

# Uncertainty Associated With X2 Interpolation

DSM2 Users Group  
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# Uncertainty Associated With X2 Interpolation

Background

Methods

Results

Conclusions

# Background

## Purpose of Investigation

- Develop Long-Term Record of Monthly Isohaline Position Based on Observed Data (early 1920s to Present)
  - 2 ppt Bottom Salinity (i.e. X2)
  - Low Salinity Zone Surface Salinity (1, 2, 3, 4, 5, 6 ppt)
- Develop Long-Term Record of Daily Isohaline Position Based on Observed Data (mid 1960s to Present) to Assist in ANN Model Development

# Background

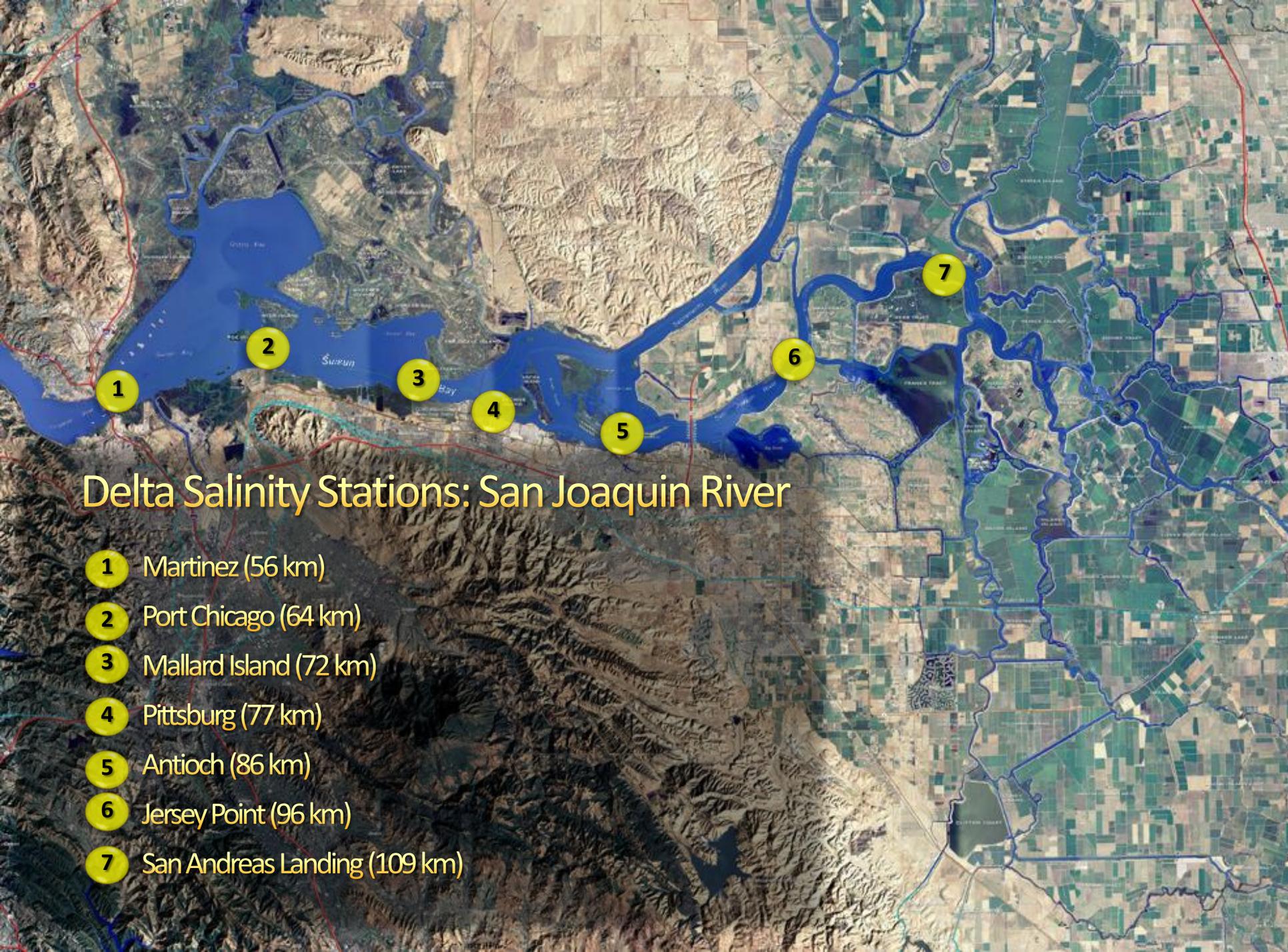
## Data Sources

- Grab Sample Chloride Data
  - Sacramento-San Joaquin Water Supervisor's Report: DPW & DWR Bulletin 23 (1924-61)
  - Quality of Surface Waters in California: DWR Bulletin 65 (1962)
  - Hydrologic Data: DWR Bulletin 130 (1963-71)
- Continuous EC Data (1960s to Present)
  - CDEC
  - IEP Archives
  - STORET
  - USGS (sites downstream of Martinez)



