Improving Aquatic Modeling: Changes to conceptual models and mathematical approaches incorporated into Bins 3 and 4 (flowing waters)
Breakout Group 1 - Report Out

June 30, 2016

Breakout Discussion

- Current model runs indicate waterbodies are only flowing when runoff occurs. Waterbodies should have a minimum volume that affords baseflow and that can increase with the addition of daily runoff.
- Current model runs indicate a disconnect with loading and runoff. Results of model runs assume that mass load enters bin in advance of and separate from runoff. This outcome results in very high pesticide concentrations.
- Concentration in receiving waterbody can't exceed the concentration in the runoff, except when spray drift occurs.
- Time scale of reported output should be in line with time scale of inputs – meteorological data available at a daily time step.
- For a Bin 3 / 4 watershed, the peak concentrations should be reduced, when compared to Bin 2 EECs, and flattened out over time to be reflective of dispersion and peak desynchronization due to time of travel.

EECs – Estimated Environmental Concentrations

Breakout Discussion

- Use of watershed model would allow for division of a larger watershed into smaller subbasins and catchments that would allow for the following:
  - different uses and agronomic practices to be modeled and aggregated,
  - proper accounting of pesticide loading and routing thru the waterbody, and
  - accounting for dispersion/time of travel issues.
- Intensive parameterization would keep watershed modeling on a national-scale from being a short-term task, but short-term tasks for different charge questions could be used to collect the parameters that would eventually lead to watershed modeling in the long-term.

Breakout Group 1
Estimating Exposure in Aquatic Habitats Represented by Flowing Bins 3 and 4

- CHARGE QUESTION (1):
  - **EPA explored several factors in using the PWC, including incorporation of a baseflow and use of the daily average instead of the instantaneous peak EEC. What are the strengths and weaknesses of these modifications? Are there other modifications that can be made and what are their strengths and weaknesses?**

PWC – Pesticide in Water Calculator

Short-term Tasks

- Charge Question 1
  - Conduct spatial analyses to evaluate variation of baseflow throughout HUC 2s and incorporate baseflow into PWC runs.
  - Evaluate how baseflow varies over course of a year (SWAT, USGS data) and consider introducing temporal variation (*i.e.*, seasonal).
  - Use daily average EECs rather than an instantaneous peak; include daily surface runoff volume addition to the waterbody.
  - Conduct sensitivity analyses on parameters that were used in previous refinements exercise to evaluate which ones have greatest impacts on EECs.

HUC – hydrologic unit code. SWAT – Soil and Watershed Assessment Tool , USGS – US Geological Survey

Breakout Group 1
Estimating Exposure in Aquatic Habitats Represented by Flowing Bins 3 and 4

- CHARGE QUESTION (2):
  - **How appropriate are the methods used in the draft BEs to develop field/watershed sizes and waterbody lengths for these Bins? What reasonable alternatives could be used to model watershed processes that allow for accurate estimation of possible exposure concentrations (including the maximum) in these flowing bins based on product labeling?**

Short-term Tasks

- Charge Question 2
  - Identify a watershed with Bins 3, 4 dimensions and determine how the model hydrograph compares with the watershed hydrograph.
  - Employ different techniques to evaluate realism of watershed and waterbody dimensions: *e.g.*, StreamStats and USGS-derived GIS coverage.
  - Use baseflow residence time of one day to constrain length of waterbody and size of watershed (dependent on outcome of Short-term Tasks, Charge Question 3).
  - In regions where waterbodies do not reach conceptual flow of Bin 4, cap watershed size and waterbody length using highest flowrate.

Breakout Group 1
Estimating Exposure in Aquatic Habitats Represented by Flowing Bins 3 and 4

- CHARGE QUESTION (3):
  - **For the bins (3 and 4) that represent larger flowing systems, what ways of incorporating the effects of dispersive mixing and/or peak desynchronization into concentration estimates are reasonable?**

Short-term Tasks

- Charge Question 3
  - Explore the “time of travel” convolution approach to represent dispersive and advective mixing and peak desynchronization.
    - Within a watershed, the lengths of streams that converge on a common point vary, and transport times for constituents introduced to the streams vary similarly. This means that if a pulse of some constituent were to be introduced to all streams simultaneously, they would arrive at the common downstream point at different times (peak desynchronization).

Breakout Group 1
Estimating Exposure in Aquatic Habitats Represented by Flowing Bins 3 and 4

- CHARGE QUESTION (4):

  - **What are the strengths and weaknesses of alternative mechanistic or regression-based watershed models such as the Soil and Watershed Assessment Tool (SWAT), the Hydrological Simulation Program-Fortran (HSPF) and the Watershed Regressions for Pesticides (WARP) for simulating aquatic pesticide concentrations at the temporal resolution and national scales required for ESA assessment? Are there other watershed models that should be considered?**

Short-term Tasks

- Charge Question 4
  - Evaluate watershed models (*e.g.*, SWAT, HSPF, SAM, and WARP) on local-scale and compare to results of PWC EECs.
  - Conduct / take advantage of existing sensitivity analysis on inputs to watershed models.

SAM – Spatial Aquatic Model

Breakout Group 1
Estimating Exposure in Aquatic Habitats Represented by Flowing Bins 3 and 4

- CHARGE QUESTION (5):
  - **What is the desired and appropriate spatial scale for EECs for Bins 3 and 4? Specific PWC EECs were developed for HUC2 regions. Can or should the EECs for Bins 3 and 4 be at a finer spatial scale given a nationwide consultation?**

Short-term Tasks

- Charge Question 5
  - Scale of modeling Bins 3 and 4 is dependent on where you are in the country (*e.g.*, humid versus arid conditions).
  - For Bin 3, a single scenario across a HUC 2 does not seem reasonable, but how many scenarios do you develop and how do you interpret results?
  - Explore use of GIS to evaluate variety of cropping patterns and inform number of different scenarios needed
  - Explore use of SSURGO to inform development of various PRZM scenarios, particularly in areas that fall in the vicinity of the listed species range.

GIS – Geographic Information System. SSURGO - Soil Survey Geographic Database.
PRZM – Pesticide Root Zone Model

Long-term Tasks

- Use of watershed models (*e.g.*, SWAT, HSPF, SAM, and WARP) to estimate spatially and temporally explicit concentrations in medium and high flow waterbodies (*i.e.*, Bins 3 and 4).
- Consider employing PRZM5 with SWAT water routing routines.
- Identify a watershed with wealth of monitoring data to evaluate modeling results.
- Examine sources of annual production volumes and spatial usage patterns: *e.g.,* the Section 7 (FIFRA) tracking system (OECA) annual production volume, AGROTRAK and economic projections to get upper bound projections on potential applications.
- Reconcile spray drift contribution at the watershed scale.
- Explore the watershed size vs "time of concentration."

FIFRA – Federal Insecticide, Fungicide, and Rodenticide Act. OECA – Office of Enforcement and Compliance Assurance

Parking Lot Issues

- Identify a vulnerable watershed and explore the development of a generic screening-level watershed(s) for modeling.

Questions?