Long run-out debris flows from Mount Meager volcano

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Outline

• Cascade volcanoes in B.C.
• The 2010 Capricorn Creek landslide
• Mount Meager flank collapses
• Downstream debris flows
• Risk
The 2010 Capricorn Creek landslide
Cascade volcanoes in B.C.

Mount Meager

USGS

Clague et al. 2003

Clague et al. 2007

Juan de Fuca Ridge

Juan de Fuca plate

Cascadia subduction zone

Explorer plate

North America plate

British Columbia

Clague et al. 2003

Cascadia Volcanic Arc

Clague et al. 2007
Clague et al. 2003
Flank collapses
Downstream debris flows

Friele et al. 2005
Figure 5

Debris Flow Volumes (cubic metres)

- Red: 1,000,000
- Yellow: 10,000,000
- Green: 100,000,000
- Pink: 1,000,000,000

Simpson et al. 2006
<table>
<thead>
<tr>
<th>Debris flow class</th>
<th>Volume (m$^3$)</th>
<th>Peak discharge$^1$ (m$^3$/s)</th>
<th>Inundation area$^1$ (m$^2$)</th>
<th>Potential consequences$^1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>$10^5$–$10^6$</td>
<td>$3 \times 10^3$–$3 \times 10^4$</td>
<td>$2 \times 10^6$–$3 \times 10^7$</td>
<td>Could obliterate valleys or fans up to several tens of km$^2$ in size and dam rivers. Modeling indicates events are confined to Meager and upper Lilooet valleys.$^2$</td>
</tr>
<tr>
<td>7</td>
<td>$10^6$–$10^7$</td>
<td>$3 \times 10^4$–$3 \times 10^5$</td>
<td>$3 \times 10^7$–$3 \times 10^8$</td>
<td>Could obliterate valleys or fans up to several tens of km$^2$ in size, and dam large rivers with the potential for destructive outburst floods and hyperconcentrated flows. Modeling indicates debris flows travel up to 5 km downstream from the Meager-Lilooet river confluence.$^2$ The 1931 Devastation debris flow reached Lilooet River and caused muddy surges 15 km downstream.</td>
</tr>
<tr>
<td>8</td>
<td>$10^7$–$10^8$</td>
<td>$3 \times 10^5$–$3 \times 10^6$</td>
<td>$3 \times 10^8$–$3 \times 10^9$</td>
<td>Could inundate large valleys up to 100 km$^2$ in size, and dam large rivers with the potential for destructive outburst floods and hyperconcentrated flows. Modeling indicates debris flows may reach upstream limits of settlement.$^2$ Vast and complete destruction over hundreds of km$^2$. Modeling indicates debris flows would inundate the entire Lilooet River valley, travelling 20–75 km downstream from Mount Meager to Lilooet Lake.$^2$ Field evidence documents deposits of three debris flow deposits 32–50 km downstream from the volcano.</td>
</tr>
<tr>
<td>9</td>
<td>$10^8$–$10^9$</td>
<td>$3 \times 10^6$–$3 \times 10^7$</td>
<td>$3 \times 10^9$–$3 \times 10^{10}$</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>$&gt;10^9$</td>
<td>$3 \times 10^7$–$3 \times 10^8$</td>
<td>$&gt;3 \times 10^{10}$</td>
<td>No known events.</td>
</tr>
</tbody>
</table>

Friele et al. 2008