What will our computing needs at ESRL be in the coming decade(s)?
All roads lead to cloud-resolving/eddy-resolving coupled GCMs...

Solutions for atmospheric convection do not statistically converge until $h < O(1000 \text{ m})$
• High resolution global models
  – Below 5 km, scales and physics change
• Global non-hydrostatic numerical weather model
  – 2 km resolution requires ~200 TF sustained
  – 1 km requires 1.6 PF sustained
• Major research problem just getting started

<table>
<thead>
<tr>
<th>Resolution (km)</th>
<th>TFLOPS sustained to achieve 60 days/day</th>
<th>TFLOPS sustained to achieve 5 years/day</th>
<th>Global WRF Data volume TB/sim year</th>
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<td>1892</td>
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</table>

Src: Petascale Collaboratory for the Geosciences, 2005

and it’s not just a single run of the model...
• ensembles
• data assimilation