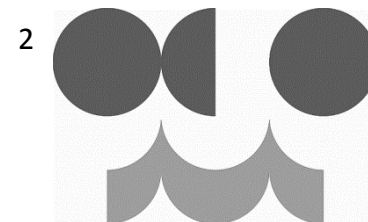


An Estimation of Precipitation Thresholds for Shallow Landslide Initiation, *Outer Western Carpathians, Czech Republic*

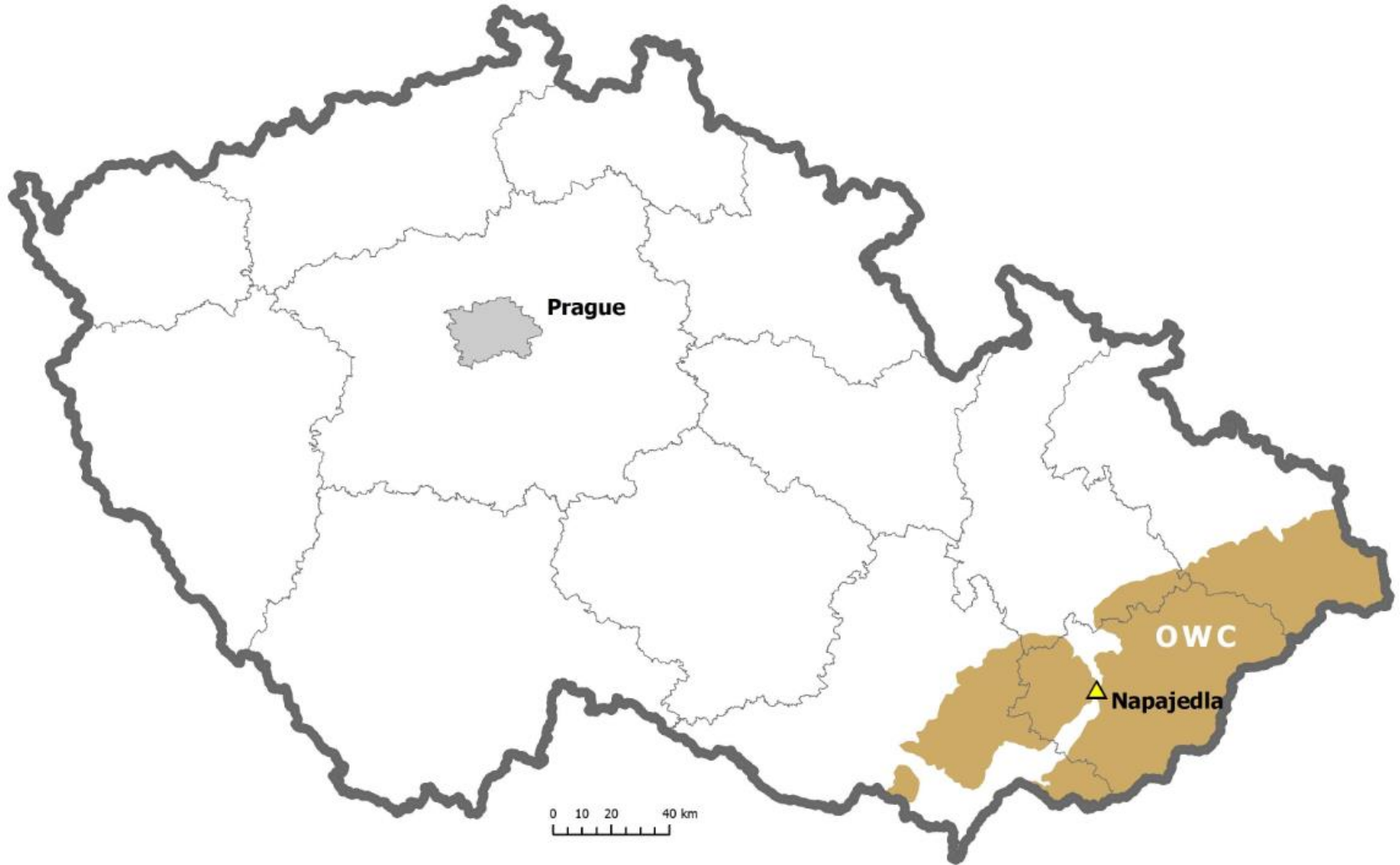
Michal Bíl¹, Richard Andrášik¹,

Jan Kubeček¹, Jiří Sedoník¹,

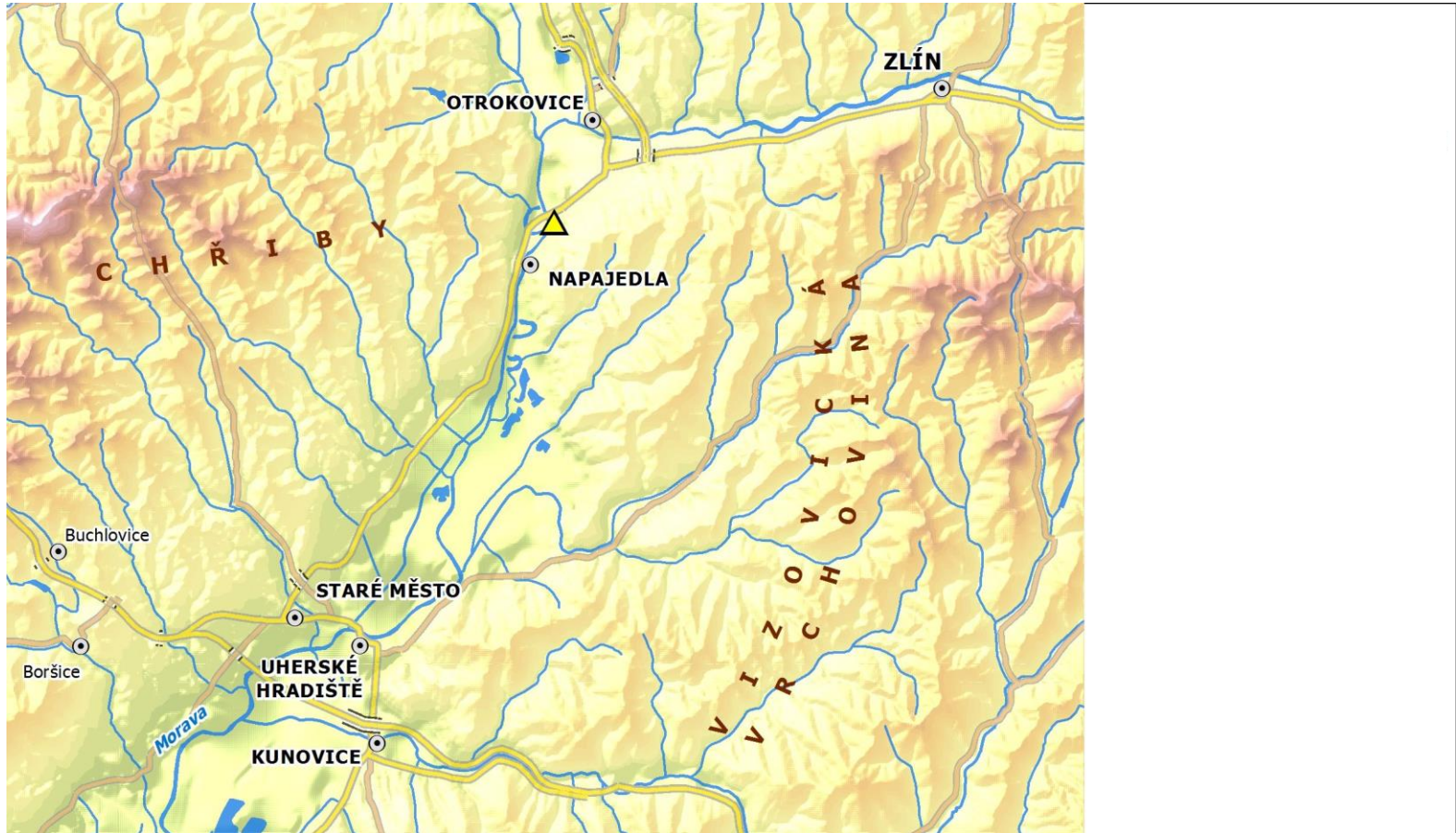
Pavel Zahradníček², Petr Štěpánek²



