Estimating Combined Old & Middle River Flow

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Metropolitan Water District

- Motivation
- Hydraulic Forces
- Model Development
- Model Validation
- Conclusions & Next Steps

2008 CWEMF Annual Meeting
Pacific Grove, CA

Acknowledgements

Allison Dvorak

Tracy Hinojosa

Pete Smith

Chuching Wang

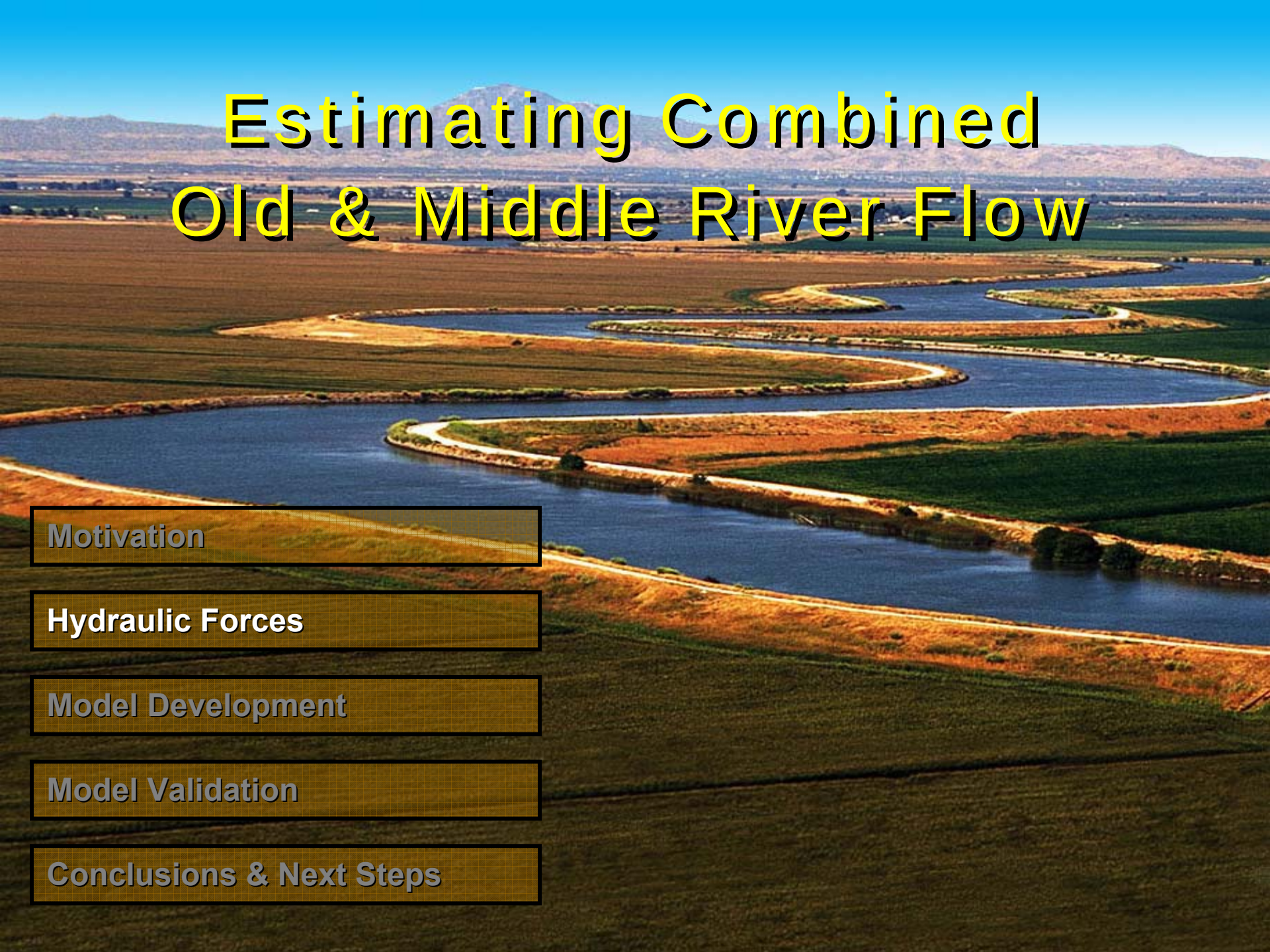
Min Yu

Motivation

DWR & USGS OMR Flow Models

$$Q_{OMR}\ (cfs) = A * Q_{vernalis} + B * Q_{exports} + C$$

Water Year Type	Water Supply Impacts OMR > -750 cfs (TAF per year)			Water Supply Impacts OMR > -5000 cfs (TAF per year)		
	DWR Model	USGS Model	Difference	DWR Model	USGS Model	Difference
73-Yr Average	1300	1770	470	320	490	170
Wet	1110	1780	670	250	550	300
Above Normal	1520	2270	750	420	720	300
Below Normal	1570	2150	580	380	610	230
Dry	1510	1720	210	410	400	-10
Critical	760	800	40	180	150	-30



