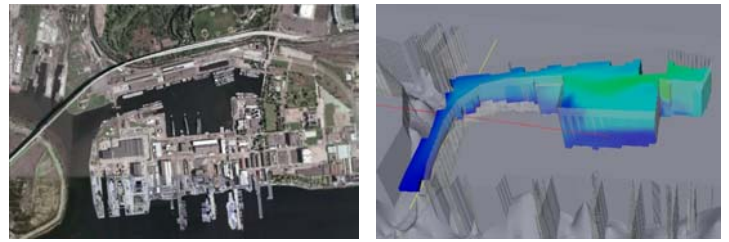


Circulation and Thermal Effects of Heated Discharge

NAVFAC, Naval Reserve Basin, Pennsylvania



Situation

Naval Facilities Engineering Command (NAVFAC) is installing new test equipment at the Naval Reserve Basin (NRB) that will result in a thermal load in addition to the load from the existing power plant at the site. The system was modeled to characterize the size and configuration of the thermal plume due to the operation of the combined sources. The physical processes that need to be incorporated into the 3-D hydrodynamic and transport computations are tides in the Delaware River, surface wind shear and heat exchange throughout the model domain, freshwater inflow rates and temperatures for the Schuylkill River, the intake and discharge rate and condenser temperature rise for the power plant, and the intake and discharge rate and temperature rise for the Building 633 Test Facility.

Approach

GEMSS® (Generalized Environmental Modeling System for Surfacewaters) was used to study the circulation and thermal effects of the combined, heated discharge. To properly incorporate the physical processes that force the circulation in the NRB, the model domain needs to cover a portion of the Delaware River, the Schuylkill River to the head of tide at Fairmont Dam, and the NRB itself. Figure 1 shows the grid. The effect on circulation of the ships stored in the NRB was also considered.

Results

The 3-D model results indicate the circulation patterns change rapidly with tidal reversals in the Delaware. Figure 2 shows the velocity vectors and excess temperature contours in the NRB and adjacent Schuylkill. The effects of the

thermal plume decrease with distance from the Building 633 Test Facility. The model results also show that a portion of the thermal plume enters the Schuylkill River, but does not impact the Delaware River.

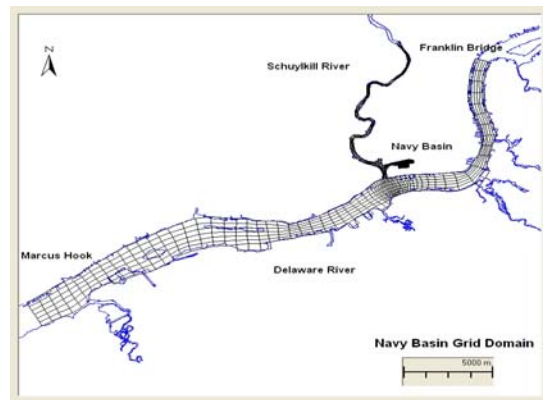


Figure 1 Model domain and grid

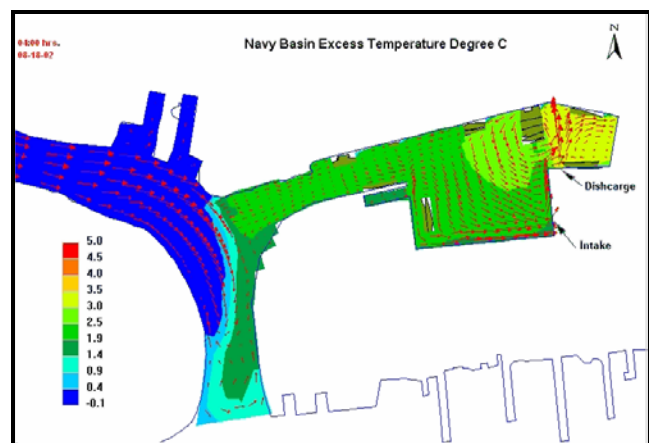


Figure 2 Example of the computed circulation and temperature rise due to the thermal discharge