SIMPTM: A Simplified Explanation

SIMPTM (SIMplified Particulate Transport Model) is a computer program that simulates how stormwater gets polluted in urban areas. It focuses on how different processes contribute to this pollution over time.

Key Processes Simulated by SIMPTM:

1. **Dry Weather Accumulation:** The model tracks the build-up of "street dirt" (contaminated sediment) on roads, driveways, parking lots, and other surfaces when it's not raining.
2. **Wet Weather Accumulation (Washon):** SIMPTM accounts for how rain washes additional contaminated sediment from surrounding areas onto these surfaces, adding to the existing street dirt.
3. **Washoff:** The model simulates how rainwater flowing over these surfaces (either in shallow sheets or concentrated in gutters) picks up and carries away the accumulated contaminated sediments. It uses established sediment transport equations.
4. **Street Sweeping:** SIMPTM factors in removing contaminated sediment through regular street sweeping, using equations specific to different types of street sweepers.
5. **Catch Basin Sediment Trapping:** The model includes equations to estimate how effectively catchbasins (storm drains with sumps) trap and remove sediments transported by stormwater.
6. **Pollutant Association:** SIMPTM can link other pollutants of concern to sediment particles. Based on street dirt data, it uses "potencies" (ratios) to relate the amount of a specific pollutant to the different sizes of sediment particles. It considers eight different particle sizes from one micron to greater than 6,370 microns.

How SIMPTM Works:

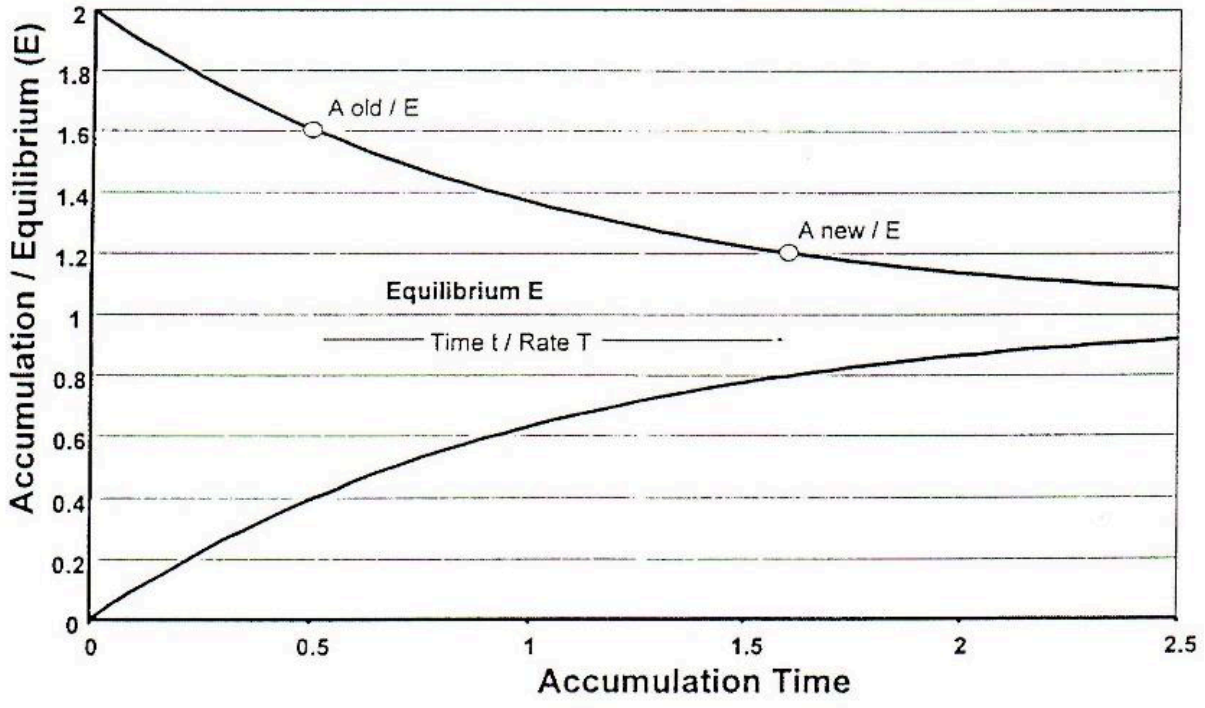
- **Continuous Simulation:** SIMPTM runs continuously, tracking these processes over time.
- **Driving Data:**
  - It can use historical hourly rainfall data for areas without freezing/thawing.
  - Alternatively (Version 5.0 and later), it can use a continuous runoff (water flow) trace with time steps from 5 to 60 minutes. This allows SIMPTM to be linked with other hydrologic models

like SWMM or HSPF, which provide the runoff data.
This is particularly useful in areas with freeze-thaw cycles, as the hydrologic model can account for these conditions before providing flow data to SIMPTM.

- **Sediment Transport Equations:** SIMPTM employs the Yalin-Einstein and Foster-Meyer equations. It also continuously considers sediment armoring (where larger particles protect smaller ones from being washed away) to calculate the flow's capacity to transport sediment. According to the document, this is more accurate than the simple exponential washoff method used in other models like EPA's SWMM.
- **Deposition and Resuspension:** SIMPTM models sediment settling and re-entering the flow.
- **Removal Practices:** The model estimates sediment removed by street cleaning and catch basin maintenance based on measurable data rather than user-specified removal percentages.

Key Advantages of SIMPTM:

- **Realistic Accumulation Modeling:** Unlike some other models (SWMM, SLAMM), SIMPTM accounts for sediment accumulation on paved surfaces that can *increase* during wet periods due to "washon" from surrounding areas. It recognizes that dry days don't always lead to increased accumulation, especially after significant rainfall. Instead, SIMPTM uses a dynamic equilibrium. See graphic below.



$$A_{new} = (A - E)(e^{-t/T} - 1)$$

- **Basin-Wide Planning:** SIMPTM generates spreadsheet-ready output files, which facilitates the combination of unit runoffs and pollutant washoffs from various land uses across a basin. This allows for easy calculation of subbasin and basin-wide predictions.

Calibration:

Many input parameters can be determined from site visits, maps, aerial photos, or drainage system inventories. Google Earth's Street View can also be helpful. The document suggests the following for calibrating the model:

1. **Match Runoff Volume:** Adjust effective impervious area and loss parameters to match runoff volume and rainfall/runoff durations.
2. **Match Sediment Accumulation and Washoff:** Adjust impervious accumulation and availability to match total solids (TS) or total sediments accumulation and washoff, especially during smaller storms. Consider pervious area contributions during larger events.
3. **Match Other Pollutants:** Adjust pollutant strengths for each particle size group to match other pollutants. Compare TS-pollutant ratios on paved surfaces with those washing off and in sediment traps.
4. **Verify Parameters:** Use data from different periods to verify the calibrated parameters.
5. **Account for Land Use Differences:** Adjust parameters to reflect observed land-use characteristics differences between the calibrated and to-be-simulated basins. Use good judgment to assess the results.

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