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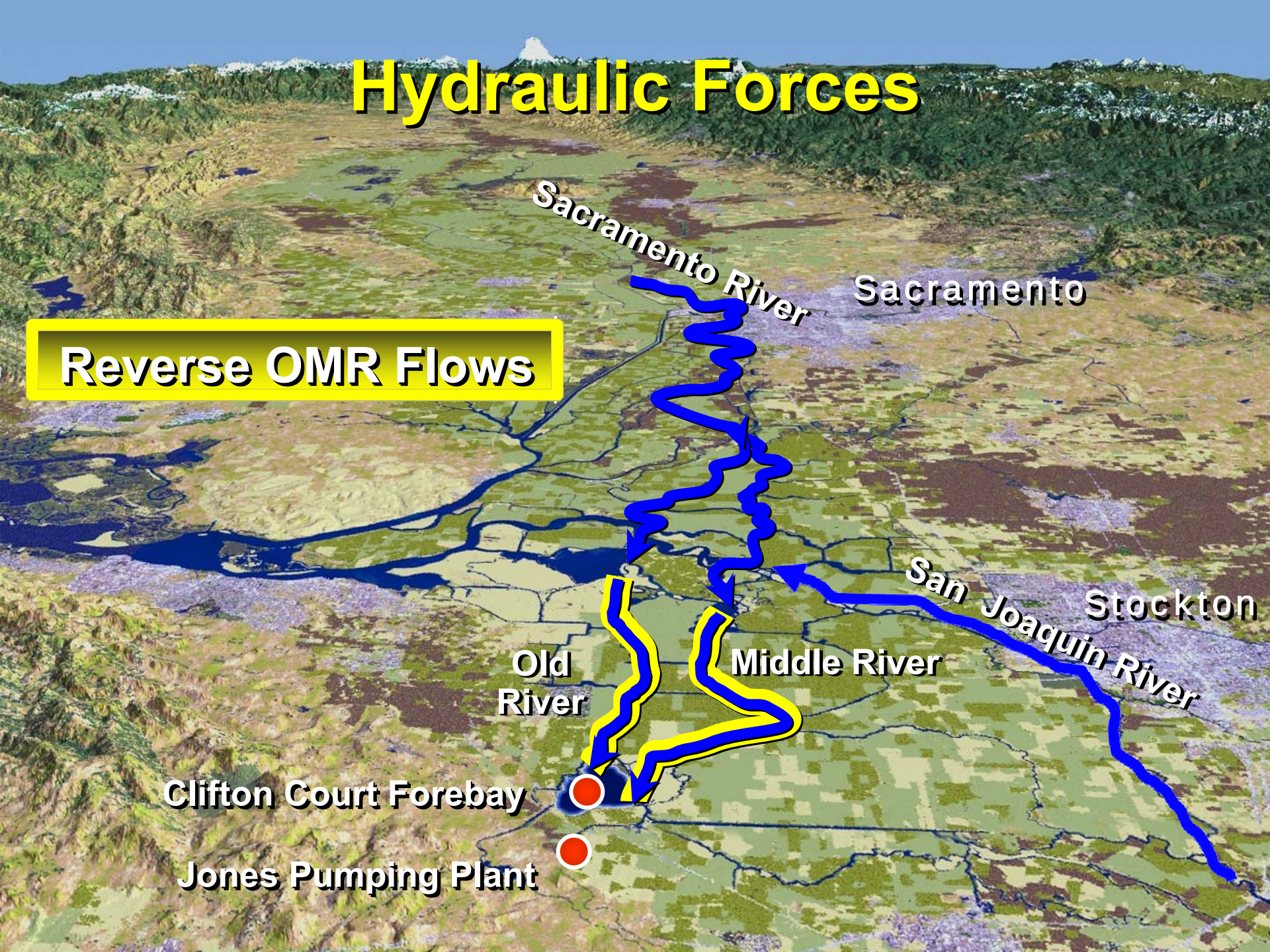
