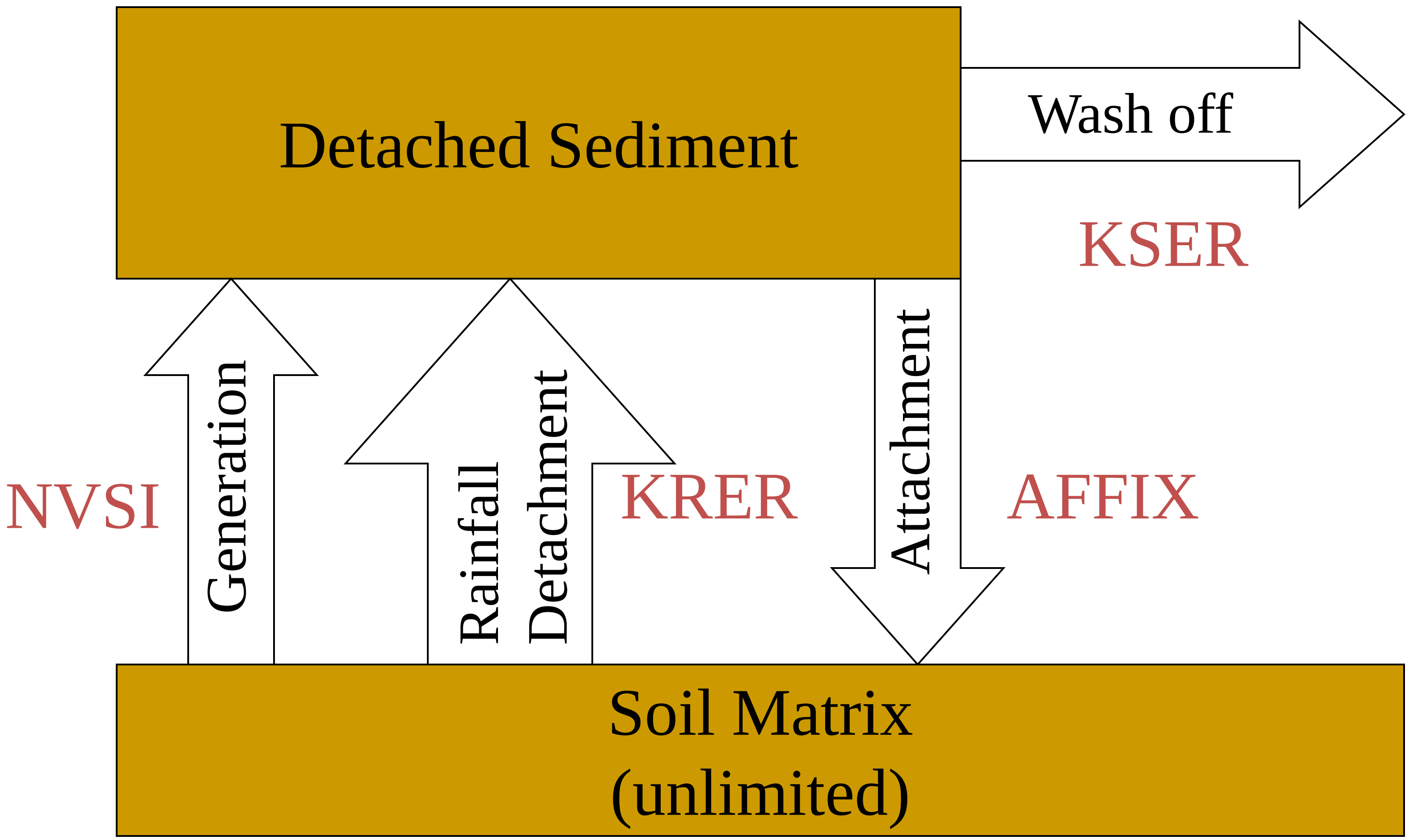
Refinements to the EOF Sediment Yield Calibration Method

Gopal Bhatt
[gopal.bhatt@psu.edu]