## Delta Salinity Stations: Sacramento River

- 1 Martinez (56 km)
- 2 Port Chicago (64 km)
- 3 Mallard Island (72 km)
- 4 Collinsville (81 km)
- 5 Emmaton (92 km)
- 6 Rio Vista (102 km)



## Delta Salinity Stations: San Joaquin River

- 1 Martinez (56 km)
- 2 Port Chicago (64 km)
- 3 Mallard Island (72 km)
- 4 Pittsburg (77 km)
- 5 Antioch (86 km)
- 6 Jersey Point (96 km)
- 7 San Andreas Landing (109 km)

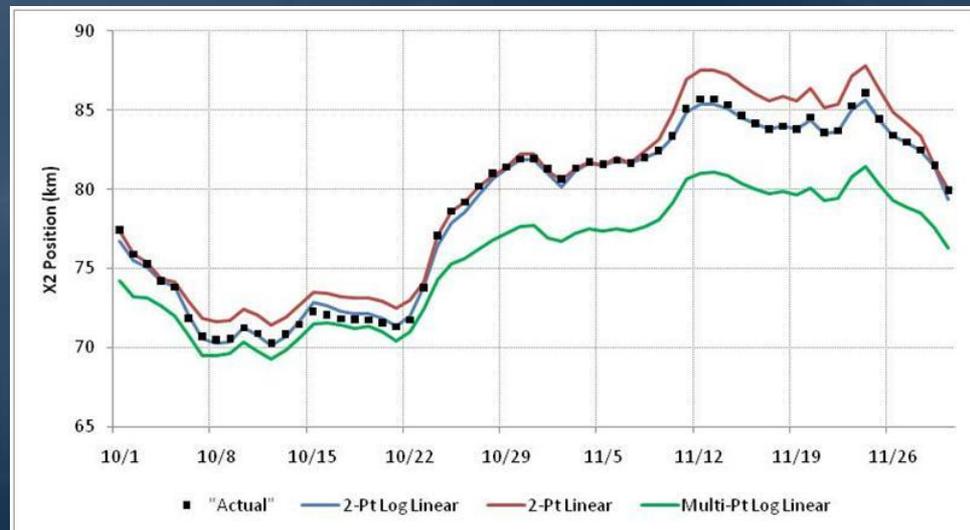
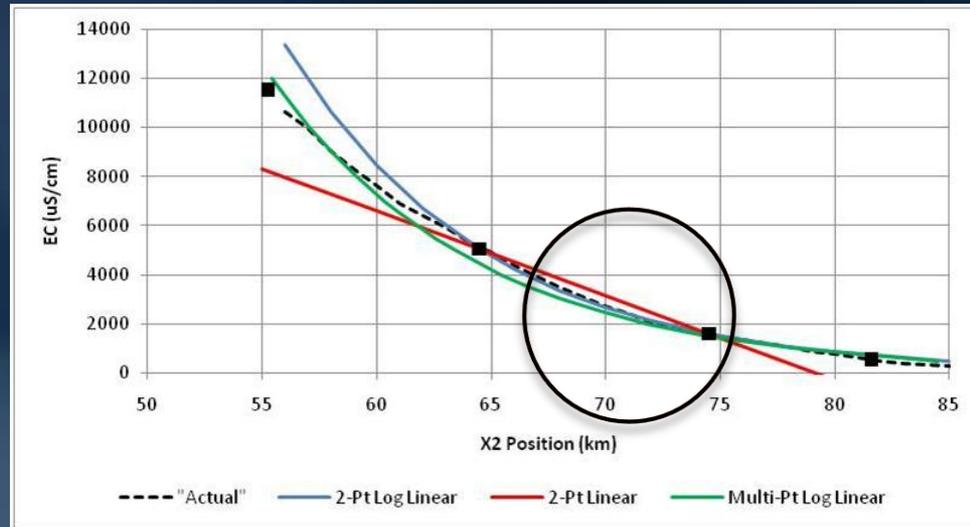
# Background

## Interpolation Methods Investigated

- Two-Point Log Linear (K-M X2 Model)
- Two-Point Linear (DWR OCO Delta Compliance)
- Multi-Point Log Linear (Tetra Tech Study Proposal)