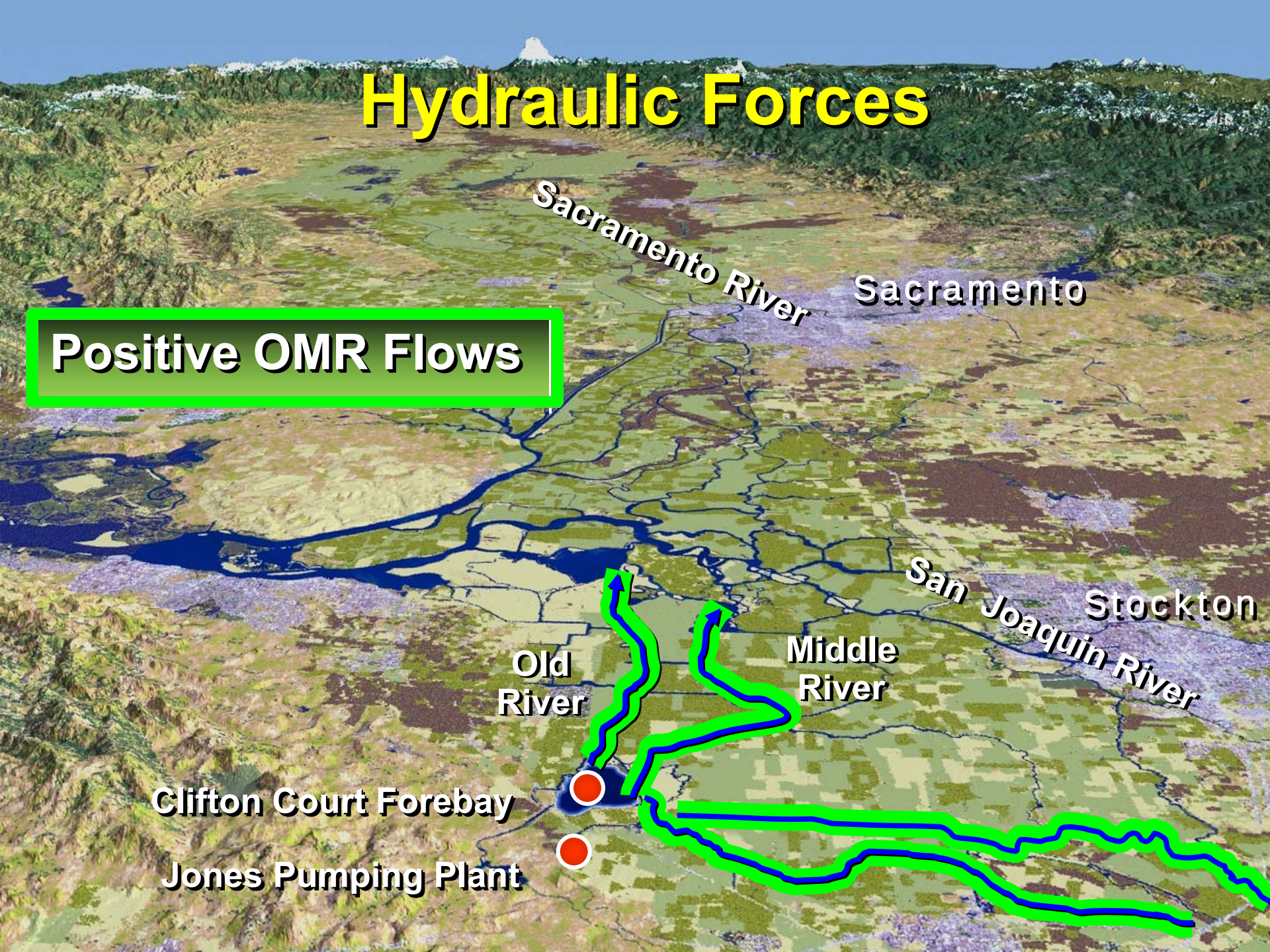
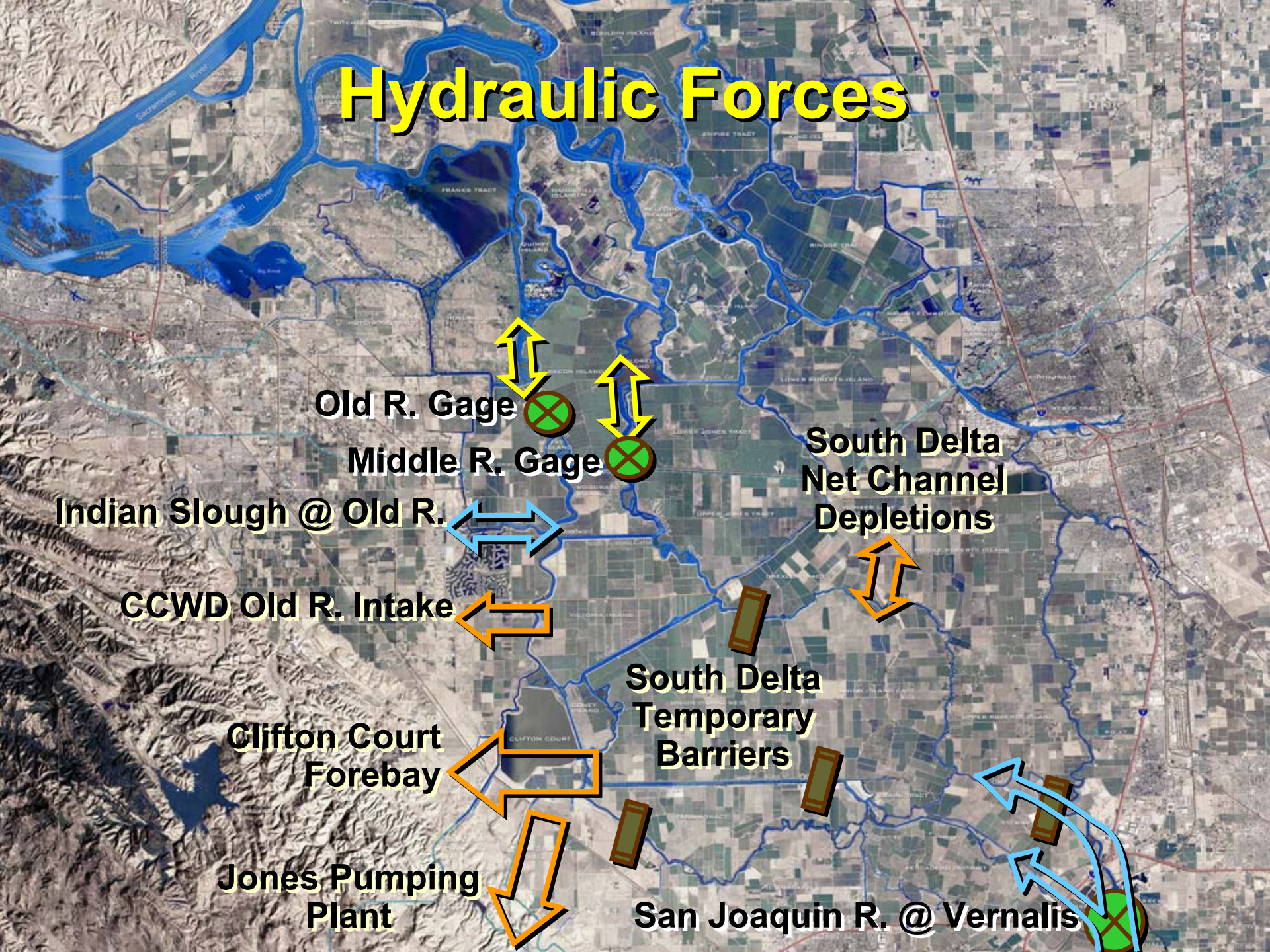

