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# **Methodology for Flow and Salinity Estimates in the Sacramento-San Joaquin Delta and Suisun Marsh**

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## **Chapter 9: Use of Repeating Tides in Planning Runs**

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# 9 Use of Repeating Tides in Planning Runs

## 9.1 Introduction

The Delta Modeling Section has traditionally utilized a “19-year mean tide” (at Martinez) in all DSM2 planning runs. The hydrology used in a traditional planning run has been monthly varying. The main argument for using a 19-year mean tide has been a reduction in CPU time and disk-space requirements, since a one tidal day HYDRO simulation was used for the entire month of QUAL simulation. The main disadvantage of using a 19-year mean tide (as opposed to a non-repeating or “real” tide) is the absence of spring/neap effects. The arrival of faster computers with larger disk-space is making the use of a real tide more practical. In fact, the Delta Modeling Section plans to use a real tide in planning runs in the near future (See Chapter 10).

During the past DSM2 calibration/validation effort (see Chapter 2), actual Martinez stage was used in the simulations. It has always been assumed that a 19-year mean tide would provide water quality results that are on average close to those corresponding to a real tide. However, this had never been proven.

Recent tests revealed results that were inconsistent with the intuitive assumptions. These tests showed that the predicted salinity results using a 19-year mean tide were consistently higher than those using the real tide. However, the first calibrated version of DSM2 (1997) on average had a tendency to underestimate salinity in the Delta. Thus, results using a 19-year mean tide were in fact closer to the field data. The predicted salinity in the Delta using the latest calibrated version of DSM2 approaches much closer to the field data compared to the 1997 version. So, it became apparent that using a 19-year mean tide with the latest calibrated version of DSM2 may overestimate the salinity in the Delta. In fact, a test run confirmed this hypothesis.

## 9.2 Design Repeating Tide

A modified repeating tide was generated. The goal was for the model results using this repeating tide to be very close to those using a real tide. To accomplish this, stage values for the 19-year mean tide were modified in such a way that the average value was kept the same, but the amplitude was reduced. The following equation illustrates how this was implemented:

$$Z^*(t) = Z_{avg} + (1-R) \times [Z(t) - Z_{avg}] \quad [\text{Eqn. 9-1}]$$

Where:

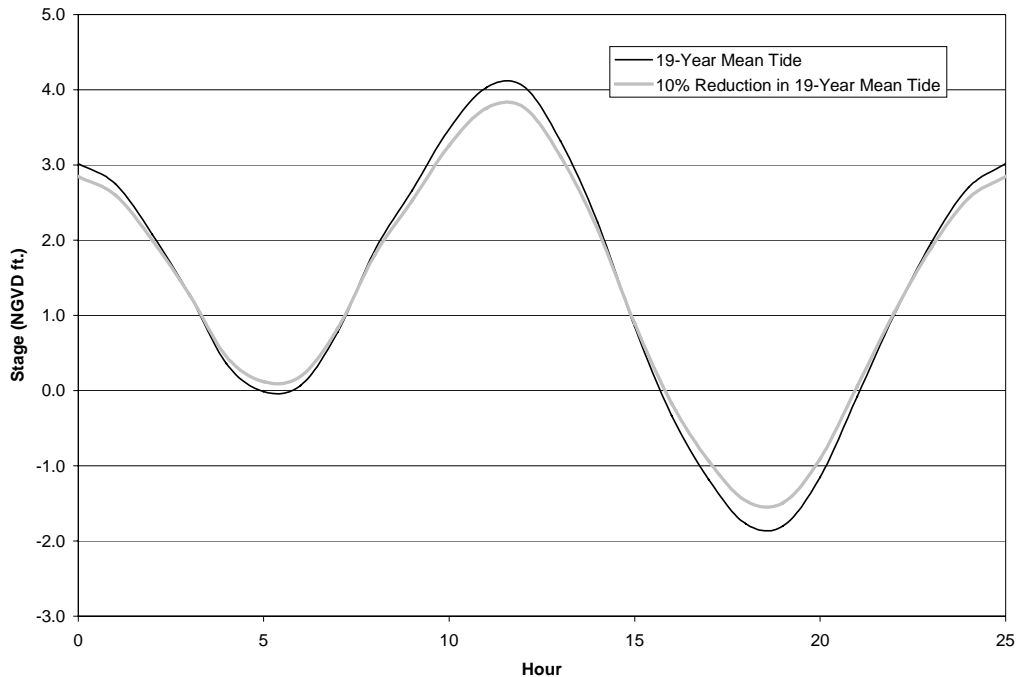
- $Z^*(t)$  = time-series for stage at Martinez for the proposed repeating tide,
- $Z(t)$  = time-series for stage at Martinez representing the 19-year mean tide,
- $Z_{avg}$  = average stage based on the 19-year mean tide, and
- $R$  = Reduction rate in amplitude (Used as a calibration parameter).