# Interpolation Methods Illustrated

Top Chart: Oct 12, 2011 Bottom Chart: Oct-Nov 2011



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## DSM2 Simulation Data

- Multi-Year Simulation of Historical Hydrology and Operations (January 1990 – February 2012)
- Daily Average EC Model Output Evaluated
  - Reported at 1 km Increments Between Rio Vista and Martinez Along the Lower Sacramento River and Suisun Bay – These Data Used to Define “Actual” X2
  - Also Reported at Key Locations: Martinez, Port Chicago, Chipps Island, Collinsville, Emmaton and Rio Vista – These Data Used to Define “Interpolated” X2

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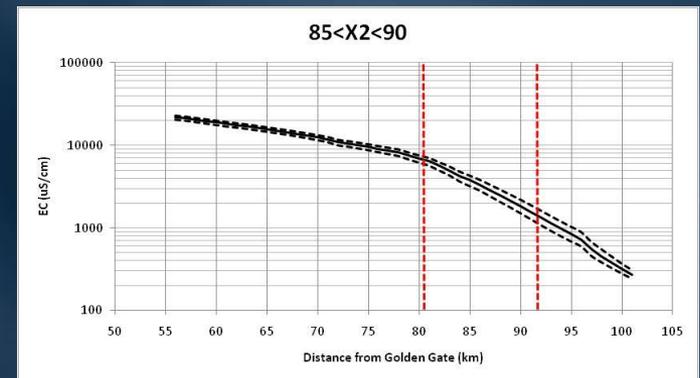
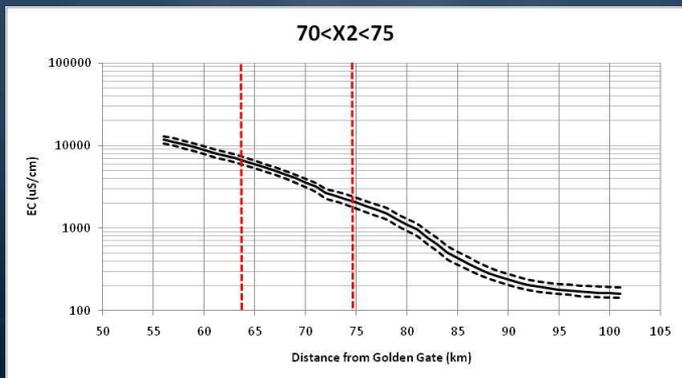
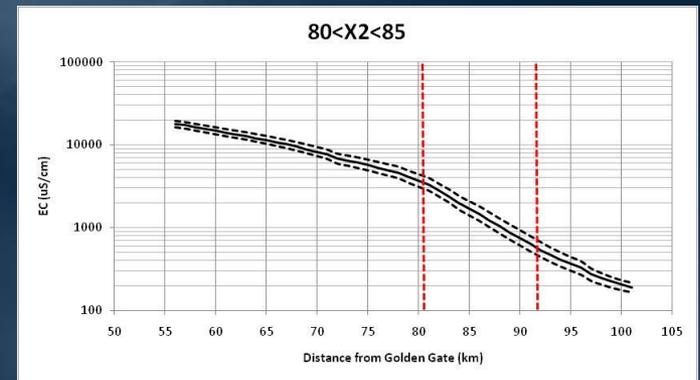
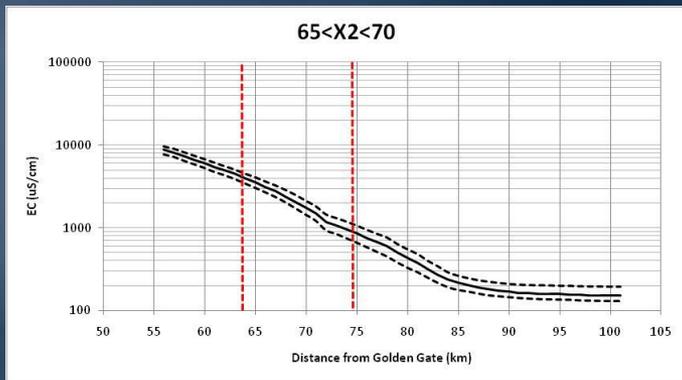
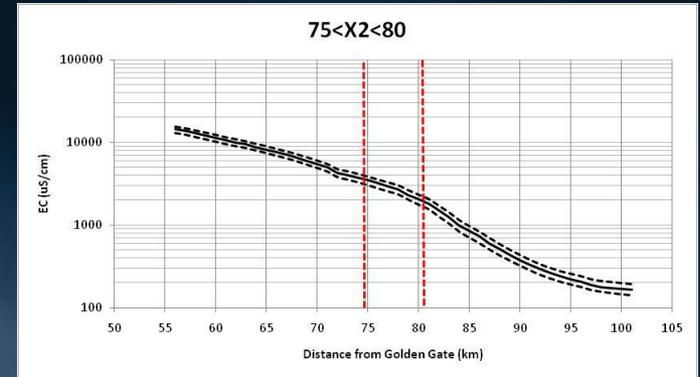
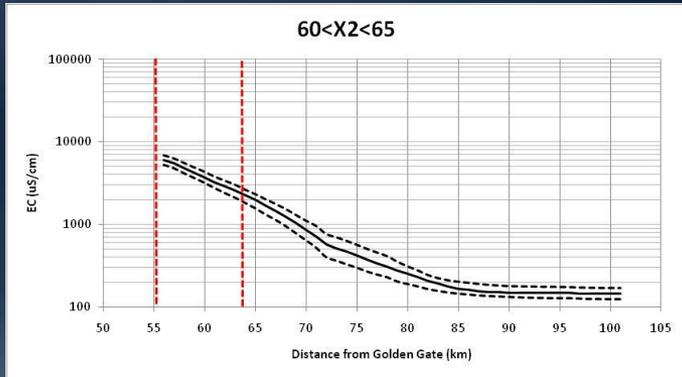
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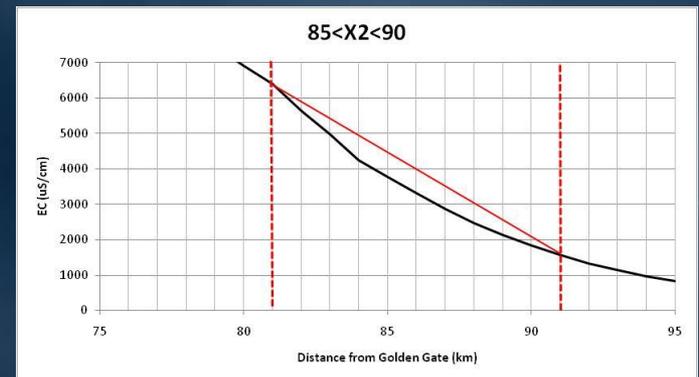
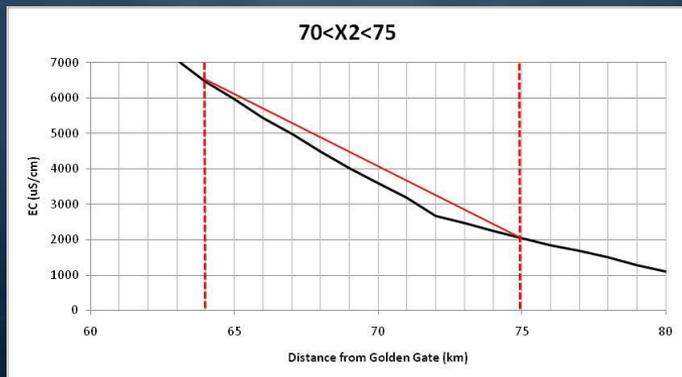
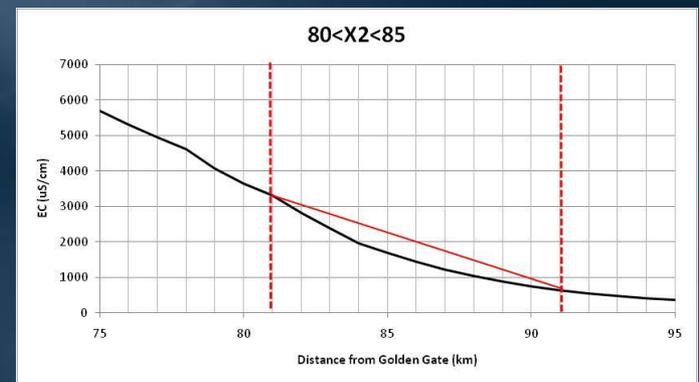
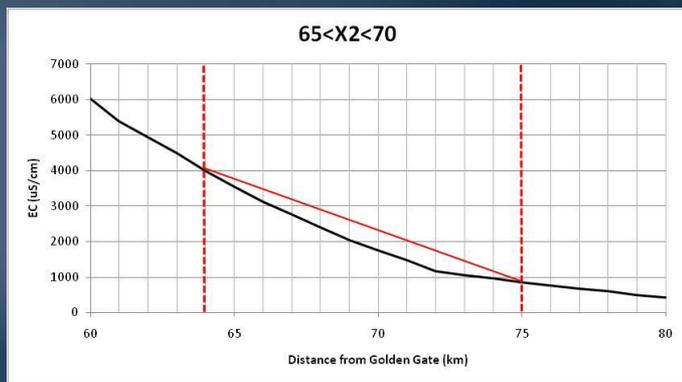
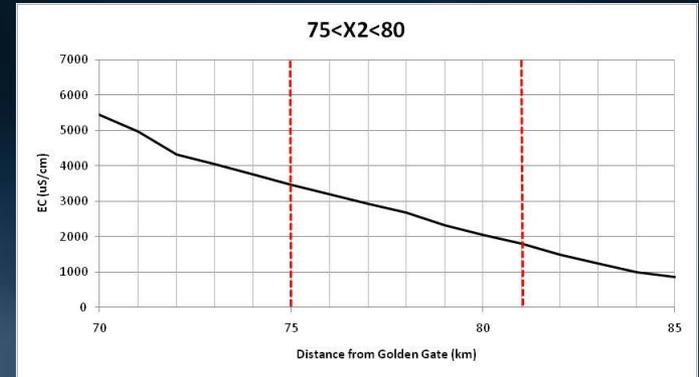
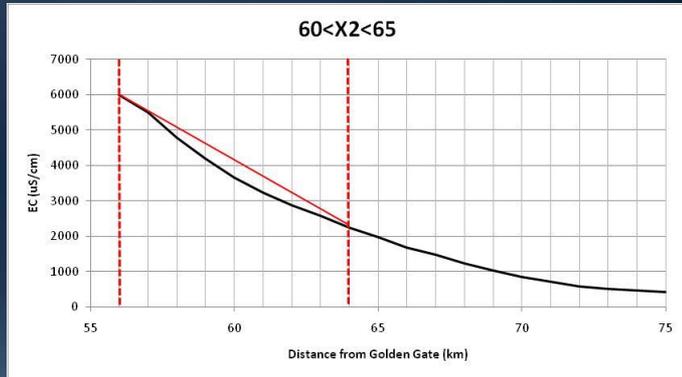
# Salinity Contours Under Various Outflow Conditions