Study area



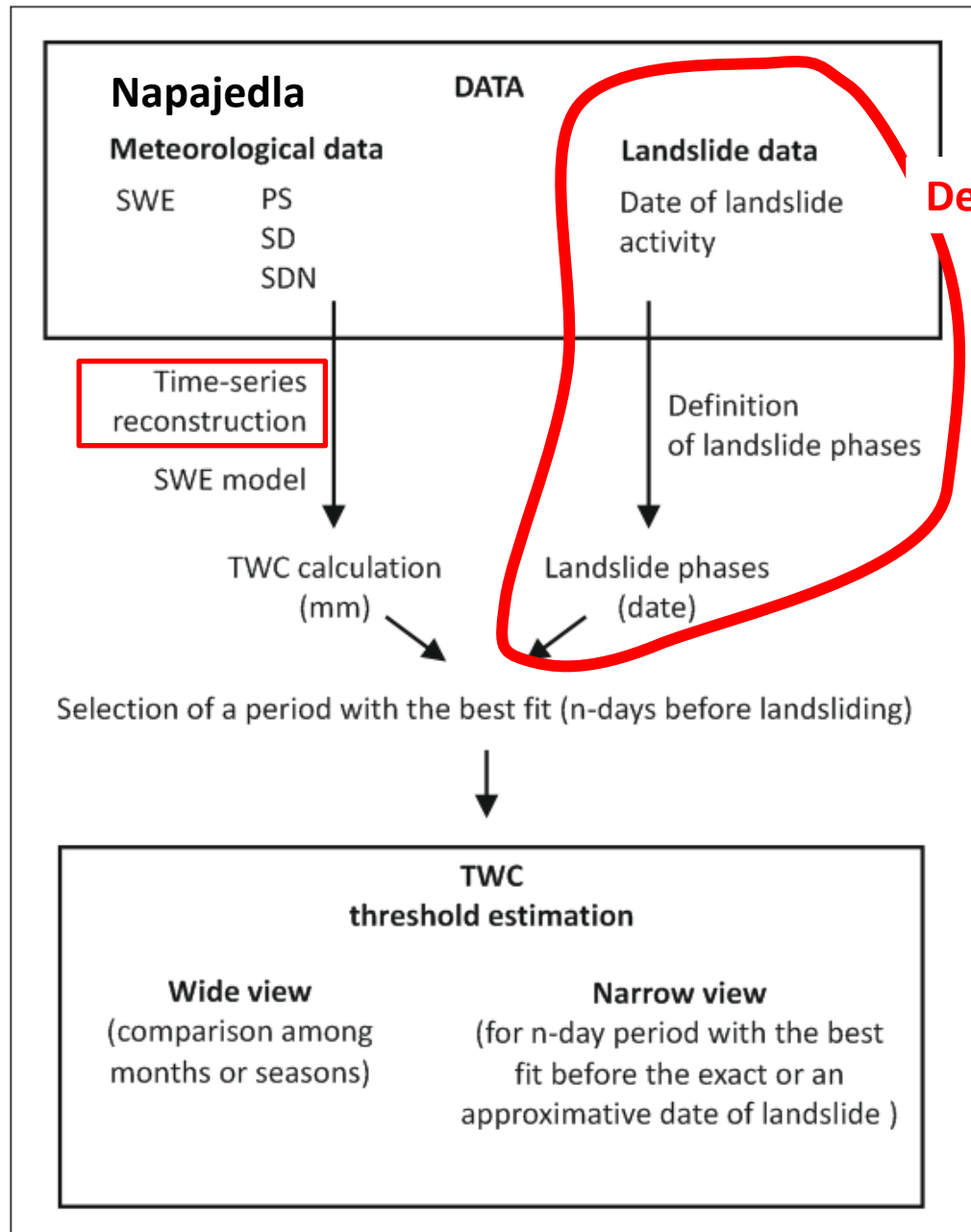
Napajedla station and landslide phases



Data issues

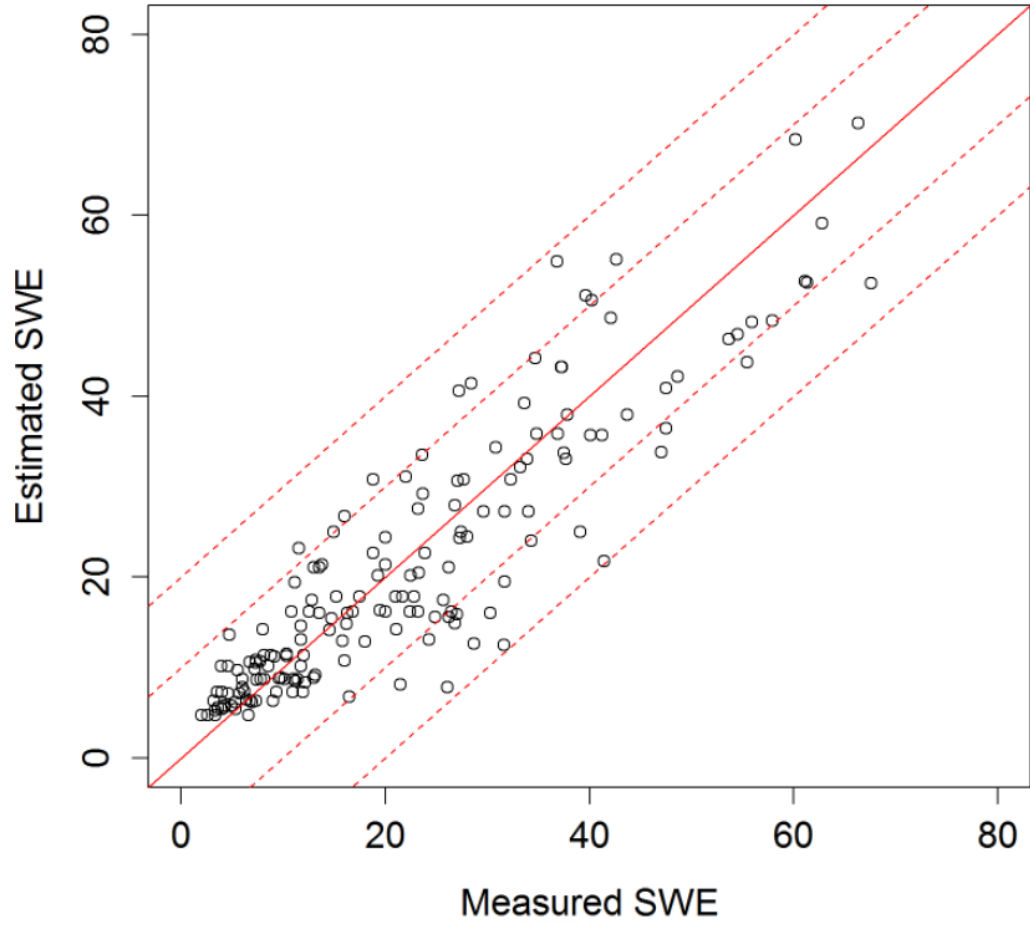
Data quality:

