WEPP – Wind Erosion Prediction System
- Wind emission and transport of soil
- Threshold: dryness, roughness, small particles
- Detachment: dry, stability, abrasion

WEPP – Water Erosion Prediction Project
- Rainfall/runoff detachment and transport of soil
- Threshold: infiltration/runoff, slope, detention
- Detachment: wet stability, shear, abrasion

WEPP Hydrology in WEPS
WEPP hydrology routines were previously integrated into WEPS to reduce the computational requirements for WEPP simulations. Testing has shown that the runoff, infiltration, evaporation, and winter hydrology within this code and the original WEPP code are significantly different. Using a fallow soil test scenario, the factors causing these differences have been isolated to include random roughness, hydraulic conductivity, soil matric potential, reference evapotranspiration, soil layering, snowfall and snow melt processes. It is expected that test scenarios with growing crops will lead to an additional set of difference factors.

Comparison Simulations
WEPP and WEPS (with WEPP hydrology) simulations were run with "identical" input data sets.

Comparison Count of Events / Depth of Runoff

<table>
<thead>
<tr>
<th>Event Model</th>
<th>Precip.</th>
<th>Runoff</th>
<th>Snowfall</th>
<th>Snow Melt</th>
<th>Snow versus Rain in other</th>
<th>Runoff/rainfall (mm/mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEPS</td>
<td>832</td>
<td>822</td>
<td>61</td>
<td>61</td>
<td>11</td>
<td>0.047</td>
</tr>
<tr>
<td>WEPP</td>
<td>832</td>
<td>838</td>
<td>79</td>
<td>84</td>
<td>28</td>
<td>0.086</td>
</tr>
</tbody>
</table>

Calculation of effective Hydraulic Conductivity
In WEPP, the effective hydraulic conductivity used for infiltration is aggregated from the baseline hydraulic conductivity of the tilled soil layers, found by fitting model runs to rainfall/runoff plot data for freshly tilled fallow plots. Additional adjustments to account for crust development, vegetation effects and frozen soil are applied to arrive at the effective value. When the WEPP infiltration routines were inserted into WEPS, the baseline hydraulic conductivity was directly estimated from the saturated hydraulic conductivity. The difference between the two is seen in the figure to the right. This likely explains much of the difference in runoff between the two models.

Necessary Modifications
Making changes requires careful monitoring of the effects in the model being modified. Calibration data sets are available for both for comparison purposes. Changing the lower limit of random roughness in WEPS changed the runoff amounts for small events.

Soil Matric Potential and Water Balance
Soil matric potential (figure to right) is also a primary driver of the infiltration rate and therefore runoff. Soil water content and a soil water release curve are used to find this value. A plot of that relationship (to right below) shows differences. Soil water content also varies between the two, possibly related to a difference in the bare soil evaporation or the method used to find potential evapo-transpiration.

Winter Routines
Independently developed systems for determining when precipitation is snow and finding the energy balance for snow melt show as snow on the ground for different periods of time.

Conclusions
The two models were developed to model very different types of erosion processes. Resolving the differences requires retaining the process sub-models from both that are critical to modeling their specific erosion type while monitoring the changes made against the original calibration data.