Land Sediment Simulation

Shenk, 2005



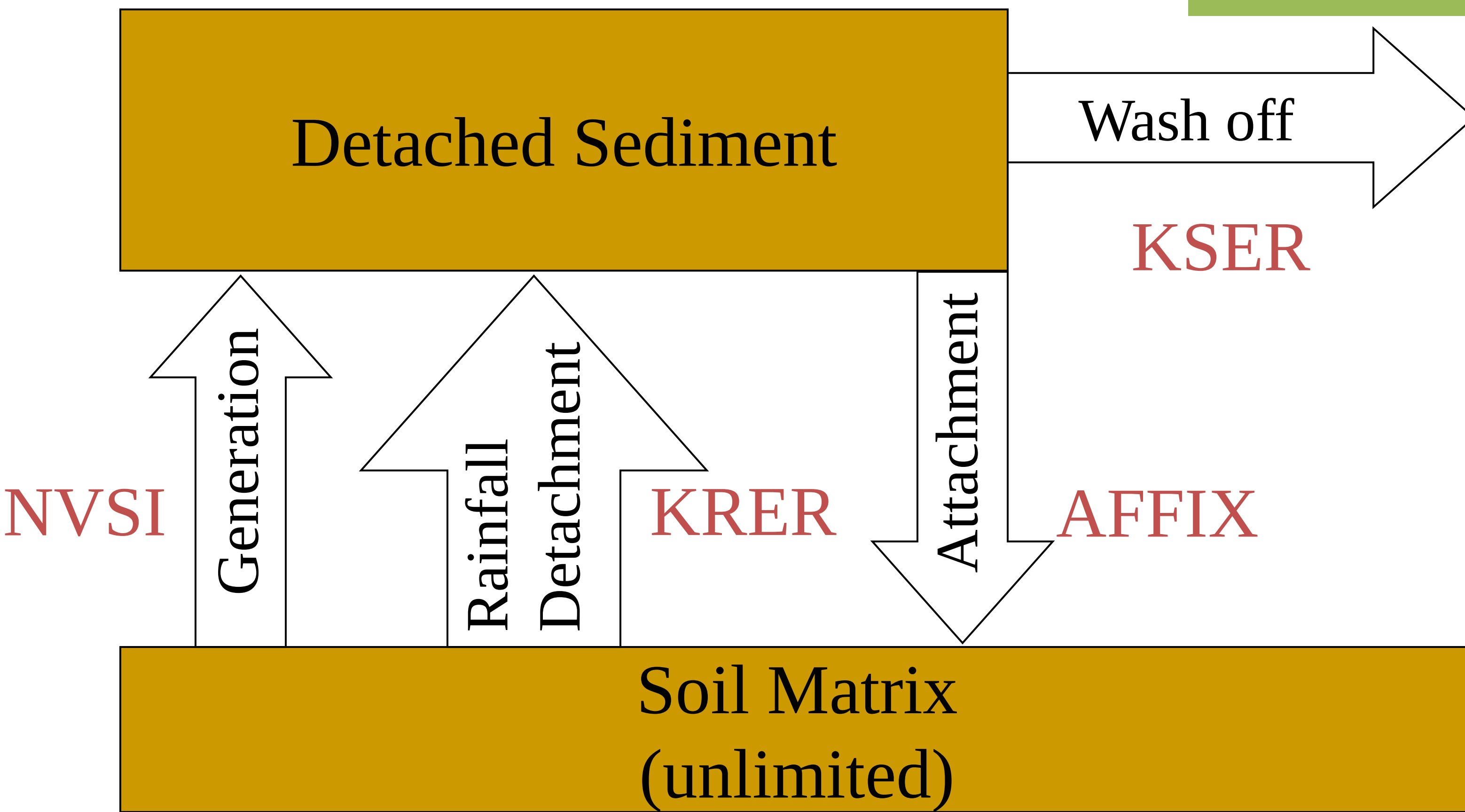
4 parameters, 1 target

Calibration Strategy: Reduce the Parameter Set

Shenk, 2005

1. Fix AFFIX
2. Assume ratio of NVSI : EOF target
3. Assume ratio of KSER : KRER
4. Adjust KSER to meet target

1 parameter, 1 target
Make several runs with different ratios (#2, 3)



Equations used in HSPF Land Sediment Module

Accumulation / Attachment:

DETS(t) = DETS(t-1) x (1.0 – AFFIX) + NVSI

Sediment Detachment:

Det. Coefficient → KRER; Det. Exponent → JRER

DET = DELT60 x (1-CR) x SMPF x KRER x (RAIN/DELT60) ^ JRER

Sediment Transport:

Trans. Coefficient → KSER; Trans. Exponent → JSER

STCAP = DELTA60 x KSER x ((SURS + SURO)/DELT60) ^ JSER

http://water.epa.gov/scitech/datait/models/basins/upload/Lecture-10-Sediment-Processes-NPS-I.pdf

Phase 5.3.2

KSER ∈ [1, 100]; KRER = KSER/10; JSER=JRER=2.0

KRER = f (KSER)

Stepwise Parameter Update Approach

Step 1: KSER ∈ [1, **10**]; KRER = KSER/10; JSER = JRER = 2.0
Step 2: KSER ∈ [1, 10]; KRER = KSER/10; **JRER = 1** & JSER = 2
Step 3: KSER ∈ [1, 10]; KRER = KSER/10; JRER = 1 & **JSER = 1**
Step 4: KSER ∈ [1, **60**]; KRER = KSER/10; JSER = JRER = 1.0