- Old rainfall and landslide data (*before and after 1997 events*)
- Unknown date when landslides took place (*esp. before 1997*)
- Incomplete Napajedla time-series (*since 1922 with gaps, SWE since 1977*)
- Standard methods duration x cumulative rainfall not possible (*too few episodes*)
- Landslides occurred during snowmelt → **snow water equivalent (SWE)** estimation → source of uncertainty

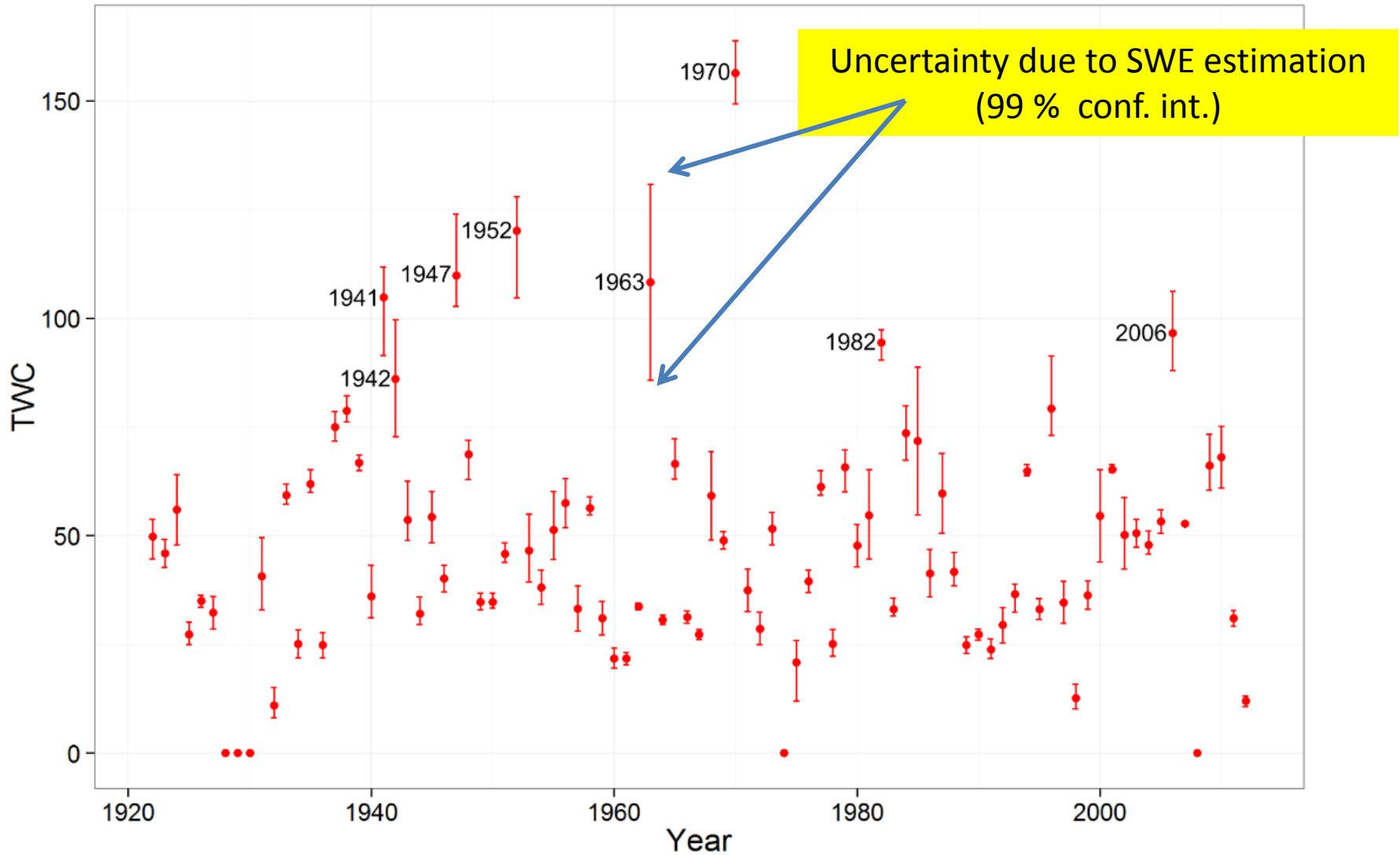


Defined previously

Snow Water Equivalent



TWC (total water content) within snowmelt period



Landslide phases according to their **TWC** within the whole Napajedla time-series (1922 – 2012)