## DSM2 25<sup>th</sup>, 50<sup>th</sup> & 75<sup>th</sup> Percentiles



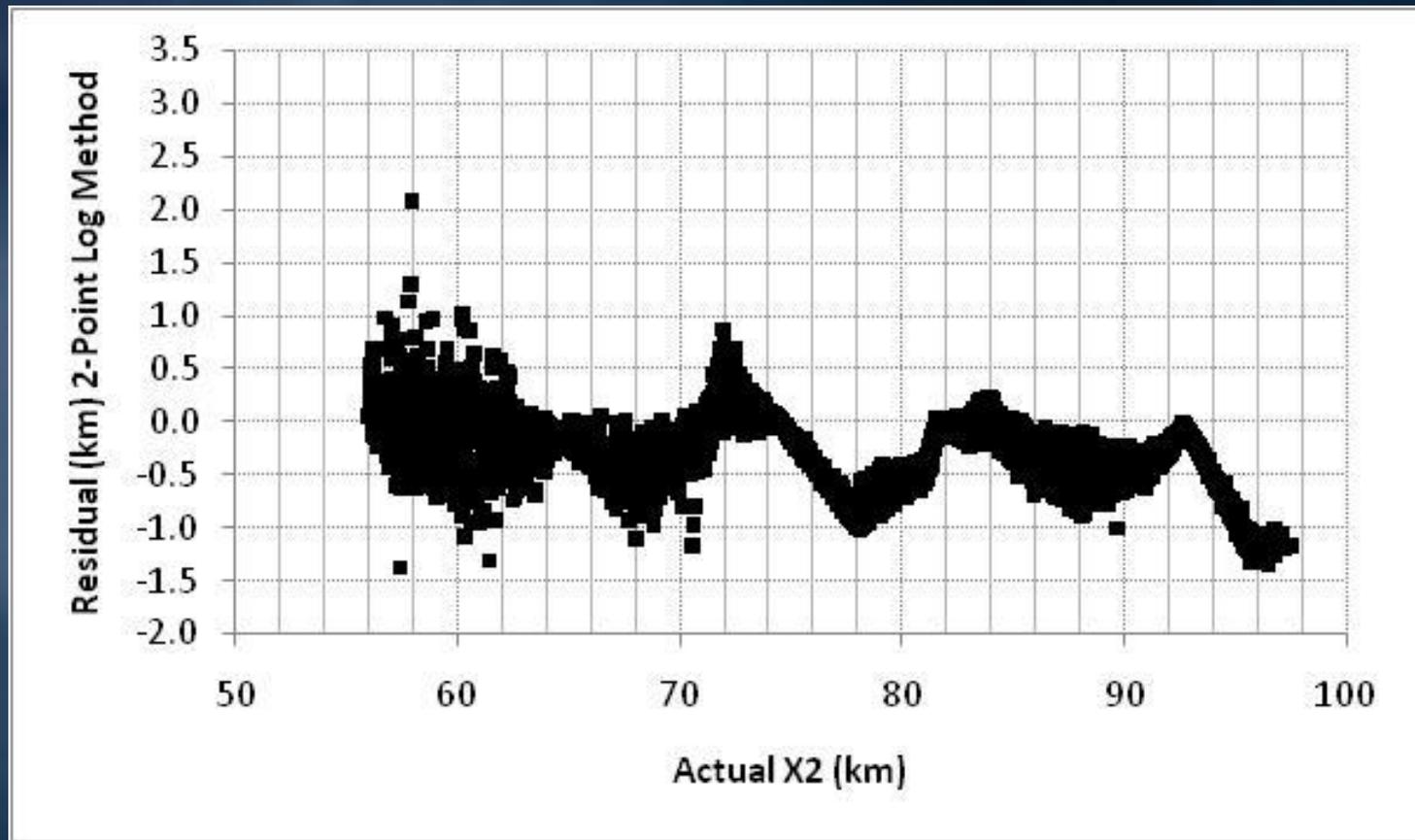
# Salinity Contours Under Various Outflow Conditions