Hydraulic Forces
Reverse OMR Flows
Sacramento River
Sacramento
San Joaquin River
Stockton
Old River
Middle River
Clifton Court Forebay
Jones Pumping Plant


Hydraulic Forces
Positive OMR Flows
Sacramento River
Sacramento
San Joaquin River
Stockton
Old River
Middle River
Clifton Court Forebay
Jones Pumping Plant


Hydraulic Forces
Old R. Gage
Middle R. Gage
Indian Slough @ Old R.
CCWD Old R. Intake
South Delta
Net Channel
Depletions
South Delta
Temporary
Barriers
Clifton Court
Forebay
Jones Pumping
Plant
San Joaquin R. @ Vernalis

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Model Development

South Delta Water Balance

OMR = San Joaquin River @ Vernalis

+ Indian Slough @ Old River

- San Joaquin River d/s HOR

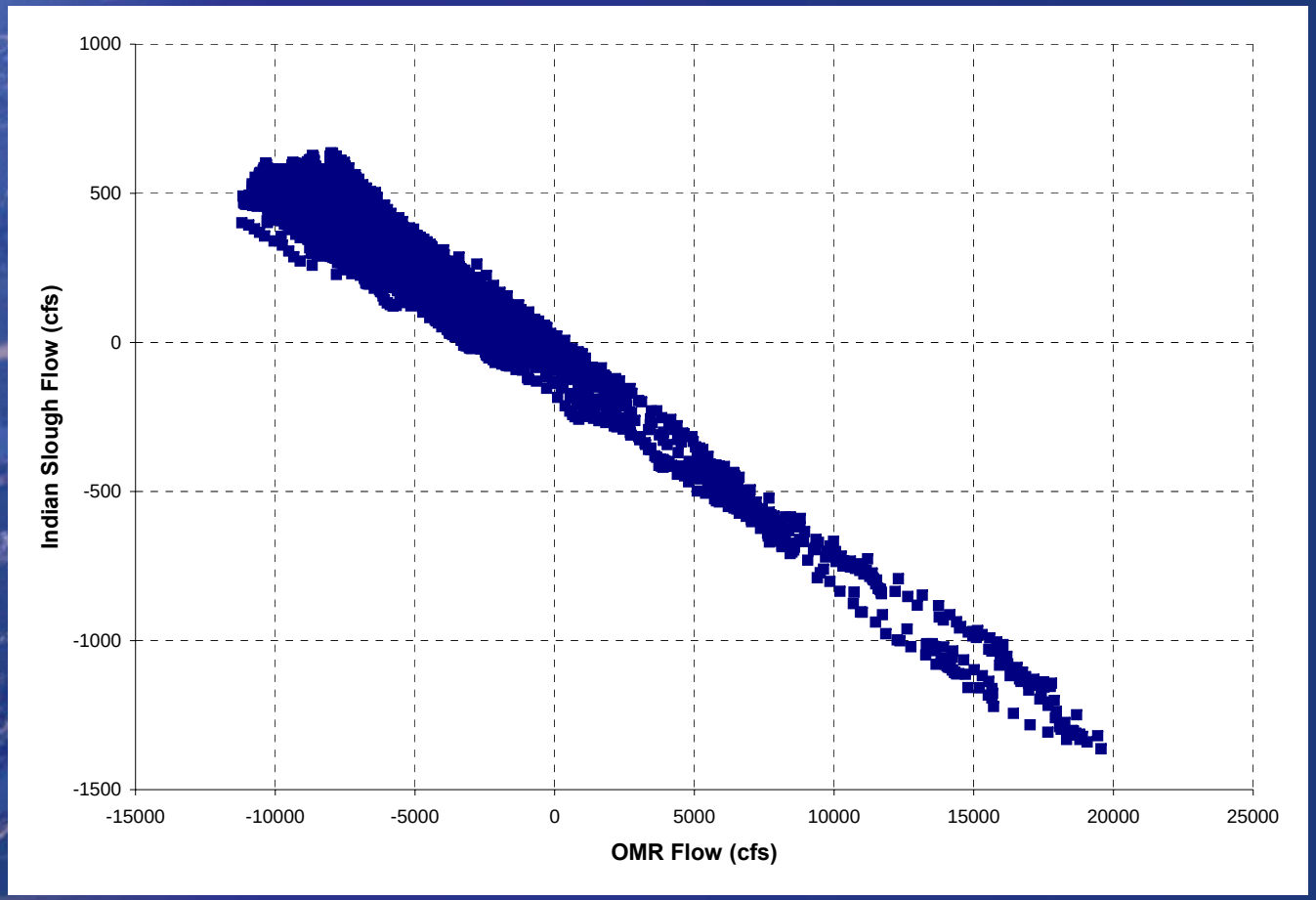
South Delta Diversions

- Clifton Court Forebay diversions
- Jones Pumping Plant diversions
- CCWD Old River diversions
- South Delta net channel depletions