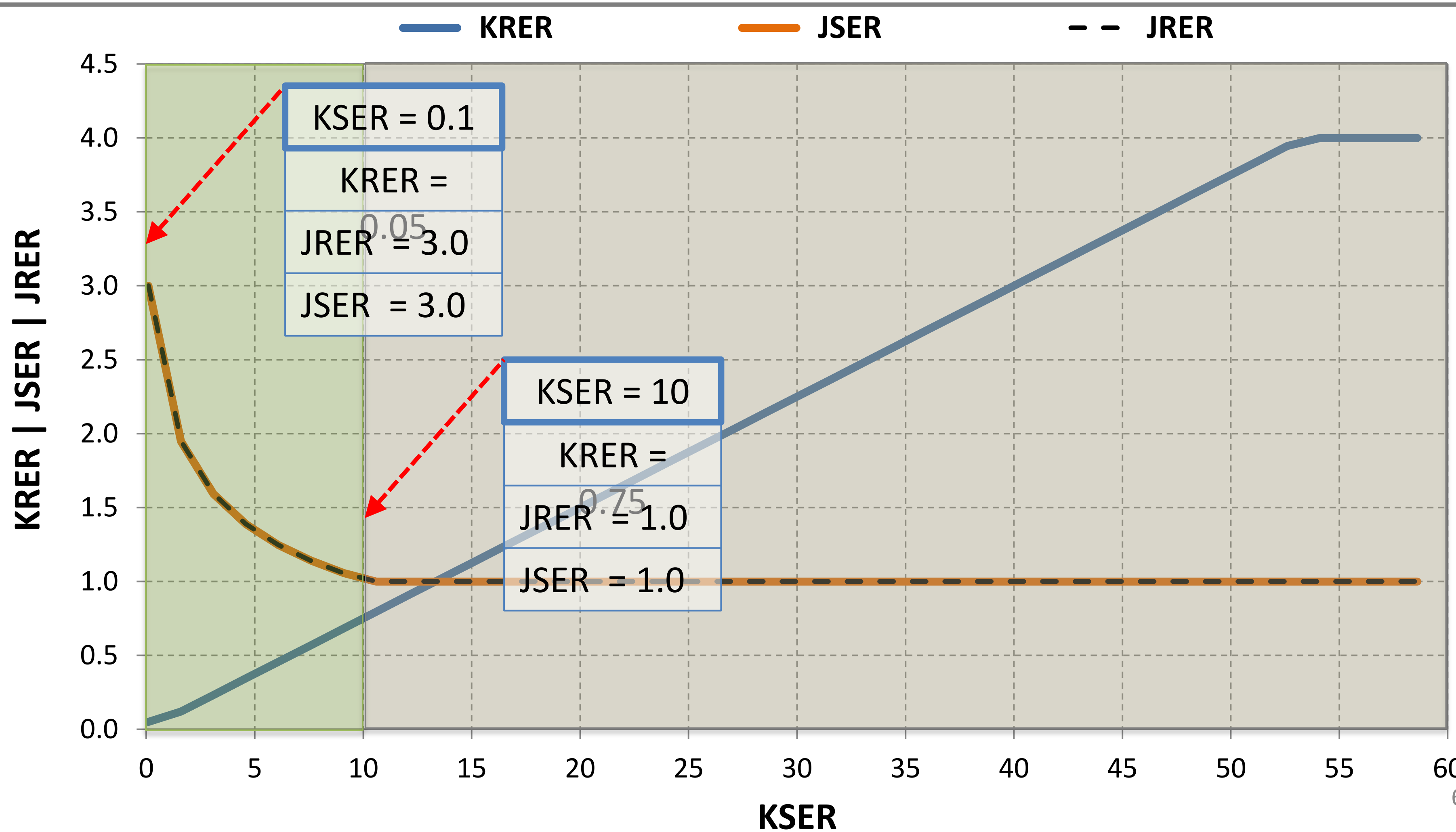
Continuous Parameter Update Approach

KSER ∈ [1, 60]; KRER = f (KSER); JRER = f (KSER); JSER = f (KSER)

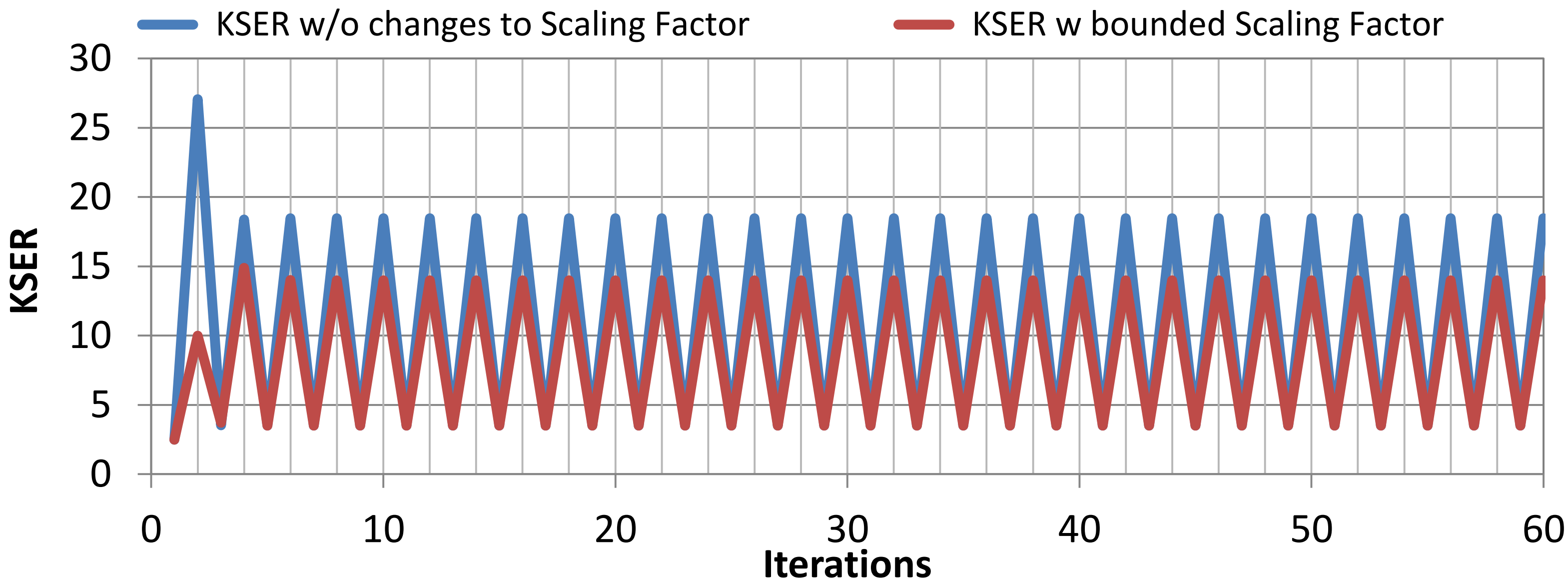
Functional relationship between Sediment Erosion, Sediment Transport parameters?

One possible relationship →

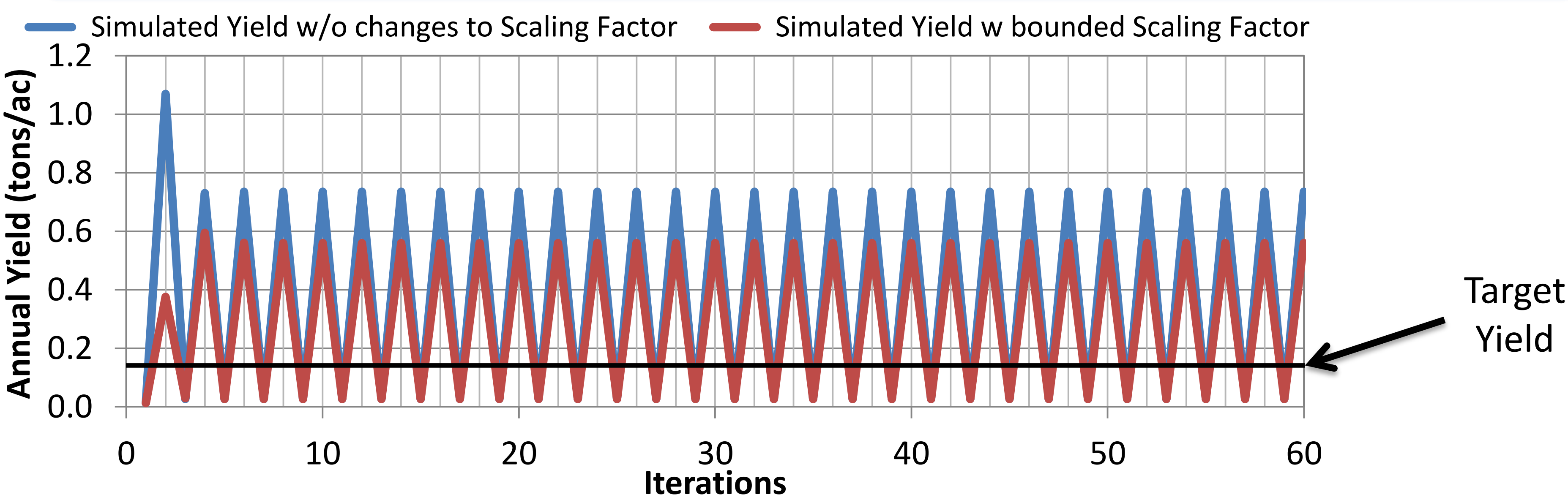
KRER = 0.075 x KSER	KRER ∈ [0.05, 4]
JRER = 6*EXP(-SQRT(SQRT(KSER)))	JRER ∈ [1, 3]
JSER = 6*EXP(-SQRT(SQRT(KSER)))	JSER ∈ [1, 3]