The reduction in amplitude implies a less powerful tide, and thus a reduction in salinity intrusion is expected. The magnitude of the reduction in amplitude was considered as a calibration parameter. A series of test runs were completed with varying degrees of reduction in amplitude of the tidal stage ( $R$ ). These test runs covered January 1992 through September 1999.

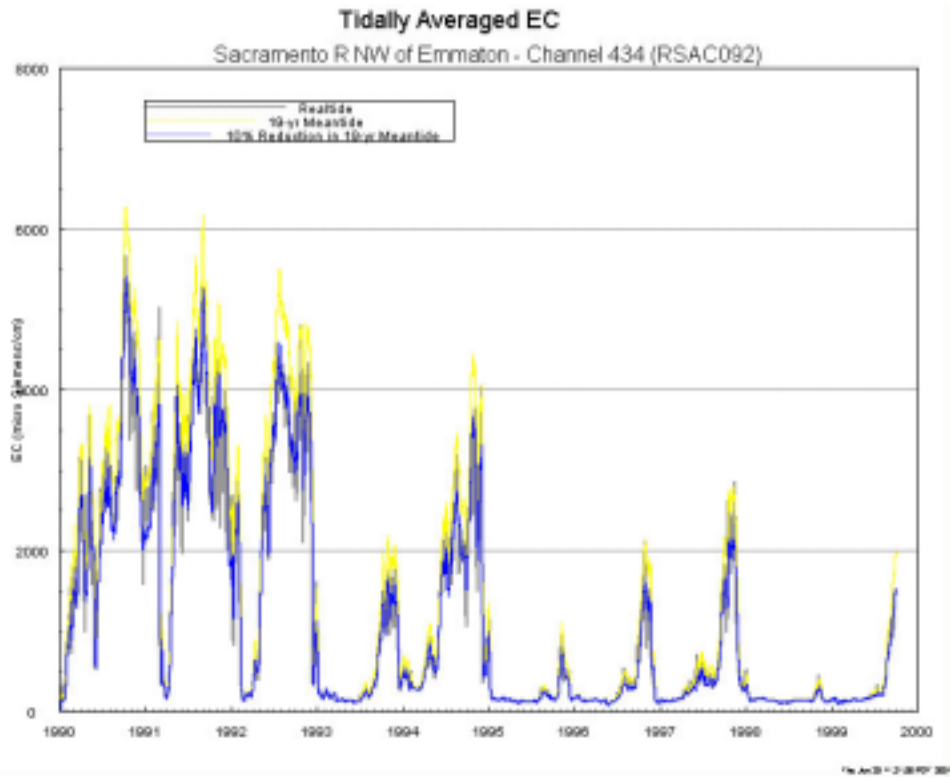
### 9.3 Results

Test runs revealed that a 10% reduction in amplitude leads to the closest match with the model results using the real tide. Figure 9-1 shows a comparison of the 19-year mean tide versus the proposed repeating tide. Figures 9-2 through 9-4 show a three-way comparison of EC predictions at three key locations in the Delta using the proposed repeating tide, and those using the 19-year mean tide versus the ones using the real tide.

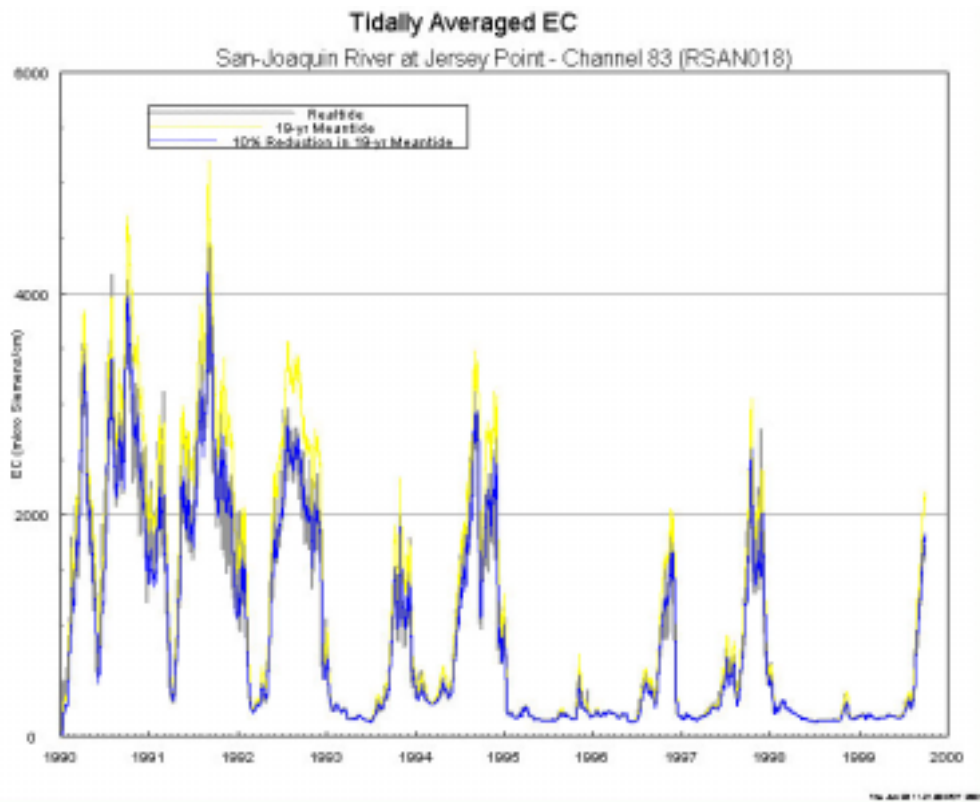
**Figure 9-1: 19-Year Mean Tide and Adjustment**