## Linear Interpolation of DSM2 50<sup>th</sup> Percentile



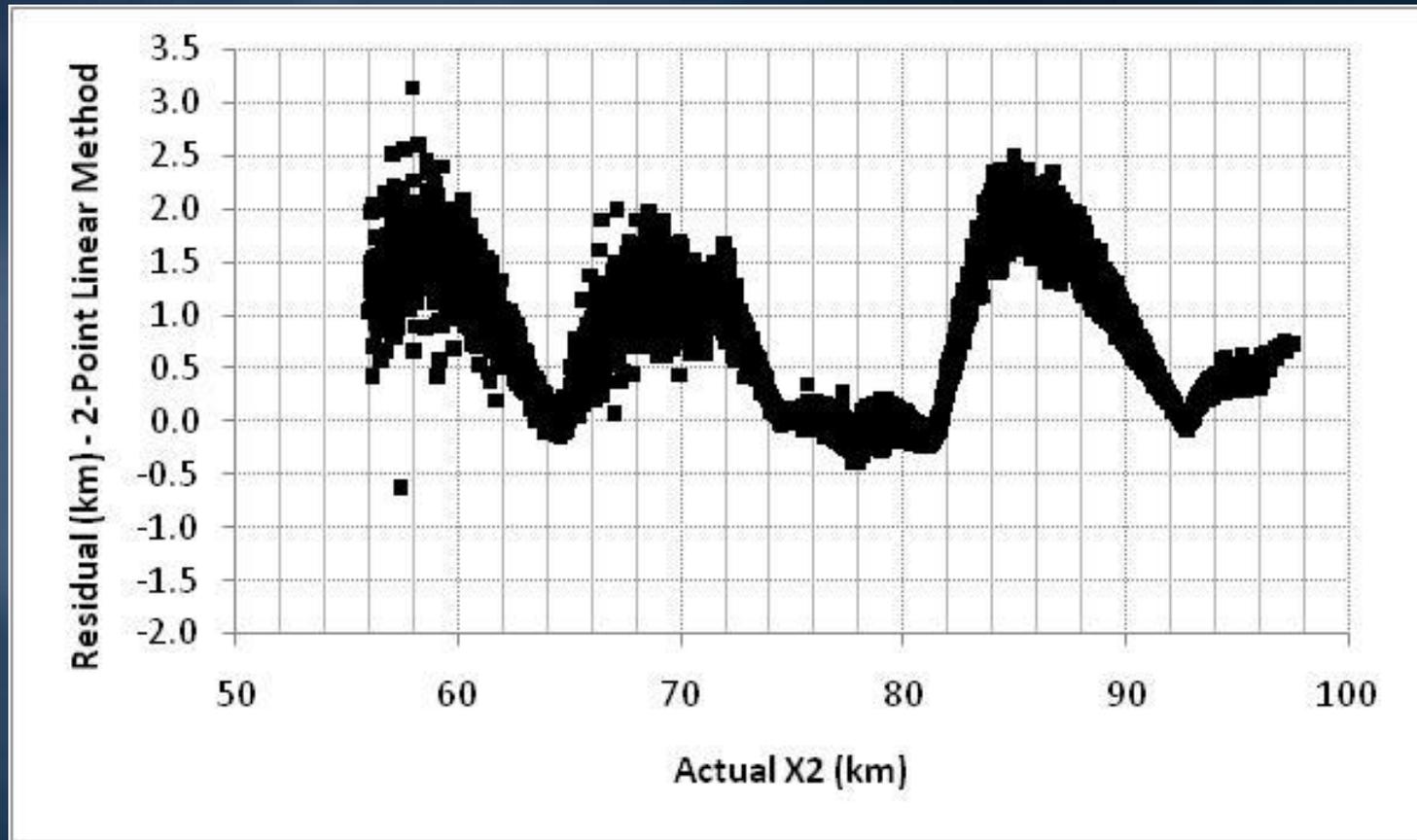
# Residuals as a Function of “Actual” X2 Position