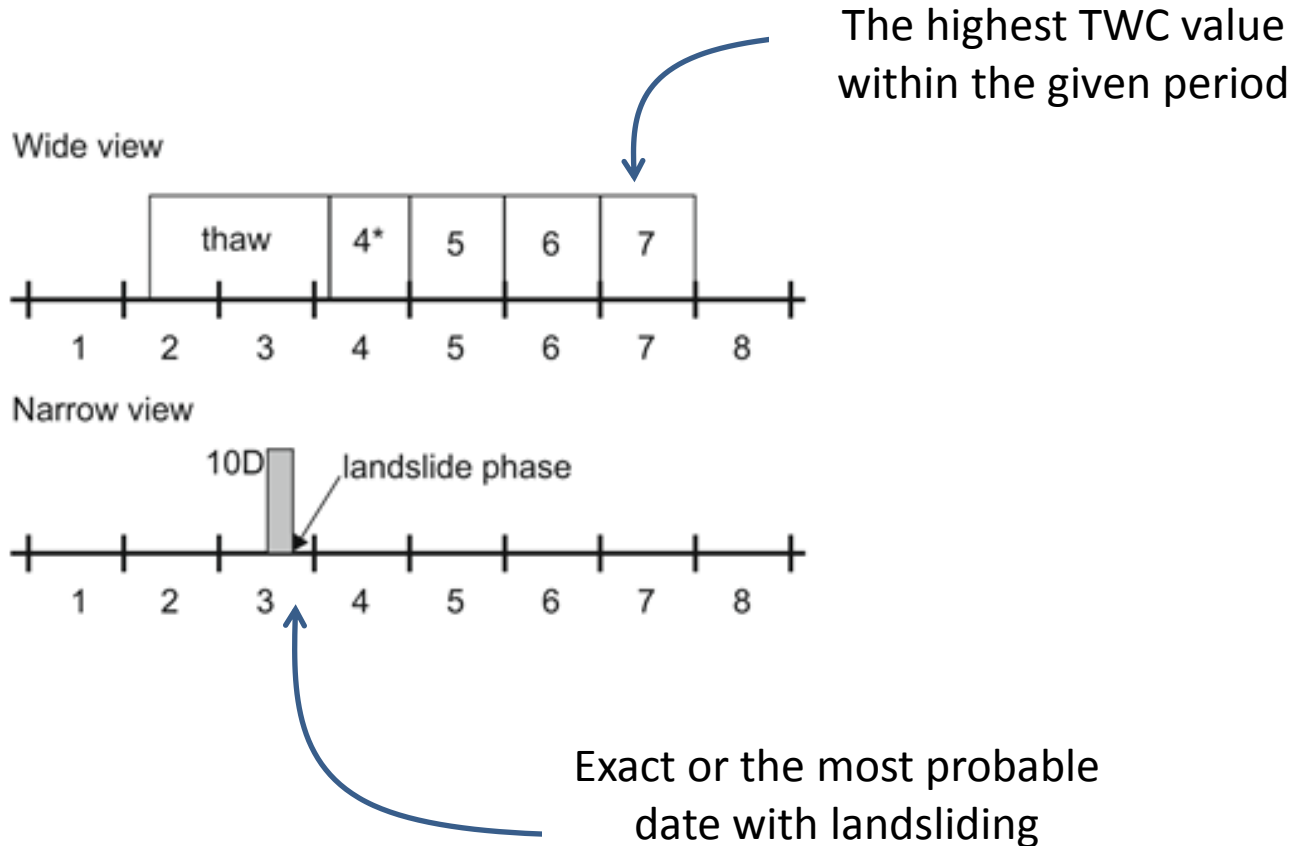
the best fit



Date	1 week	10 days	2 weeks	3 weeks	1 month	2 months	3 months	6 months
1. 4. 1939	1	1	2	5	7	24	22	41
18. 2. 1941	2	1	1	1	1	1	3	3
11. 6. 1965	2	2	3	2	3	1	3	6
13. 3. 1970	1	1	1	1	1	1	1	2
13. 7. 1997	1	1	1	1	1	1	1	9
31. 3. 2006	2	2	1	2	5	4	3	1
24. 5. 2010	2	1	2	1	1	1	8	6