~~± Change in storage~~

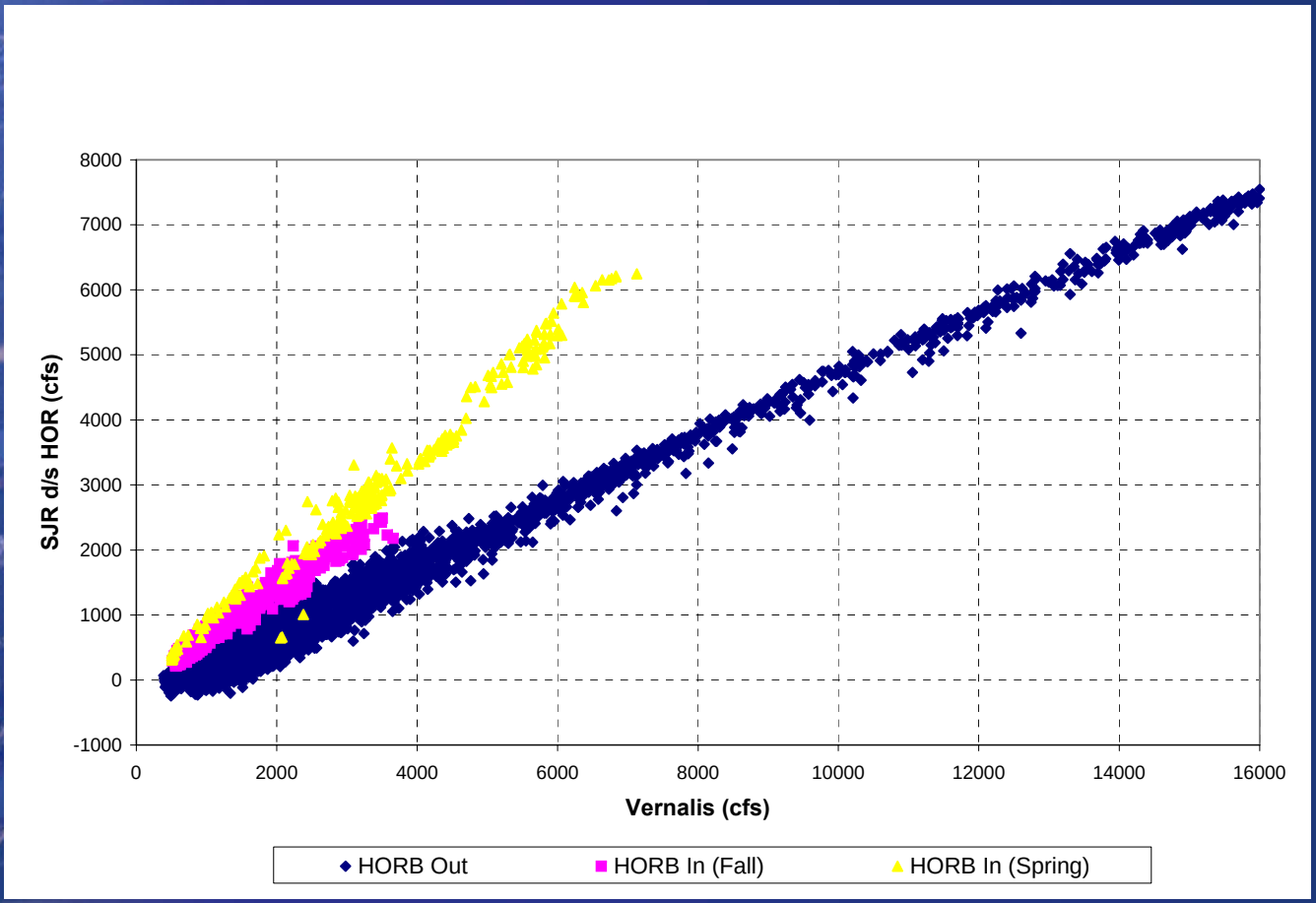
Model Development

Indian Slough @ Old River



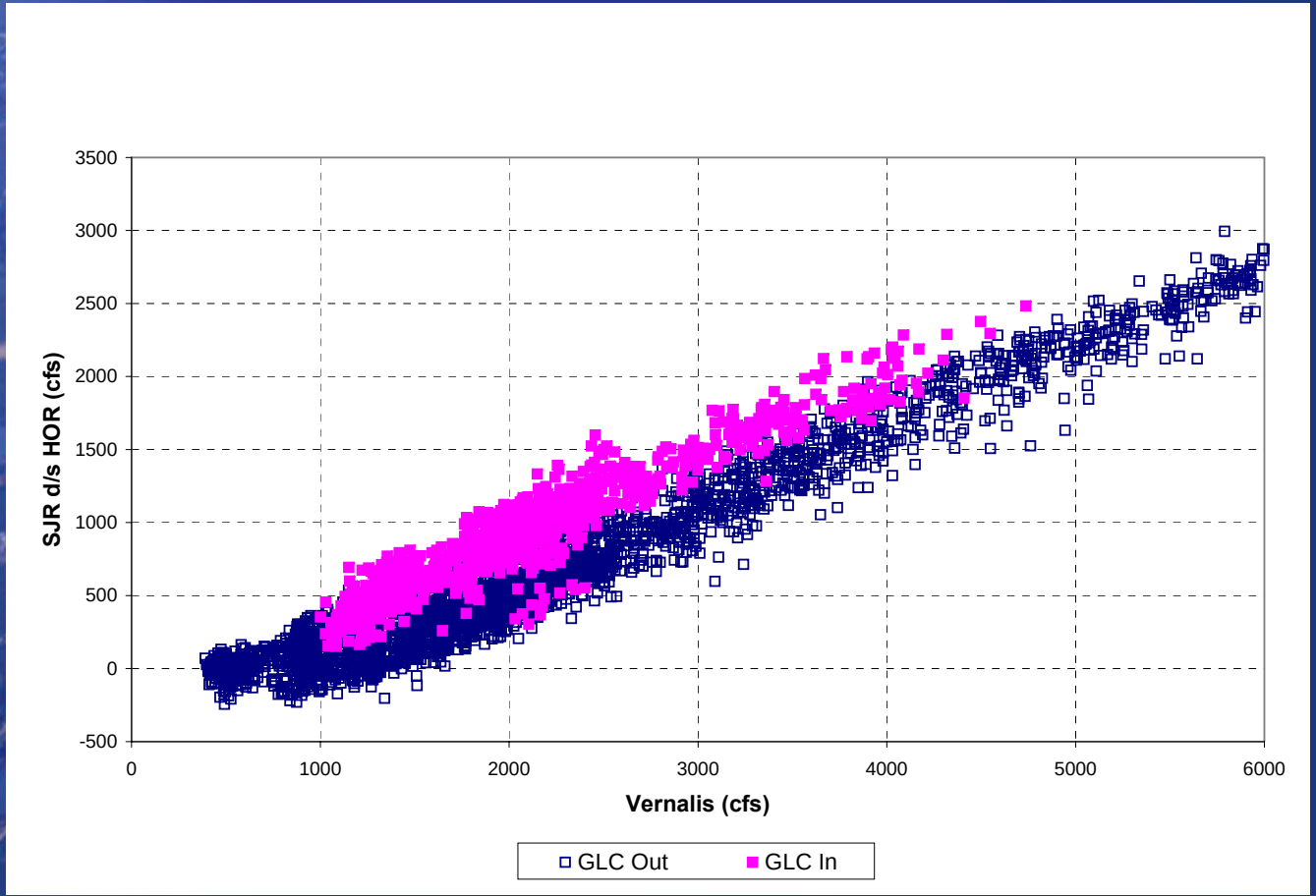
Model Development

