<table>
<thead>
<tr>
<th>Köhler theory</th>
<th>Nano-Köhler theory</th>
<th>Real molecular systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Describes the activation of CCN (d_p &gt; 50\ \text{nm}) to cloud droplets by spontaneous condensation of water vapor.</td>
<td>Describes the activation of inorganic clusters (d_p = \sim 1-3\ \text{nm}) for growth by spontaneous condensation of organic vapor.</td>
<td>A distribution of clusters of varying sizes and compositions including inorganic and organic compounds can exist simultaneously at all times.</td>
</tr>
<tr>
<td>The condensing vapor is water vapor with typical atmospheric concentrations of (\sim 10^{17}\ \text{cm}^{-3}).</td>
<td>The condensing vapor is a water-soluble organic compound with concentrations likely ranging from (\sim 10^5) to (10^8\ \text{cm}^{-3}) (Jokinen et al., 2017).</td>
<td>Vapor concentrations are not constant but may vary over time.</td>
</tr>
<tr>
<td>The seed consists of a mixture of inorganic/organic compounds and is water soluble. The seed compounds do not evaporate.</td>
<td>The seed consists of sulfuric acid and bases and is soluble in the condensing organic compound. The seed compounds do not evaporate but condense irreversibly on the cluster.</td>
<td>There is no seed in the same sense as in the theory. Both inorganic and organic compounds can condense and evaporate and may contribute to the growth.</td>
</tr>
<tr>
<td>Thermodynamic equilibrium between water and the seed particle is assumed.</td>
<td>Thermodynamic equilibrium between the organic compound, the seed cluster and water is assumed. The energy barrier width in nano-Köhler is very narrow with respect to the number of molecules compared to Köhler theory, and thus addition of only few molecules may result in overcoming the barrier.</td>
<td>Clusters can nucleate over barriers and they may not be in thermodynamic equilibrium before activation to growth.</td>
</tr>
<tr>
<td>The growing cloud droplets scavenge the available water vapor thereby limiting the activation process.</td>
<td>The loss rate of organic vapor is determined mainly by larger background aerosol particles and not the growing clusters.</td>
<td>The cluster population is affected by losses due to background particles, and cluster self-coagulation may also be important. The magnitude of external losses may vary over time.</td>
</tr>
</tbody>
</table>