(1) Parameter is updated using a scaling factor: **facKSER(ns) = targets(ns)/simEOF(ns)**



Continuous Parameter Update Approach Results in a Stiff System!!



(2) Additional Constraints were used to overcome the stiffness:

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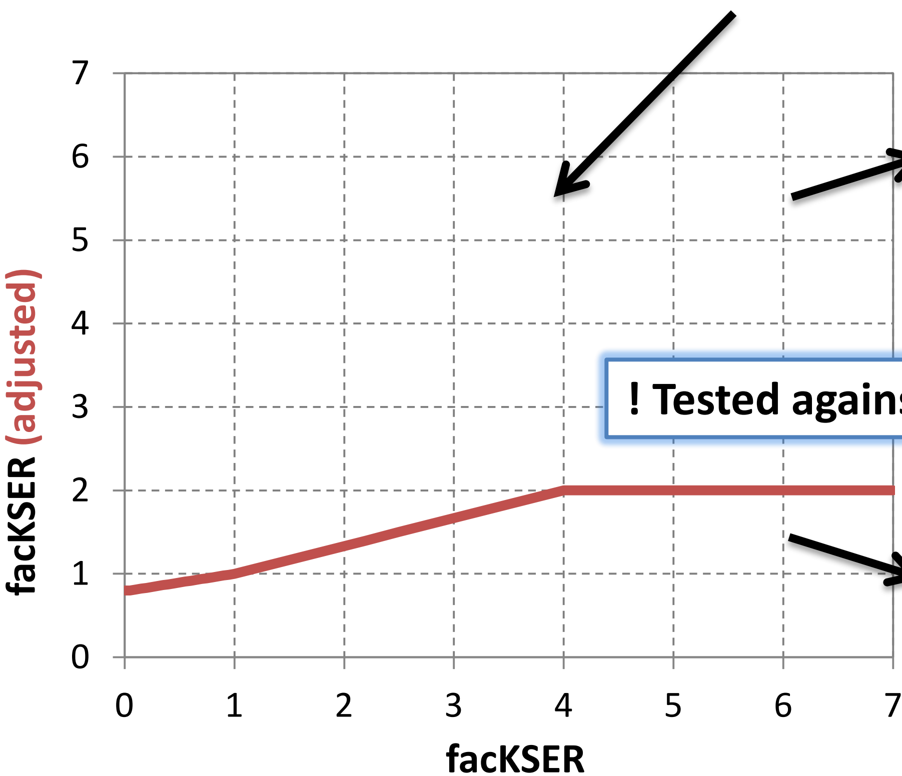
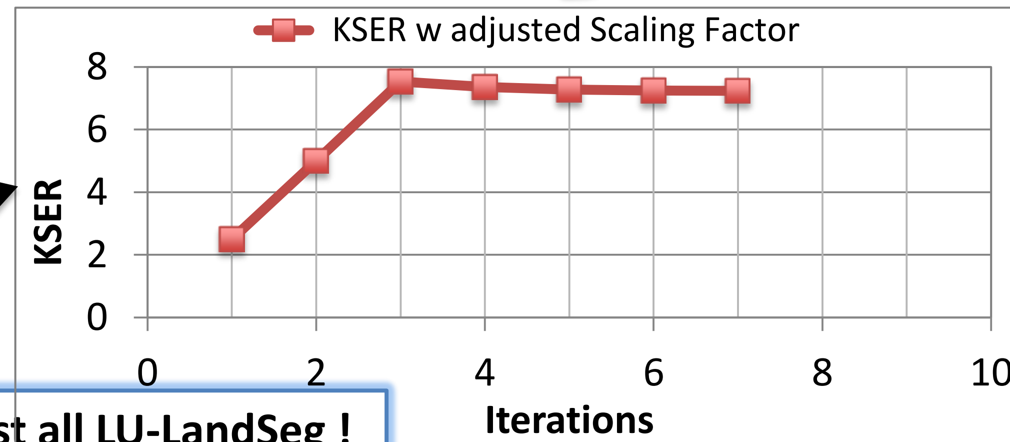
facKSER(ns) = max(min(facKSER(ns),4),0.05)

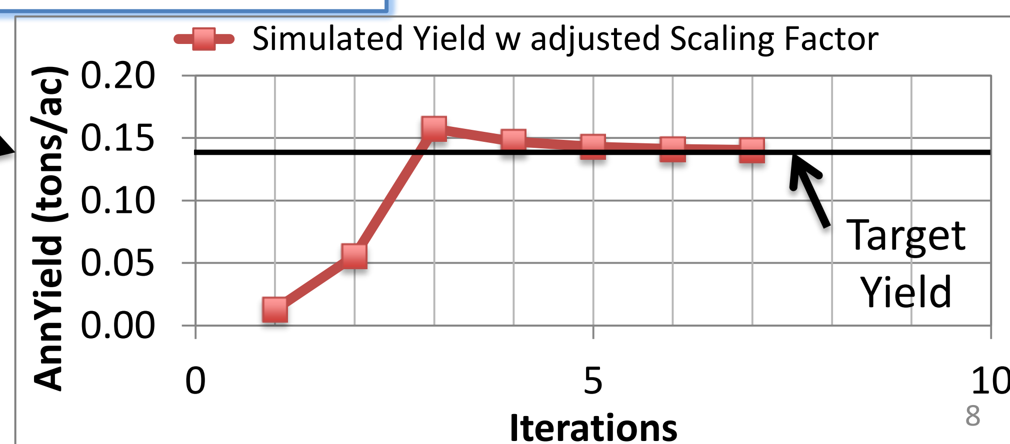
if (facKSER(ns) .gt. 1) facKSER(ns)=1+1.0*(facKSER(ns)-1)/3