San Joaquin River d/s HOR



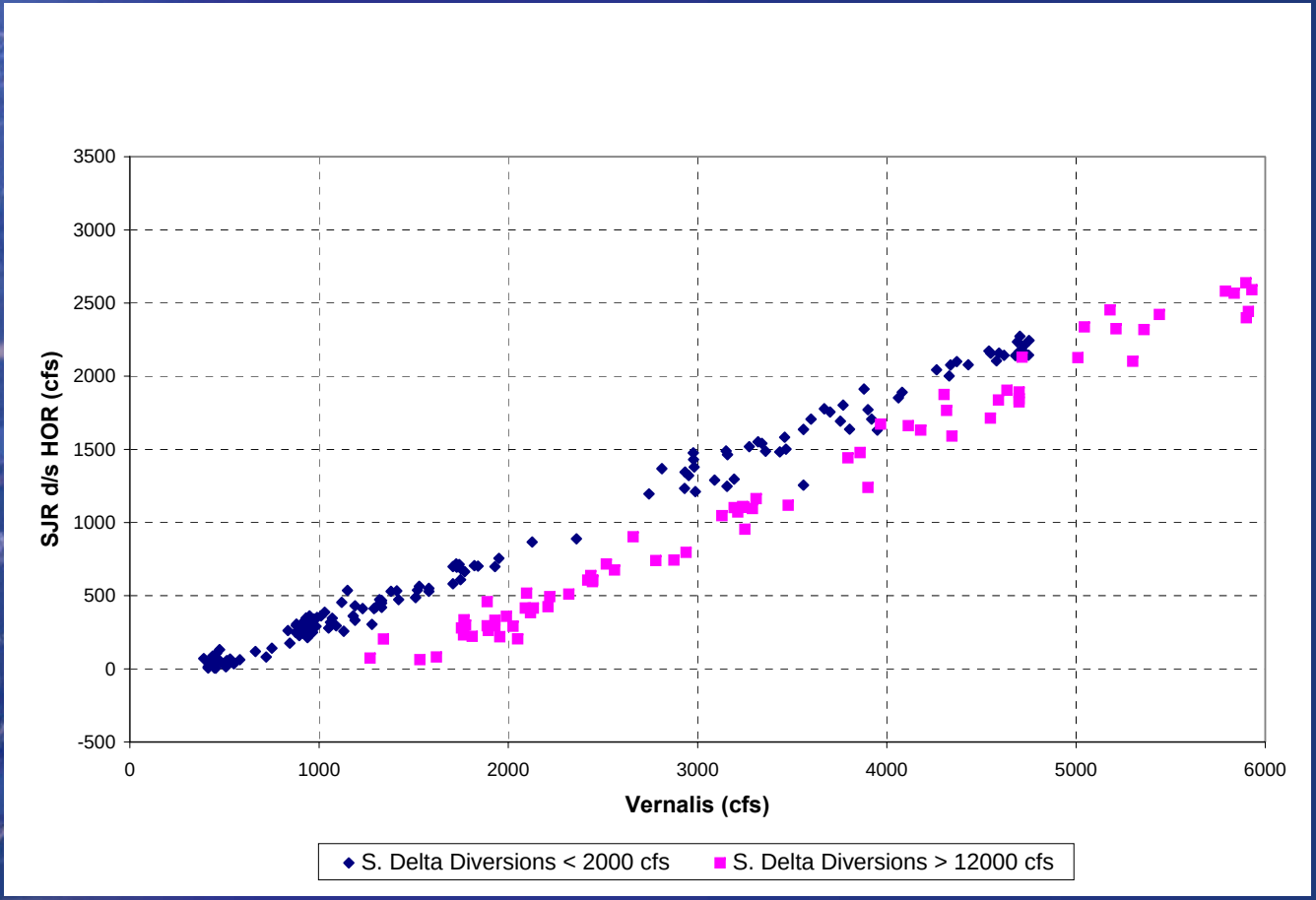
Model Development

San Joaquin River d/s HOR (HORB Out)



Model Development

San Joaquin River d/s HOR (HORB & GLC Out)



