RIVER ONLY MODELS
HEAT SOURCE - (Oregon DEQ Model)

- Riverine model developed as a masters thesis to simulate stream thermodynamics in smaller streams with varying vegetative canopy
- Simulations are focused on hourly temperature change
- Calculates riparian and topographic shading values for every minute for one full day length

CE-QUAL-RIV1 - (Army Corps Model)

- Riverine 1-dimensional (longitudinal) model, with hydrodynamic component model (RIV1H) output driving water quality component model (RIV1Q)
- Developed to simulate the transient water quality conditions associated with highly unsteady storm flows and on regulated streams below peaking facilities, but can be used under steady flow conditions
- Branched networks can be modeled with multiple and varied hydraulic control structures (run-of-river dams, locks, re-regulation dams, etc.)
- Temperature is one of 12 water quality components modeled
**DSSAMt** - (Frostburg State University Model)

- Developed to simulate the regulated flow, nutrient loading from point source and non-point sources in shallower, small to medium sized rivers

- Is dynamic with certain meteorological parameters, but not with stream flow (assumes steady flow)

- Used for water rights flow augmentation, setting TMDL’s, non-source pollution reduction, and river channel restoration

- As a water quality model, can simulate diel swings of stream temperature and up to 3 additional water quality variables

- Meteorological data input minimum time step of one hour

**RMA-11** - (Resource Management Associates Model)

(One/Two/Three-Dimensional Finite Element Model for Water Quality Simulation)

- Developed for simulating numerous water quality parameters (14 in addition to water temperature) in a rivers, estuaries, or groundwater environments

- May be executed in a steady-state or dynamic mode

- RMA-11 is designed to accept velocity and depth input from the results of the 2-D hydrodynamic model (RMA-2) or the 3-D stratified flow model (RMA-10)

- Simulates stream temperature in a longitudinal and lateral distribution pattern
SSTEMP - (Stream Segment Temperature Model)
(US Fish & Wildlife Service)

- A simplified, spreadsheet version of SNTEMP used for simple systems and as a learning tool

- May be used to evaluate alternative reservoir releases, analyze the effects of changing riparian shade, and examine the effects of different stream withdrawals and returns on instream temperature

- Limited to a single stream segment, and one time period
SNTEMP -  (Stream Network Temperature Model)  
(US Fish & Wildlife Service)

- Developed to help biologists and engineers predict the consequences of stream manipulation on water temperatures
- Is a mechanistic, one-dimensional heat transport model that predicts daily mean and maximum water temperatures as a function of stream distance and environmental heat flux
- Incorporates a topographic and vegetative shade module
- Utilizes readily available meteorological and hydrological input variables represented by 24-hour to monthly averages, and in between
- Applies to a stream network of any size, order, or complexity
- Corrects air temperature, relative humidity, and atmospheric pressure as functions of elevations within a watershed
- Provides statistical goodness-of-fit output to help judge the model’s power of estimation
- Assumption of a thoroughly mixed stream vertically and transversely

MODEL-Y -  (Timber/Fish/Wildlife)

- Simple basin model utilizing TEMPEST model’s energy balance equations combined with travel time, stream depth, and regional air temperature profiles
- Requires minimal data (sky view factor, ecoregion, and stream network) and is easy to use to test different scenarios
- Provides for dynamic simulation with a one-hour timestep
TEMP-86 - (Beschta and Weatherred)

- Reach-specific energy budget model oriented specifically to evaluate the effects of shade on stream temperatures
- Model based on a stream reach heat energy budget, with solar radiation as prime energy source
- Involves a highly detailed shade analysis – often used for forestry management (buffer strips)
- Predicts hourly temperatures for any selected day

TEMPEST - (Oregon State University)

- An unpublished, heat transfer model with simplified variable input (5 input variables)
- Involves a riparian shade analysis – most often used in forestry management (effects of buffer strips)
- Predicts hourly temperatures over any specified interval

TVA River Modeling System
(Tennessee Valley Authority Model)

- A dynamic, basin-type water quality predictive model, capable of modeling flows fluctuating on less than a 24 hour time step (can input parameters as frequent as hourly time-step)
- Consists of the ADYN flow model linked to the RQUAL water quality model (both developed by TVA)
- Capable of predicting three other variables besides temperature
- Utilizes a shade effect modeling component
- Primary use is in the southeastern region of the U.S.
COLUMBIA R TEMP MODEL - YEARSLEY

- Requires dividing the river/reservoir system into an array segments

- For each segment, a one-dimensional, “thermal energy budget” is generated – thermal energy of water flowing in and out balanced with adjustments for tributaries and groundwater as well as energy exchanged with the atmosphere

- Generates resulting temperatures as daily averages

- Does not work with unsteady flow or stratified thermal conditions