if (facKSER(ns) .lt. 1) facKSER(ns)=1-0.2*(1-facKSER(ns))/0.95
```

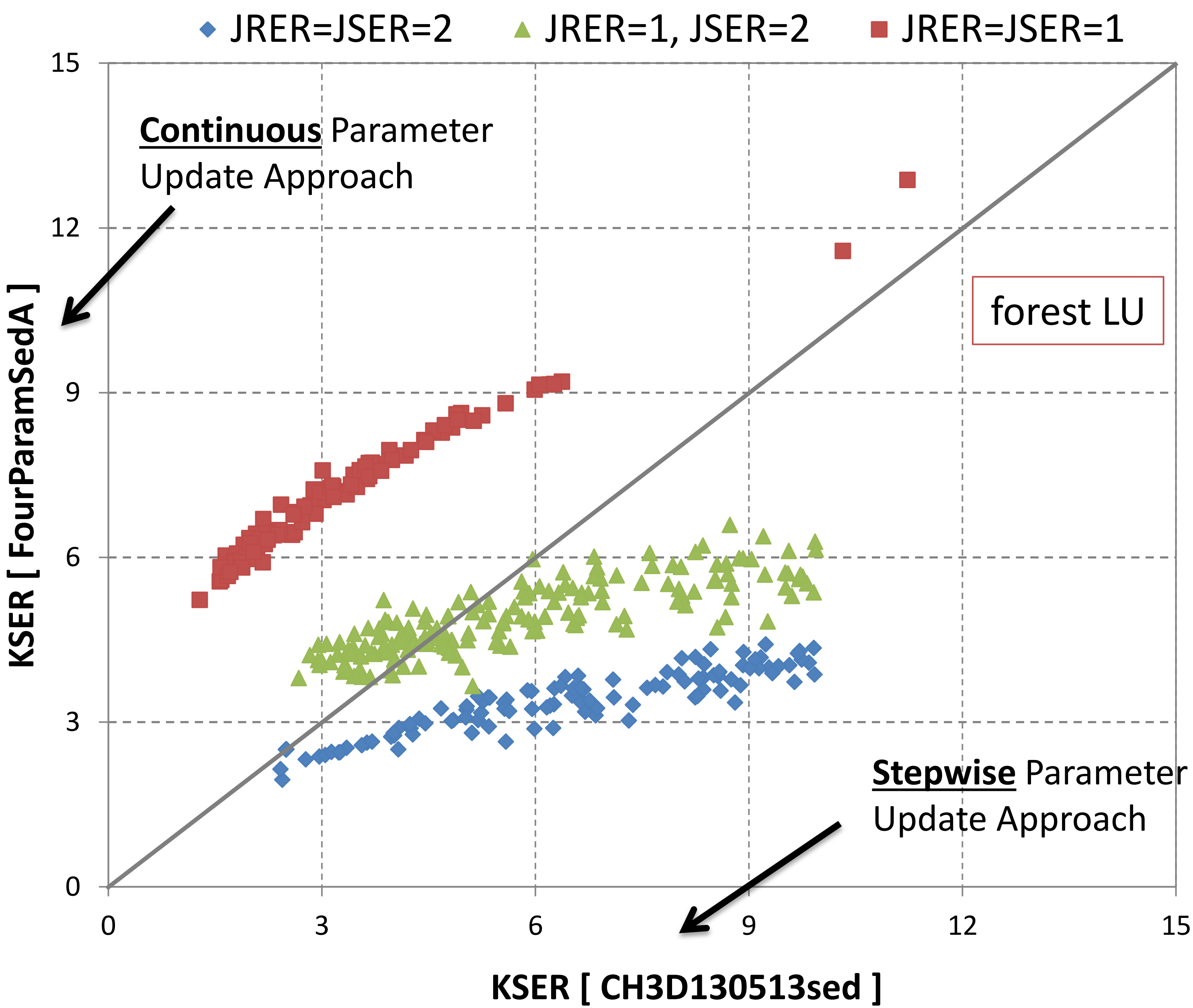




! Tested against all LU-LandSeg !

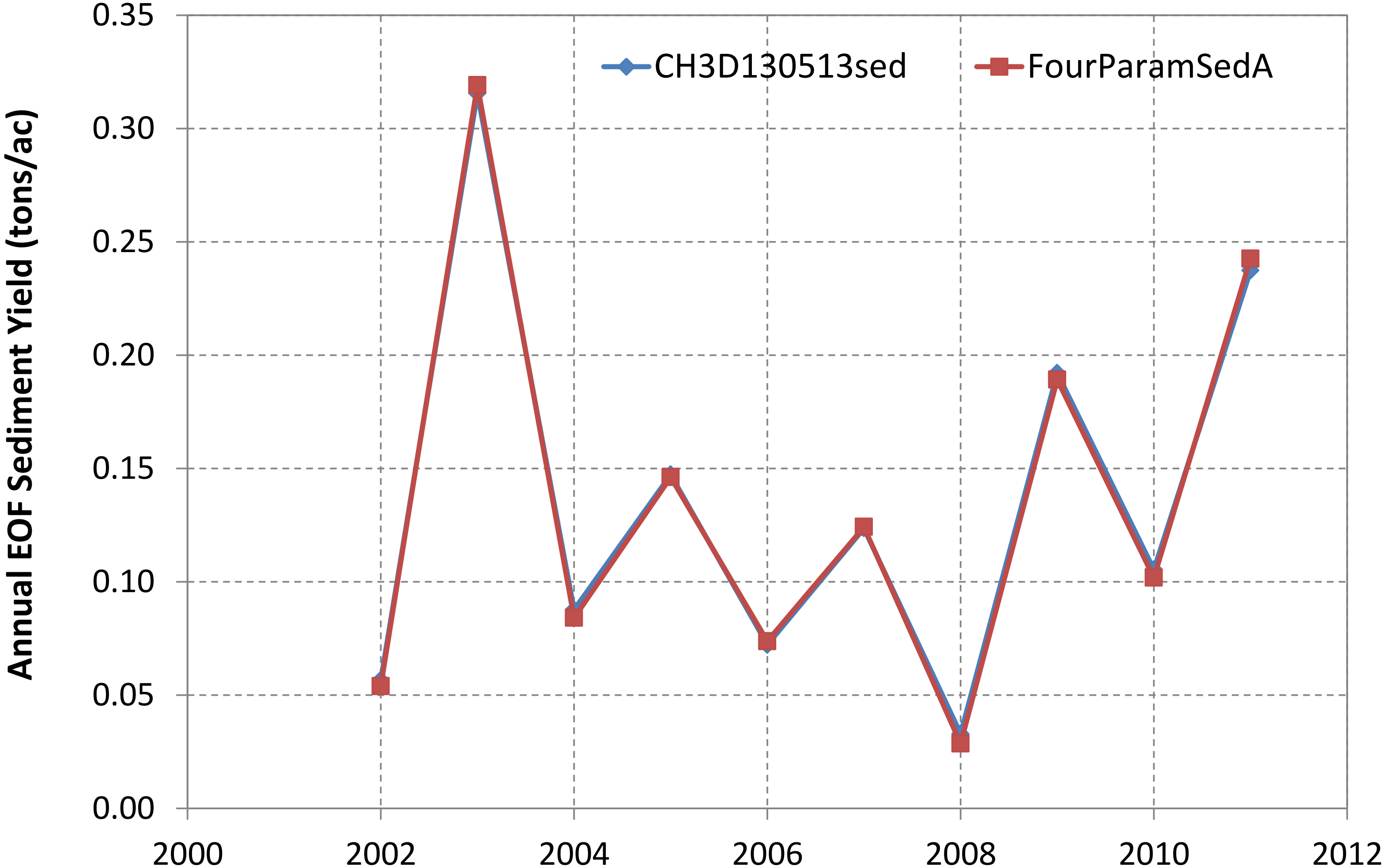


Optimized KSER Parameters (Stepwise vs. Continuous)



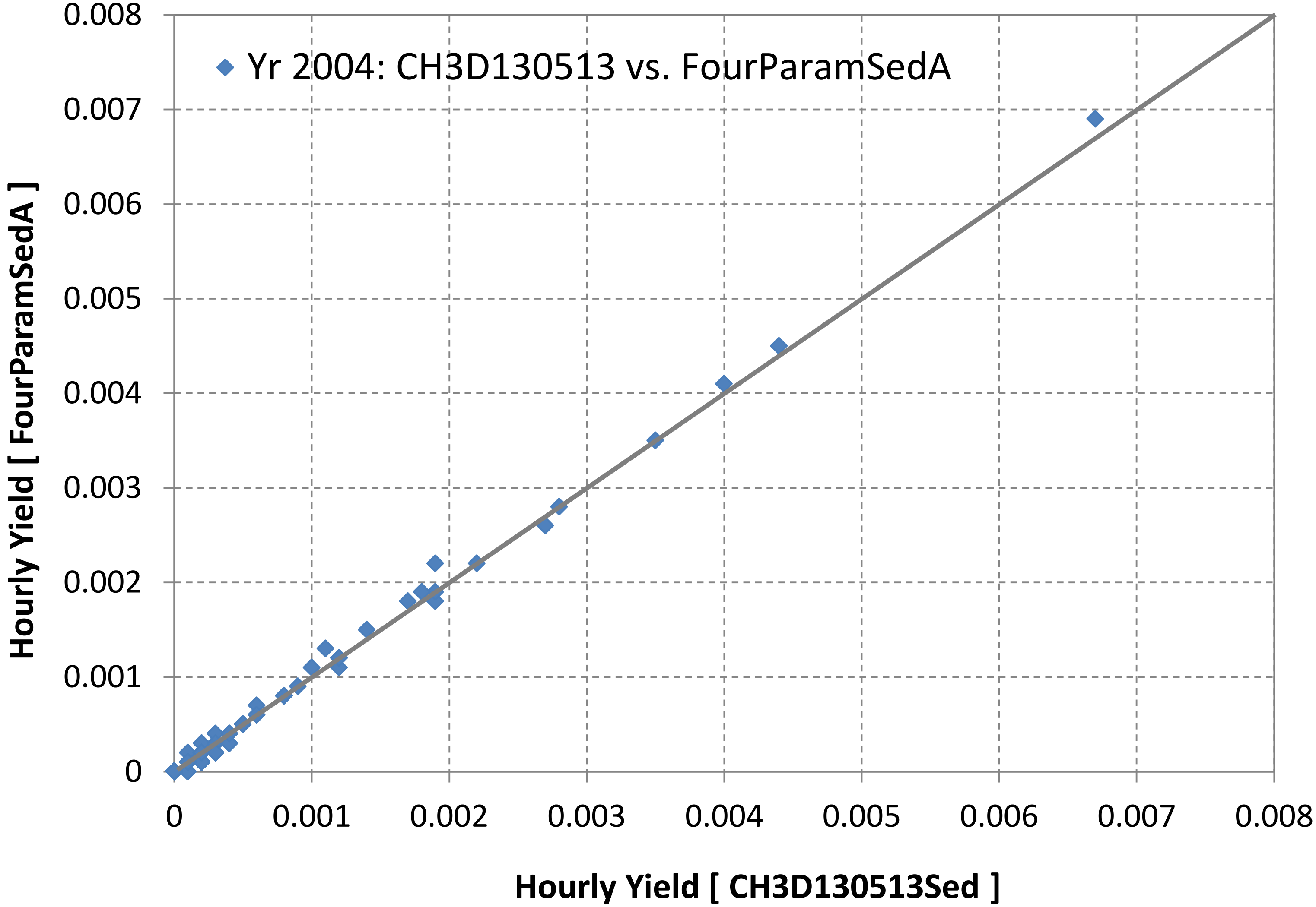
Comparison of **Annual** EOF Loads

LU=**for**; LandSeg=**A10001**;
CH3D130513sed: KSER=2.880 and JSER=JRER=1.0
FourParamSedA: KSER=7.233 and JSER=JRER=1.164

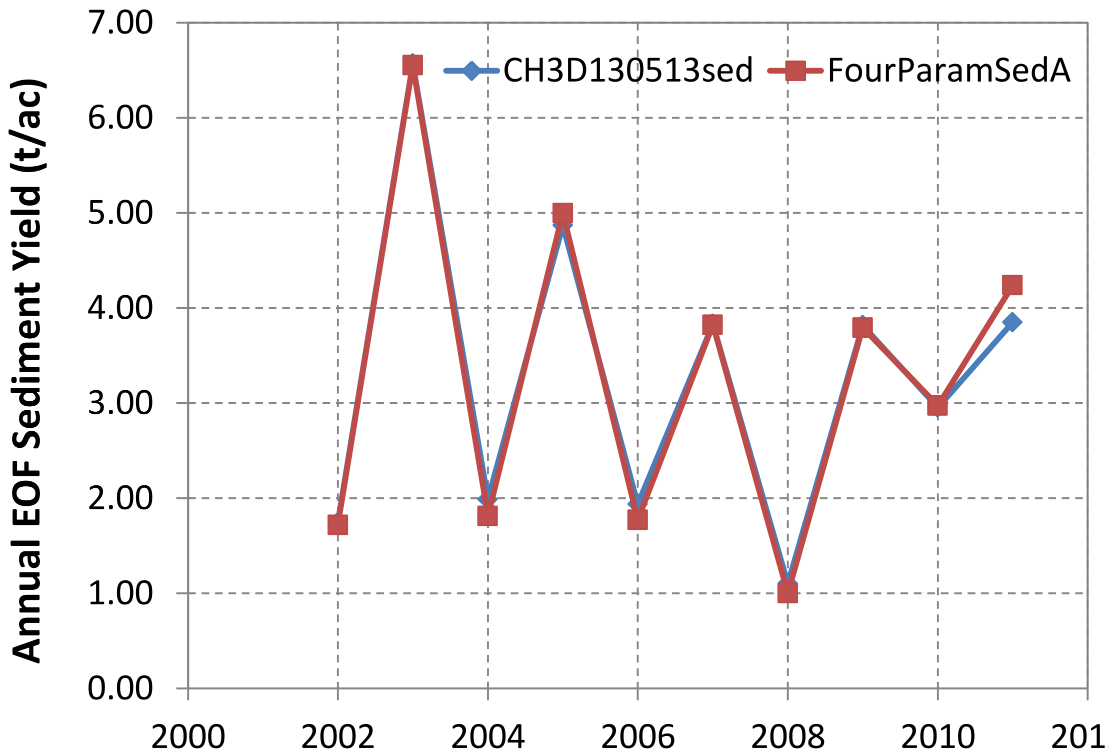


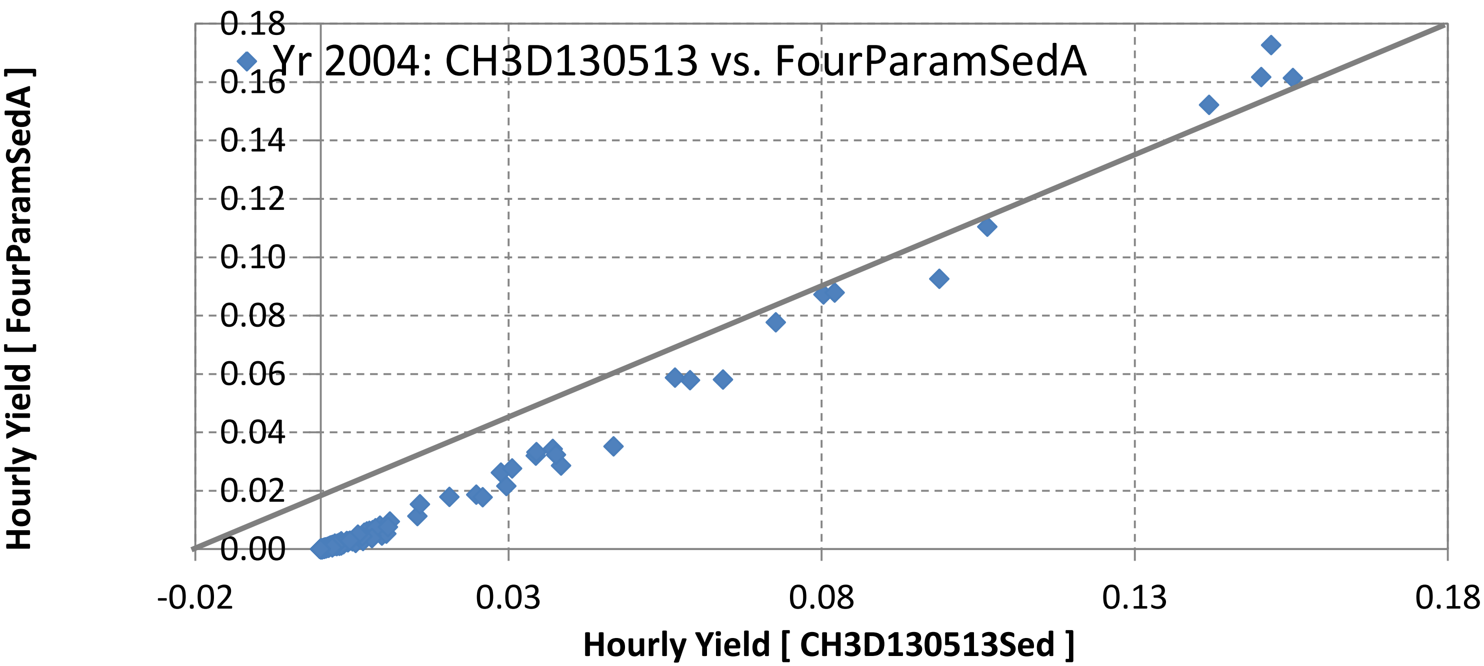
Comparison of **Hourly** EOF Loads

LU=for; LandSeg=**A10001**;