Model Development

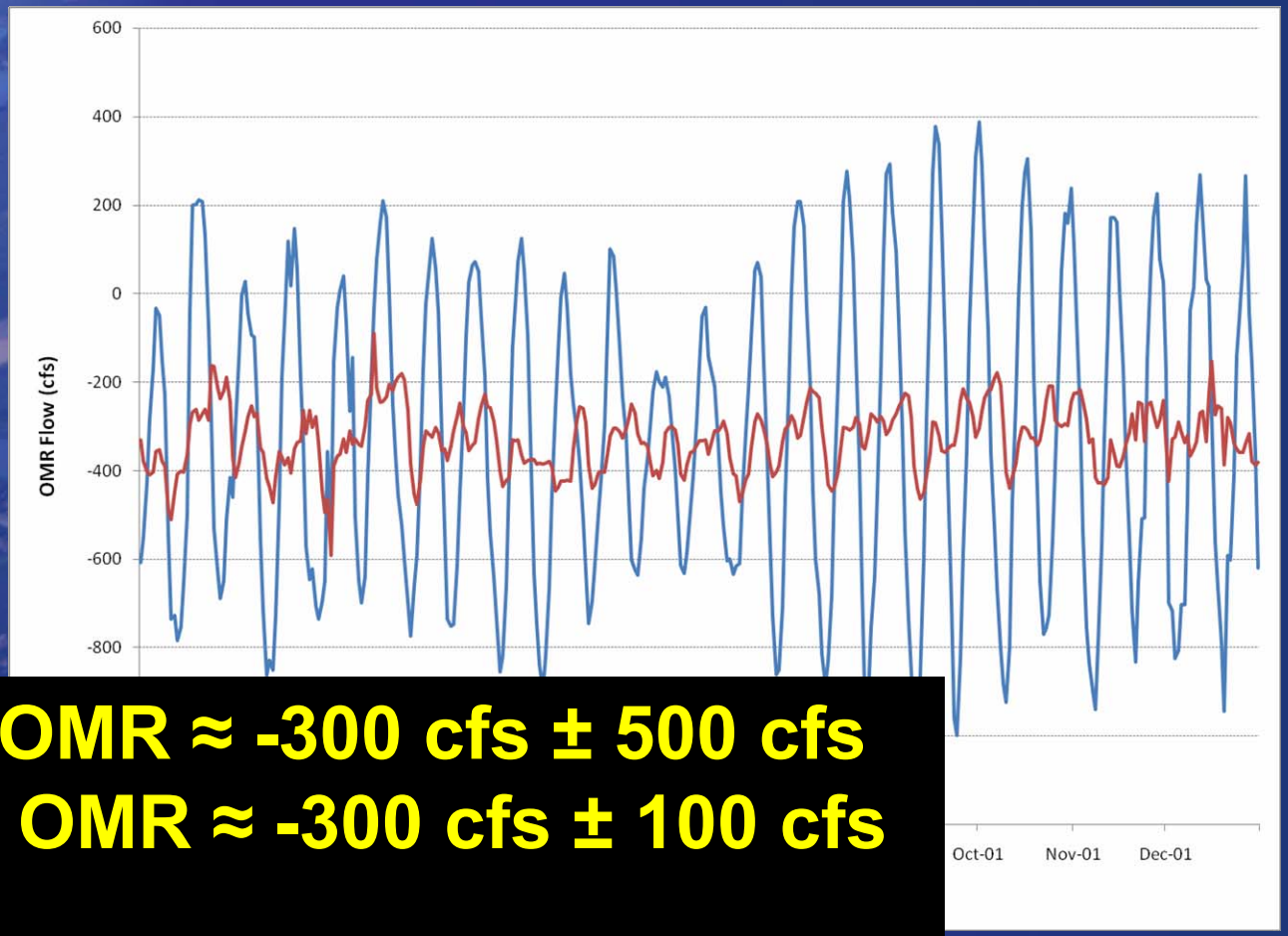
OMR Flow Model Constants

$$Q_{OMR}\ (cfs) = A * Q_{vernalis} + B * Q_{south\ delta\ diversions} + C$$

HORB	GLC Barrier	Vernalis (cfs)	A	B	C
Out	Out	< 16,000	0.462	-0.911	120
Out	Out	16,000-28,000	0.681	-0.940	-2982
Out	Out	> 28,000	0.634	-0.940	-1654
Out	In	All	0.405	-0.940	183
In (Spring)	Out/In	All	0.079	-0.940	73
In (Fall)	Out/In	All	0.259	-0.940	-9

Tidal Effects

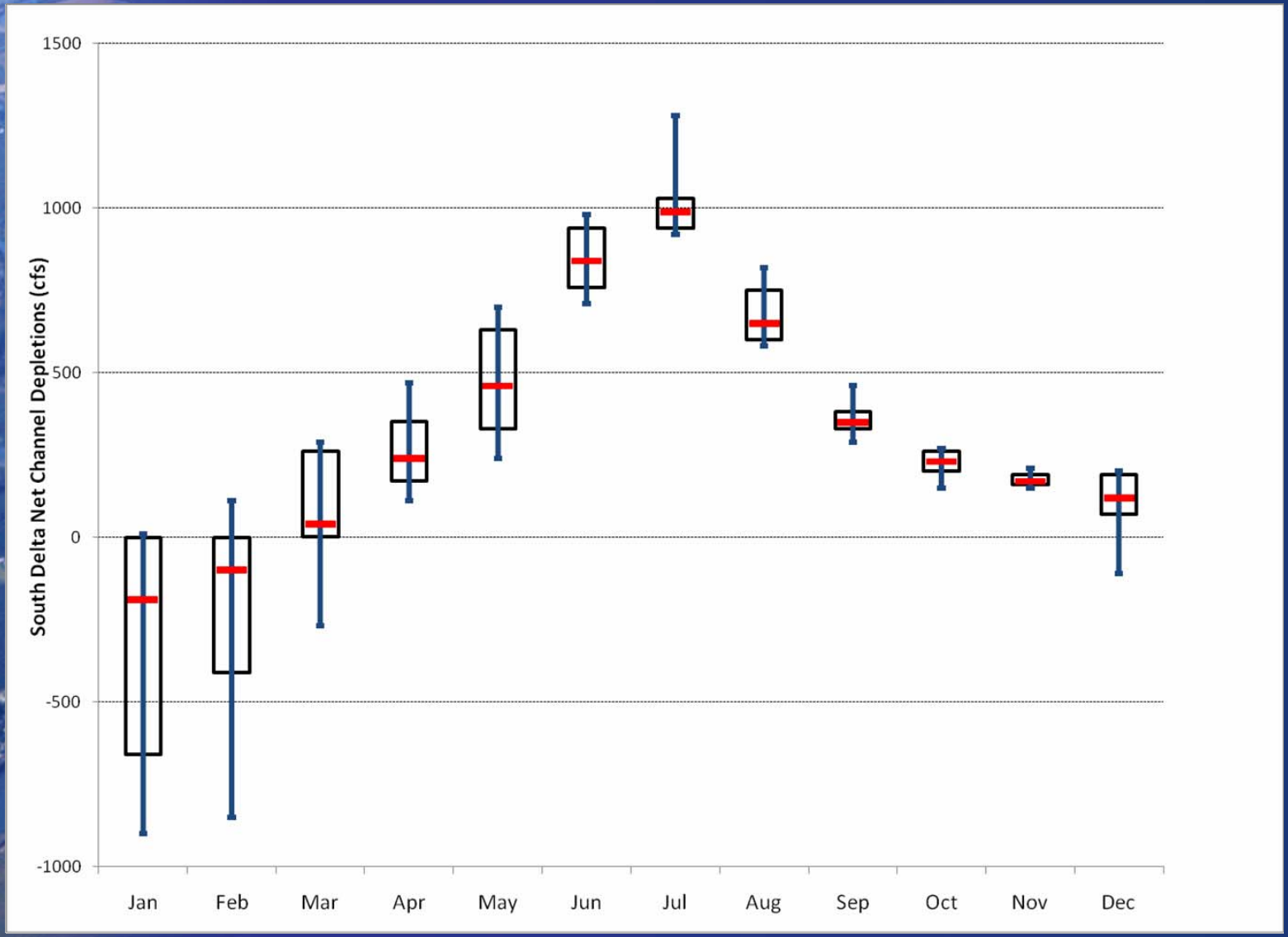
Vernalis = 1000 cfs; South Delta Diversions = 1000 cfs; No Barriers
Historical Delta Inflows for Calendar Year 2001