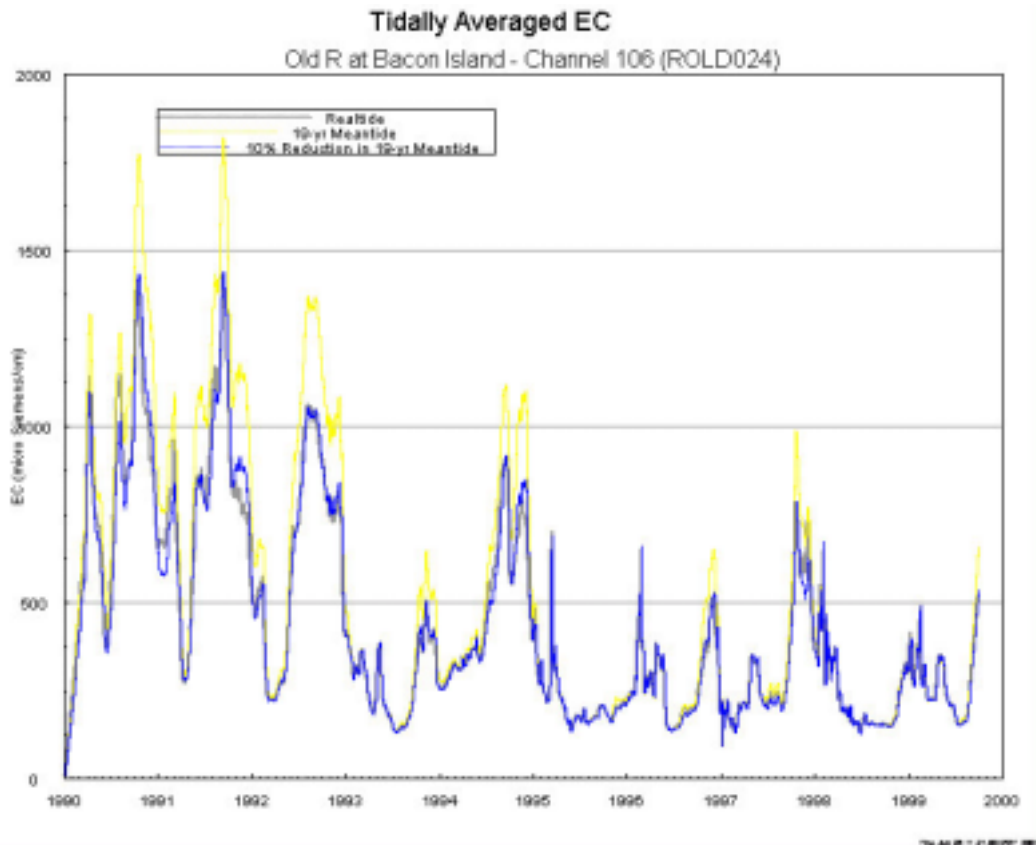
**Figure 9-1: 19-Year Mean Tide and Adjustment.**



**Figure 9-2: Comparison of EC for the Sacramento River at Emmaton.**



**Figure 9-3: Comparison of EC for the San Joaquin River at Jersey Point.**



**Figure 9-4: Comparison of EC for the Old River at Bacon Island.**

## 9.4 Recommendations

It is recommended that all future DSM2 planning runs using repeating tides utilize the above proposed tide. This can be considered a short term solution until the methodology for using a real tide in planning runs is in place.

As for the terminology, it is recommended that this proposed tide be called a “Design Repeating Tide”, as it is no longer a 19-year mean tide.