CH3D130513sed: KSER=2.880 and JSER=JRER=1.0
FourParamSedA: KSER=7.233 and JSER=JRER=1.164

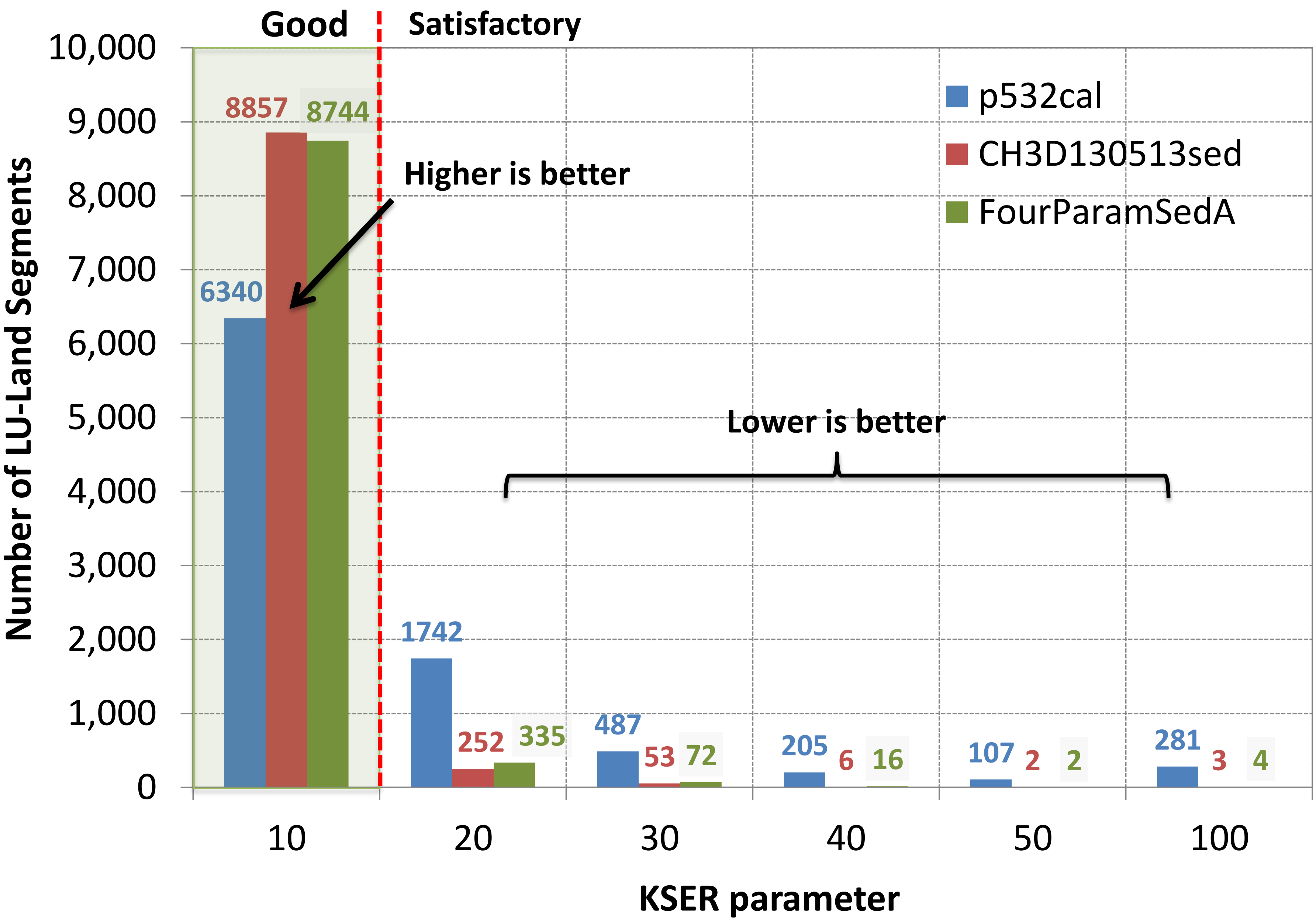


LU=hom; LandSeg=**A10001**;
CH3D130513sed:
KSER=3.1338 and JSER=JRER=1.0
FourParamSedA:
KSER=5.921 and JSER=JRER=1.261





Optimized KSER Parameters (all LU – LandSegments)



P532 vs CH3D130513

R-squared Statistic

River Name	Area	TOTN		TOTP		TSSX	
	(mi^2)	85-05	02-11	85-05	02-11	85-05	02-11
Susquehanna River near Conowingo, MD	27070	0.21808	**0.63815**	0.40720	**0.50874**	1.17930	**0.84991**