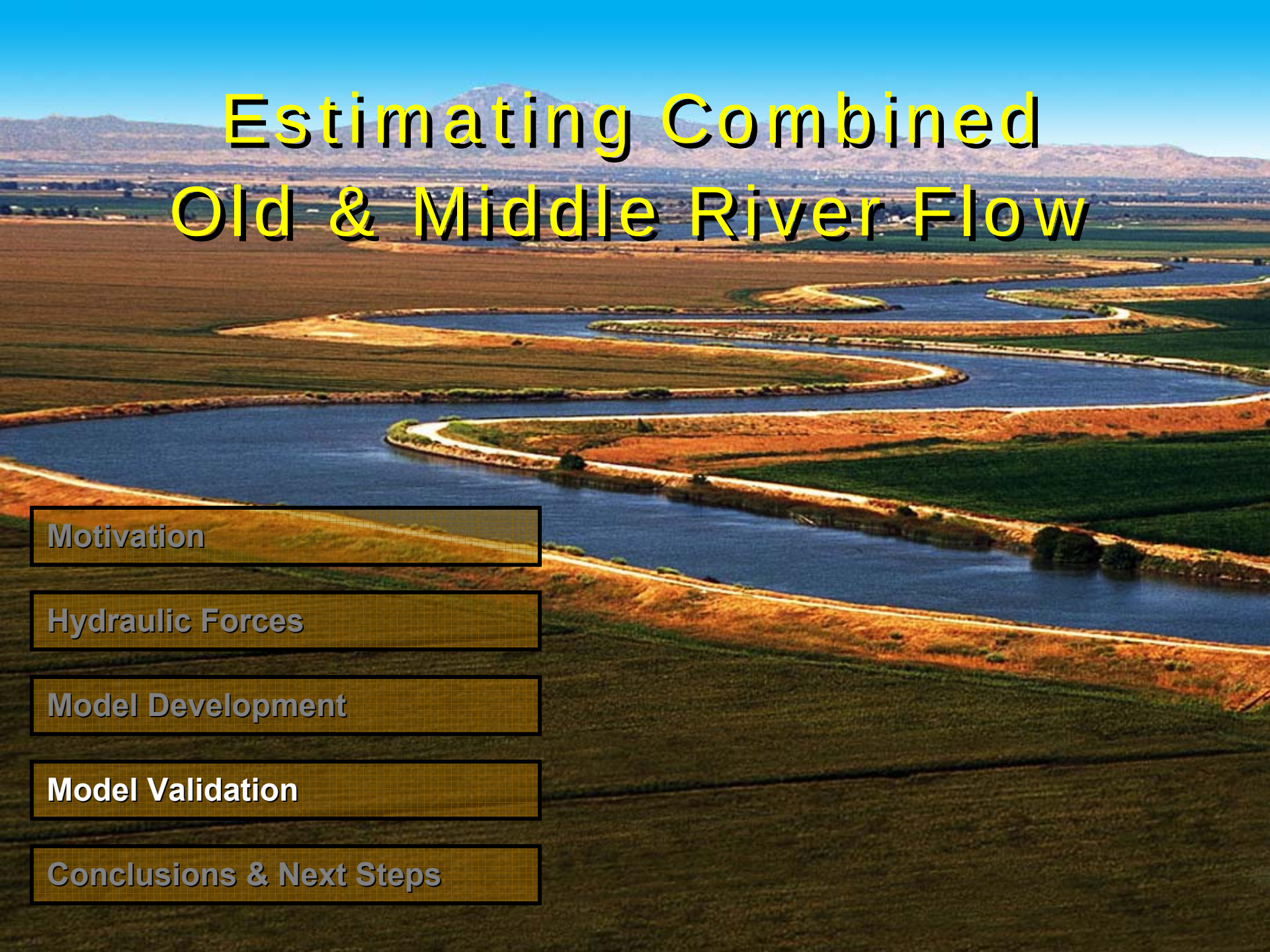


7d OMR ≈ -300 cfs ± 500 cfs
14d OMR ≈ -300 cfs ± 100 cfs

South Delta Net Channel Depletions

10th, 25th, 50th, 75th & 90th Percentile DICU Model Estimates: 1990-2006

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Model Validation

Deviations by Month with 14d Observed Data

Month	# Data Points	Average OMR Flow (cfs)	Average Deviation (cfs)			
			DWR Model	USGS Model	MWD Model	DSM2
Jan	469	-6040	310	710	250	240
Feb	452	-4560	370	1010	410	380
Mar	485	-2400	520	880	360	290
Apr	479	-1510	910	780	350	300
May	515	240	1660	760	380	360
Jun	452	-2210	1240	760	340	340
Jul	458	-6010	1240	1060	390	420
Aug	457	-7580	950	920	390	400
Sep	462	-7680	780	680	390	400
Oct	465	-6170	780	610	450	400
Nov	416	-5440	630	310	380	360
Dec	465	-5150	410	600	360	350
All	5575	-4490	820	760	370	350

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Conclusions

Model Development & Application

- Performance
  - superior validation to observed data
  - more robust sensitivity to key hydrologic variables
- Limitations
  - tidal influences are ignored
  - net channel depletion estimates are highly uncertain
- Recommendations
  - recalibrate with wider range of operations data

Conclusions

Potential Control Measures

- **Forecasting**
  - tidal effects
  - south Delta net channel depletions
- **Barrier operations**
  - Grant Line Canal appears to be the only temporary barrier that has a significant impact on OMR flow. Additional studies should be conducted to confirm this finding.
  - Water savings may result from delaying installation of the GLC temporary barrier. But will delayed installation require export curtailments to meet south Delta water levels?
- **Upstream flow augmentation**
  - Measures that increase San Joaquin River flows at Vernalis would be effective in controlling OMR flow.
  - Such measures would be even more effective if the Paradise Cut weir was modified to divert more water into the south Delta.