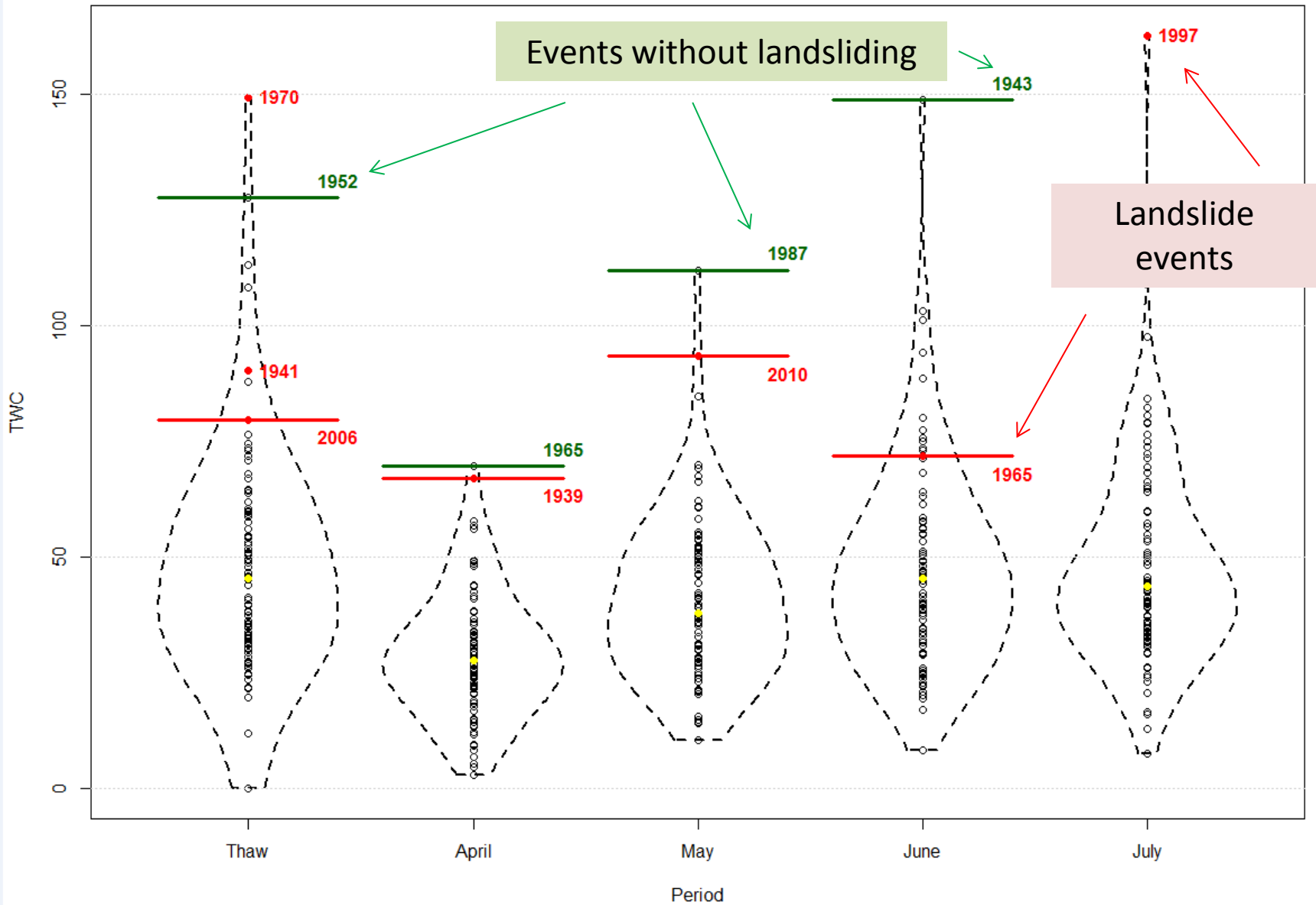
TWC = total water content (rainfall + water from snowmelt)