Potomac River at Chain Bridge, Washington DC	11578	0.19472	**0.55289**	0.57285	**0.62565**	0.82390	**1.02140**
James River at Cartersville, VA	6764	0.51053	**0.98847**	0.35162	**0.77303**	1.37960	**1.36810**
Rappahannock River near Fredericksburg, VA	1596	0.51457	**0.63862**	0.53489	**0.88087**	1.05690	**1.05370**

Slope (Obs. vs. Sim.)

River Name	Area	TOTN		TOTP		TSSX	
	(mi^2)	85-05	02-11	85-05	02-11	85-05	02-11
Susquehanna River near Conowingo, MD	27070	0.03574	**0.29393**	0.25821	**0.43542**	0.31677	**0.42713**
Potomac River at Chain Bridge, Washington DC	11578	0.03066	**0.15548**	0.27099	**0.43003**	0.43044	**0.52963**
James River at Cartersville, VA	6764	0.18548	**0.36507**	0.09502	**0.42364**	0.53028	**0.64195**
Rappahannock River near Fredericksburg, VA	1596	0.33226	**0.47227**	0.52240	**0.77995**	0.51633	**0.65423**

Possible reasons leading up to improved calibration?

- Improvements in input forcing dataset (Precipitation, Temperature, Potential Evapotranspiration etc.)?
- ~~Calibration strategy (particularly sediment yield calibration)?~~
- Calibration period (2002-2011) / Observation data?

Next Step:

Calibrate Flow, Sediment & Nutrient (PQUAL) – 1985-2005

Thank You!