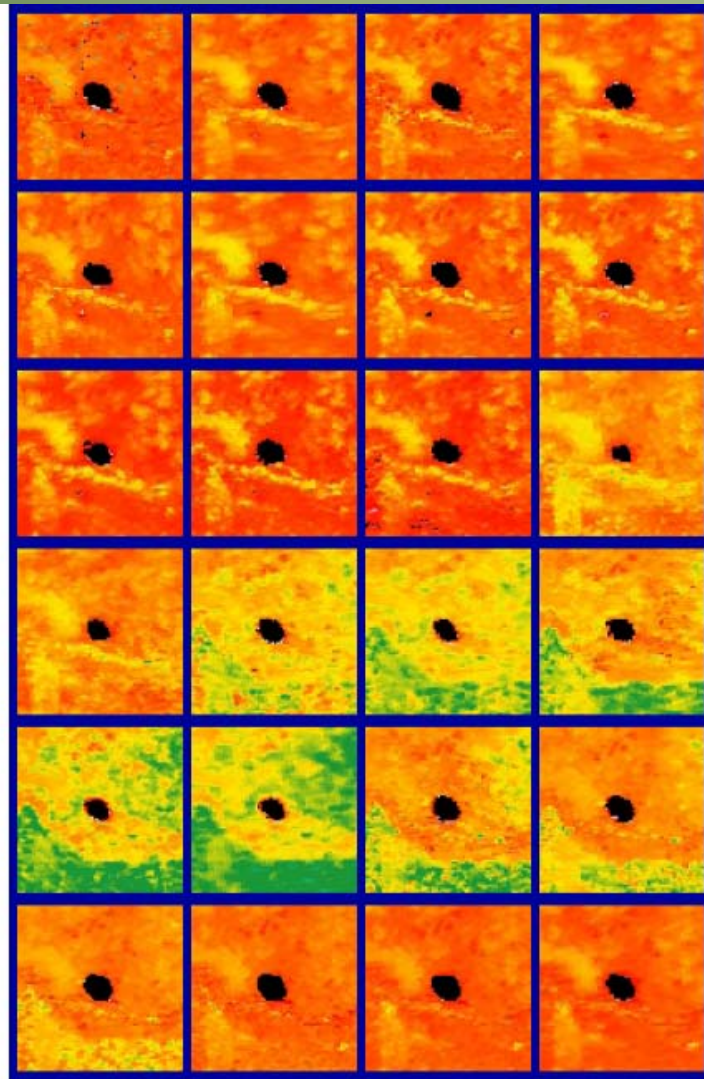
NDTI – SELEÇÃO DE COVARIÁVEIS ESPACIAIS







(a) NDTI \equiv moisture availability



(b) NDVI \equiv vegetation vigour

CONCLUSÕES

- ✓ Dualidade espaço-temporal
- ✓ Covariáveis AVHRR [R_n , VegFrac e α]
- ✓ Interpretação direta da disponibilidade de umidade
- ✓ Séries longas de dados (AVHRR)
- ✓ Não requer grades interpoladas de precipitação
- ✓ Potencial para ser utilizado na desagregação espacial
- ✓ Monitoramento em tempo real (NDTI x NDVI)