## Two-Point Log Linear Method



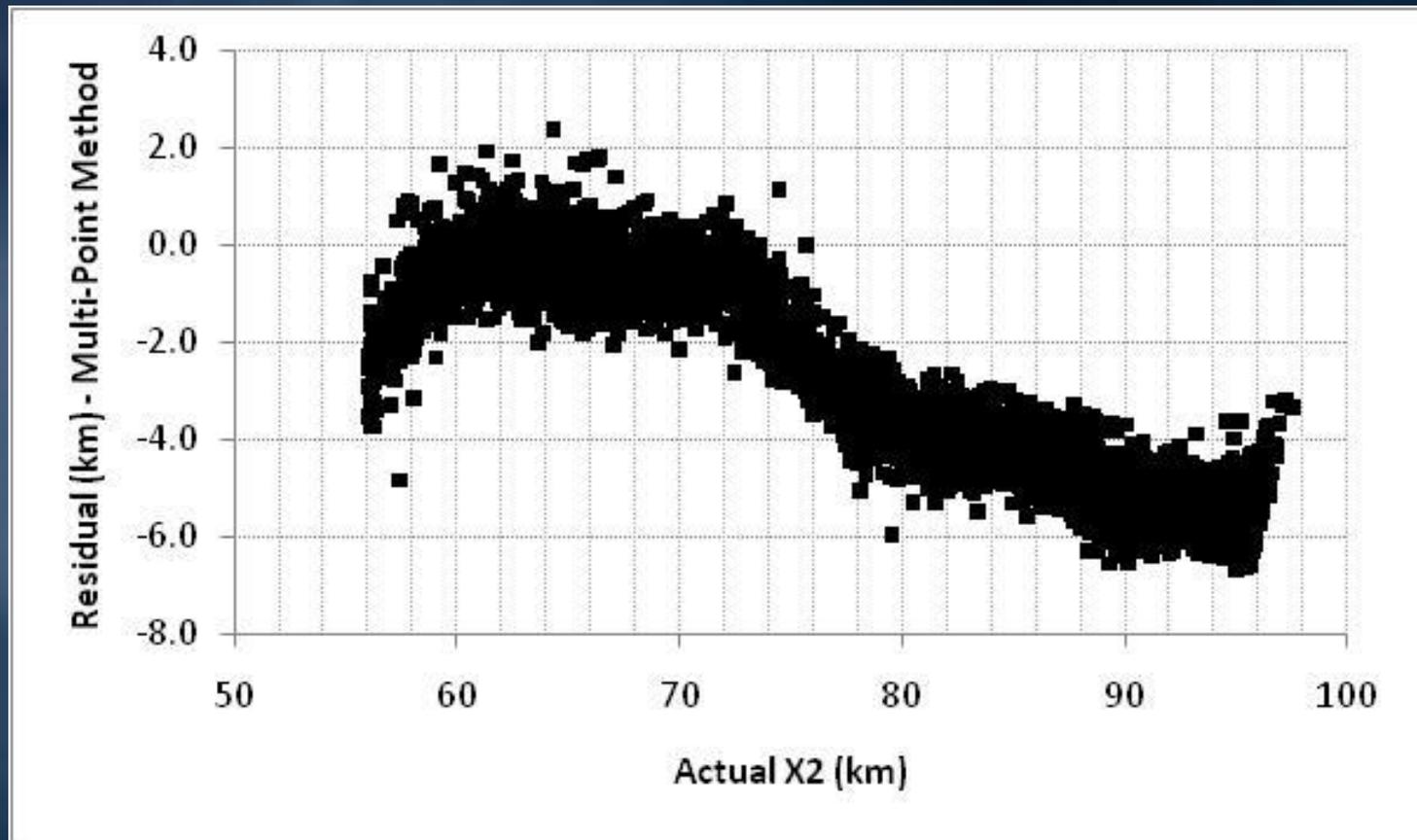
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## Two-Point Linear Method