Total water content threshold estimation

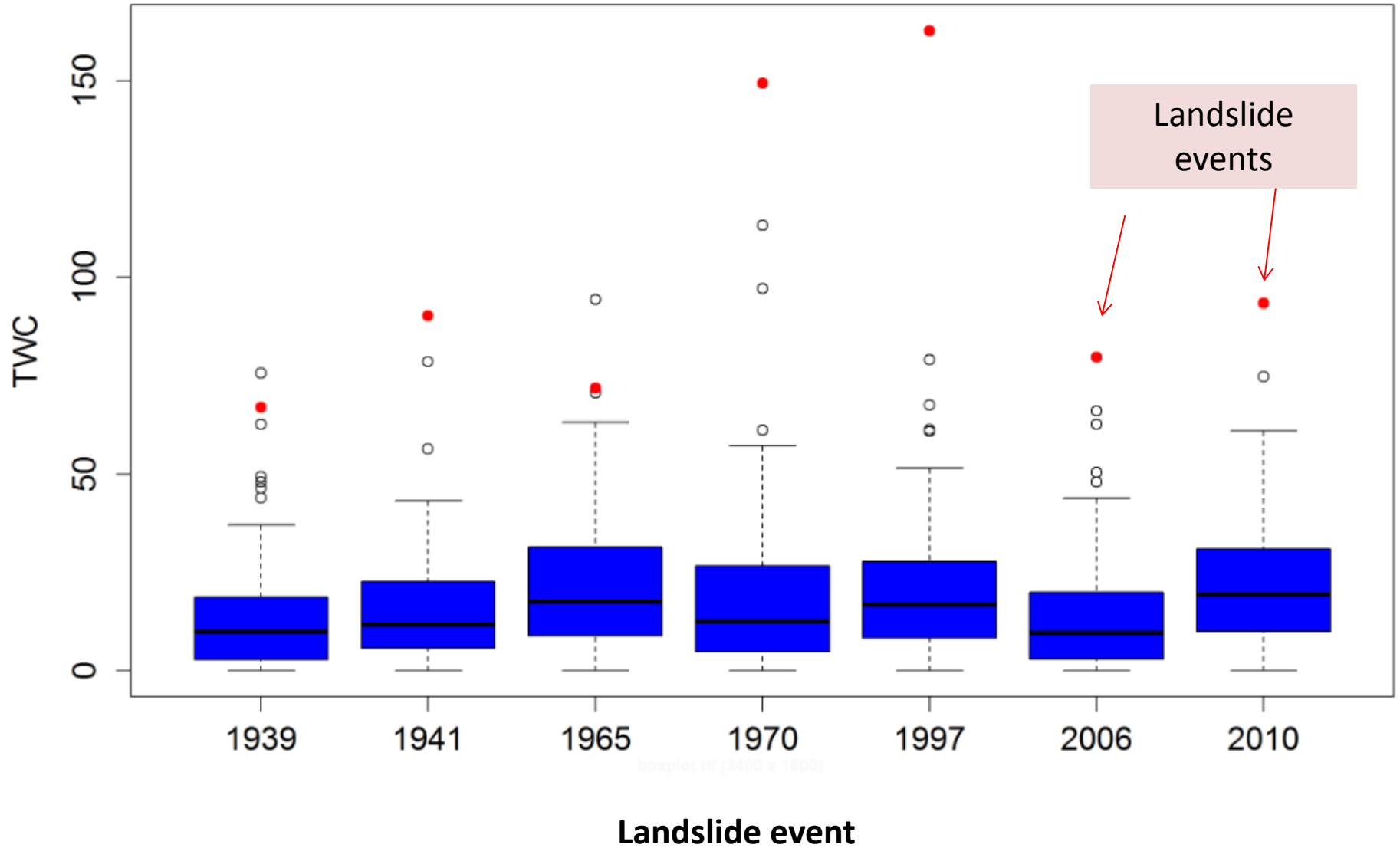


**Application to the entire
time-series (1922 – 2012)**

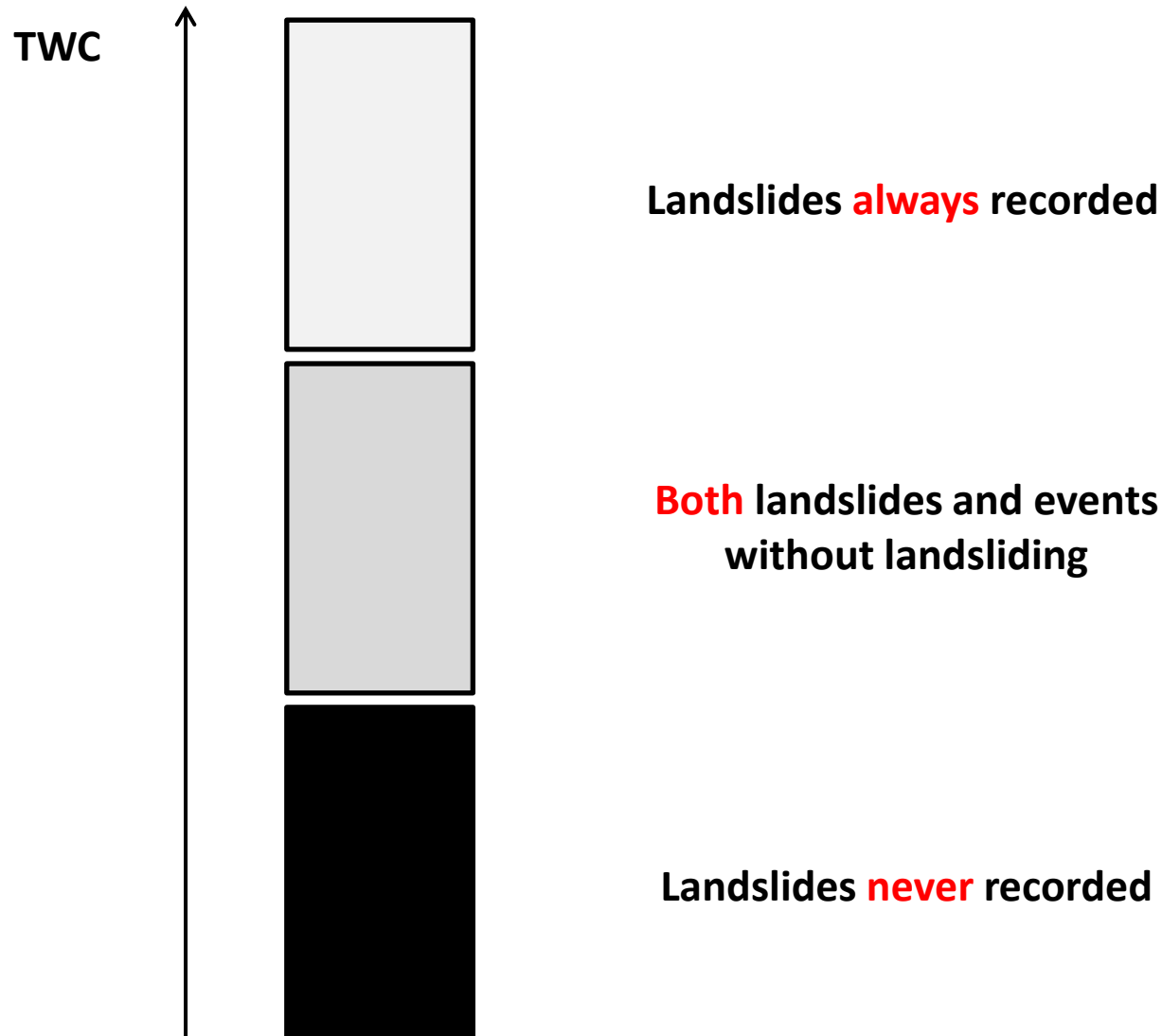
Estimation of Landslide Trigger – **Wide View**



