The key role of meteorological preconditions in triggering large-scale floods

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Flooding

Severe and large-scale flooding is triggered by the interaction of:

- Precipitation and topography
- Land use and vegetation
- Soil moisture, soil type (infiltration and surface runoff)
- Timing of precipitation and flood peak discharge of tributaries
- Snow cover
- Hydrological and hydraulic aspects of rivers
- Structural measures (dikes, retention reservoirs)

Extreme rain event (SW-Germany, November 2015) in comparison to 2013 flood event

Table: Top 8 rain events since 1 January 1951 (Federal state of Baden-Württemberg (BW), Germany, ~ 35,000 km²):

<table>
<thead>
<tr>
<th>Date</th>
<th>Precipitation 24h</th>
<th>Precipitation 48h</th>
<th>Precipitation 72h</th>
</tr>
</thead>
<tbody>
<tr>
<td>07 Aug 1978</td>
<td>48.0 mm</td>
<td>83.0 mm</td>
<td>120.0 mm</td>
</tr>
<tr>
<td>06 Oct 1982</td>
<td>47.4 mm</td>
<td>86.8 mm</td>
<td>129.0 mm</td>
</tr>
<tr>
<td>01 Jun 1992</td>
<td>45.3 mm</td>
<td>88.3 mm</td>
<td>136.4 mm</td>
</tr>
<tr>
<td>08 Aug 1978</td>
<td>47.2 mm</td>
<td>87.2 mm</td>
<td>126.0 mm</td>
</tr>
<tr>
<td>22 May 1976</td>
<td>44.1 mm</td>
<td>85.9 mm</td>
<td>124.4 mm</td>
</tr>
<tr>
<td>23 May 1978</td>
<td>40.5 mm</td>
<td>78.7 mm</td>
<td>118.2 mm</td>
</tr>
<tr>
<td>24 Jul 1982</td>
<td>45.5 mm</td>
<td>88.3 mm</td>
<td>136.4 mm</td>
</tr>
<tr>
<td>03 Jun 1982</td>
<td>40.7 mm</td>
<td>85.9 mm</td>
<td>124.4 mm</td>
</tr>
<tr>
<td>19 Sep 1988</td>
<td>39.8 mm</td>
<td>78.7 mm</td>
<td>118.2 mm</td>
</tr>
</tbody>
</table>

Date represents last day of rain event. Data source: DWD

Conclusions

Precipitation

- Rain event Nov 2015 ranks 2nd since 1951 in BW in 48 hours
- 150-200 mm within 36-48 hours are extraordinary
- Several new daily records of rain amount within 24 hours
- Rain event in BW even heavier than 2013

Meteorological Preconditions

- Very low API values. No rain in 30 days before event
- Very dry months since February 2015 (!) in Bavaria, BW, Switzerland
- Nearly all rivers in BW were at low water, many of them close to their absolute minimum low water
- No snow cover neither in the Alps nor in the Black Forest

Consequences

- Nearly no flooding at all. Recurrence interval of nearly all gauges remained below 2 years
- Under normal circumstances, Nov 2015 rain event would have caused major flooding at least in Black Forest tributaries (rivers Kinzig, Murg, Nagold, Enz, Neckar)
- Preceding rain (initial soil moisture) is crucial for flooding

Further information:

www.wettergefahren-fruehwarnung.de
www.cedim.de