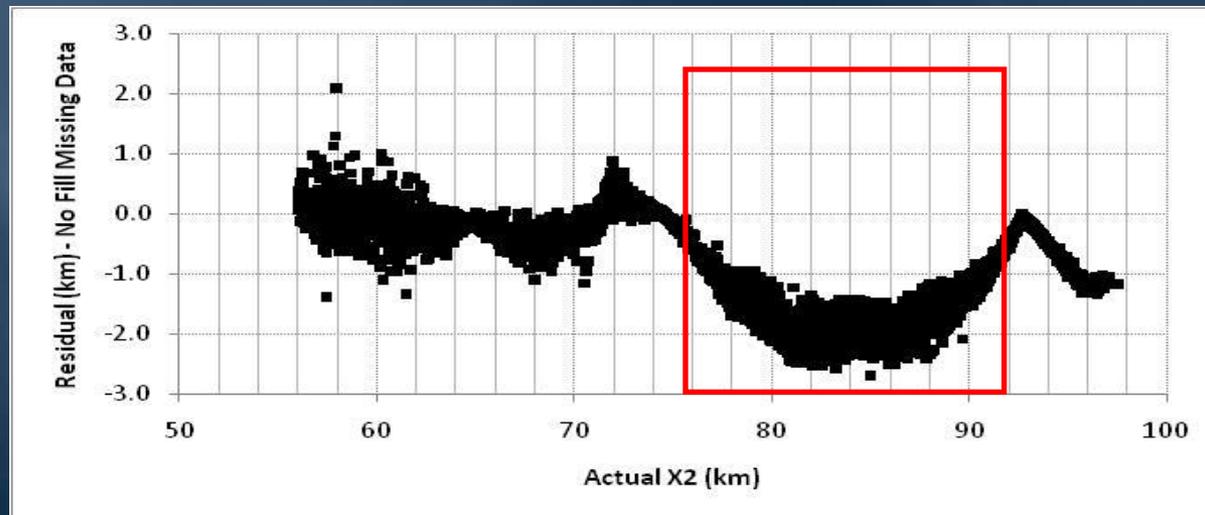
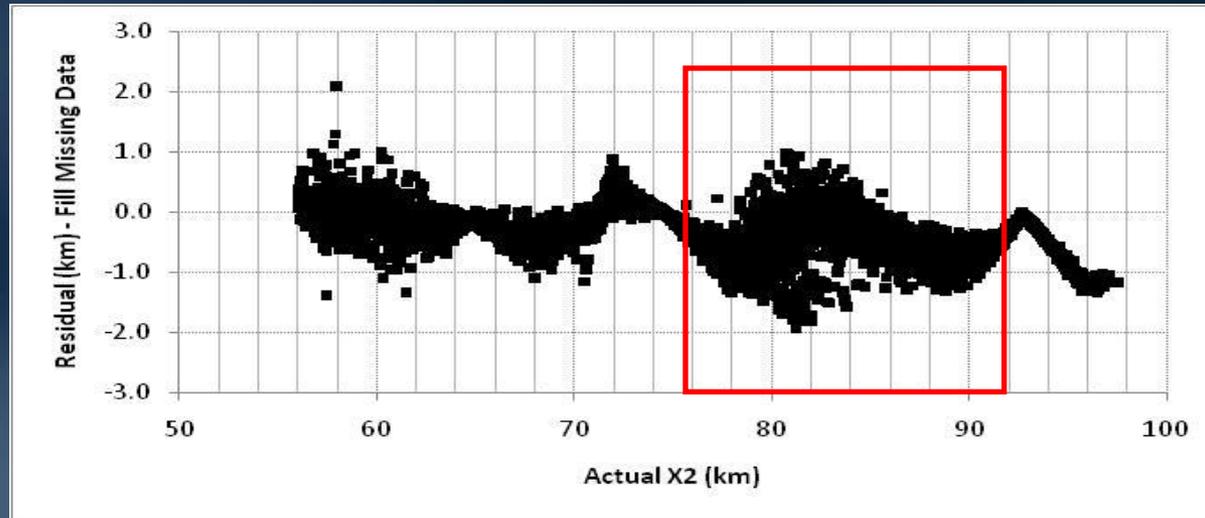


# Residuals as a Function of “Actual” X2 Position

## Multi-Point Log Linear Method



# Residuals as a Function of “Actual” X2 Position With (Top Chart) & Without (Bottom Chart) Filling Missing Collinsville Data



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# Conclusion #1

- The two-point log linear interpolation method generally provided the best estimate of X2 position as represented by the “actual” data. Therefore, this method should be selected to develop a long term record of X2 position. However, further analysis should be performed to explore why the two-point linear interpolation method appeared to provide better estimates in the important X2 range of 74-82 km.

# Conclusion #2

- Intuitively, a multi-point interpolation method holds promise, given that it provides a means of damping errors in the available data. However, more work is needed to select an appropriate method, as the multi-point log linear method does not appear to provide satisfactory results. A logistic (or sigmoid) model may provide a better interpolation method, as it may fit values at the more extreme ranges of the salinity contour. Alternatively, salinity values at the more extreme ranges could be excluded from a multi-point log linear interpolation.

# Conclusion #3

- Filling missing data generally provides a more accurate  $X_2$  estimate. Missing data at Emmaton and Martinez appeared to be particularly detrimental to interpolation accuracy. Of course, interpolation accuracy will be dependent on the quality of the data fill technique.

# Conclusion #4

- DWR OCO should consider these findings and possibly modify their X2 compliance calculations by adopting the two-point log linear interpolation method.

# Acknowledgements

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