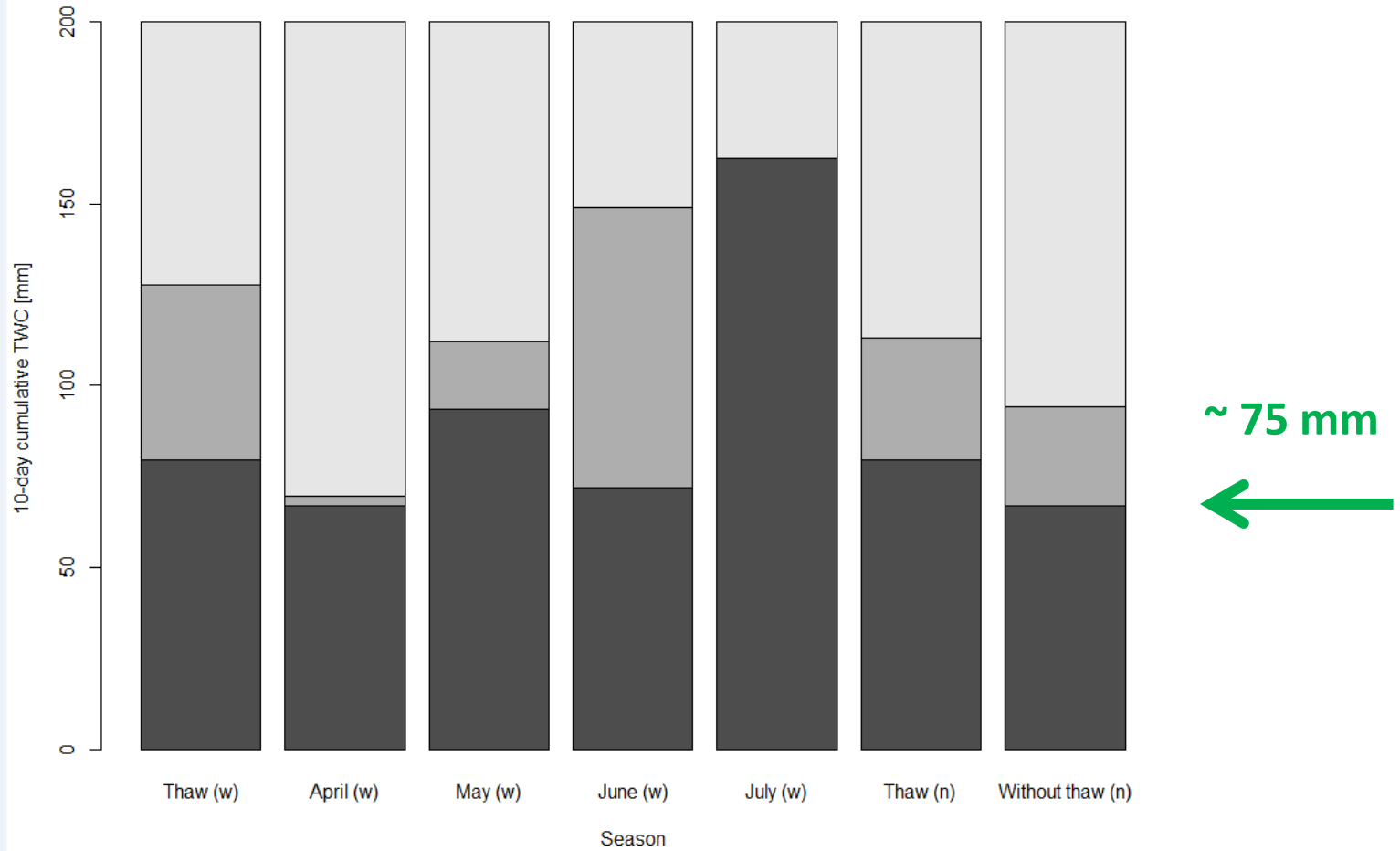
Estimation of Landslide Trigger – **Narrow** View



Landslide triggering values = **always** interval



TWC thresholds (narrow and wide views)



TWC threshold comparison

Napajedla station

Several stations

Avg long term rainfall

(higher elevations)

**ratio
1: 1.25**

(Bíl and Müller, 2008)

75 mm/10d

100 mm/10d

TWC threshold

**ratio
1: 1.33**

Summary

- **Napajedla time-series – 7 landslide phases**
- **The best fit interval – 10 days**
- **TWC Threshold – the lowest **safe** value 75 mm / 10 d**

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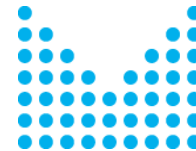
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