Koninklijk Nederlands
Meteorologisch Instituut
Ministerie van Infrastructuur en Waterstaat

Protocol for rainfall extremes for the current and future climate

The WATCH-project

Janette Bessembinder

Set-up presentation

- The WATCH-project
- Available and required rainfall statistics for the “current” climate
- Protocol for the use and generation for rainfall statistics
- Final remarks

WATCH

WATer management for road authorities in the face of climate CHange

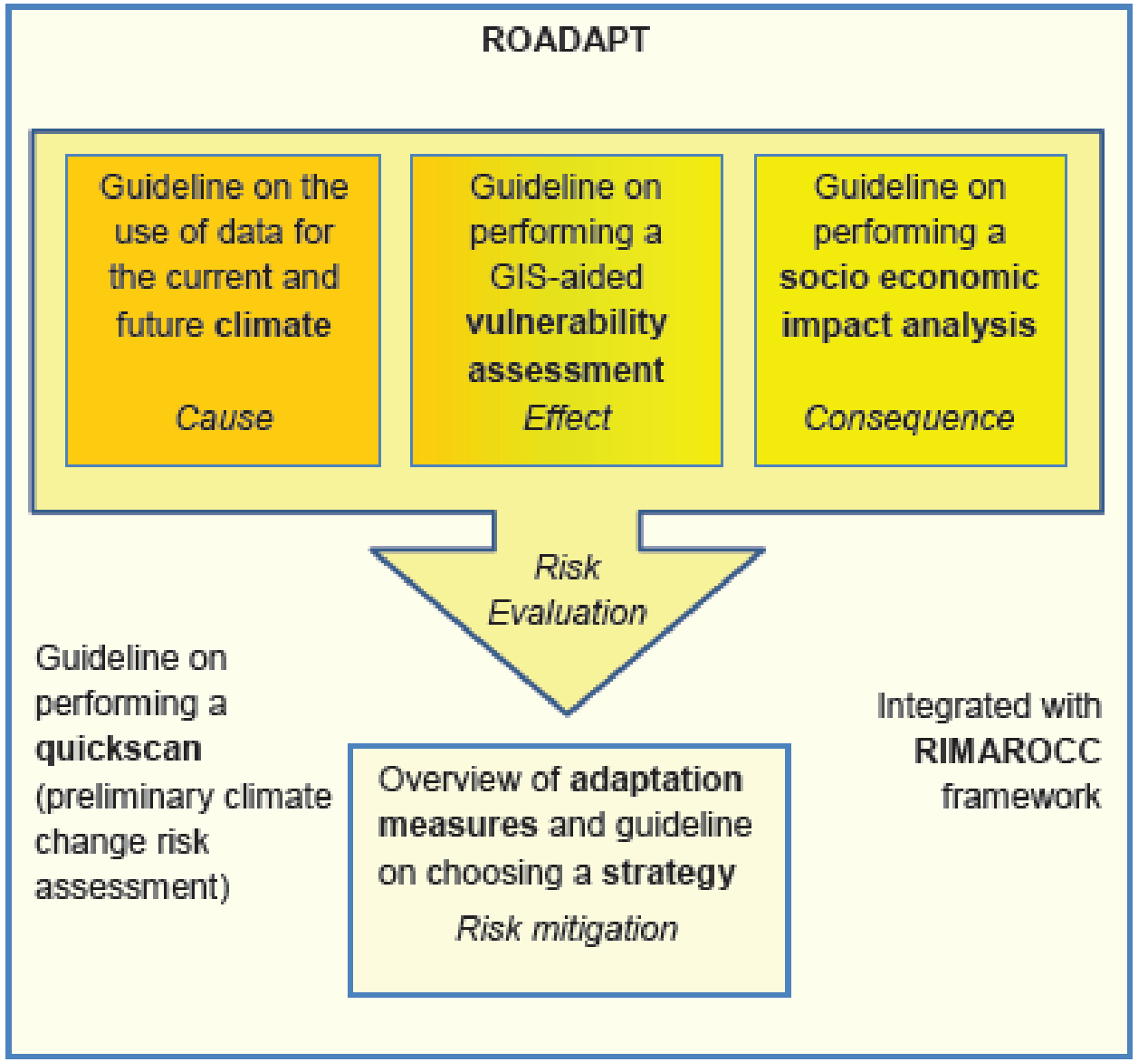
WATCH

- Follow up of RIMAROCC and ROADAPT projects

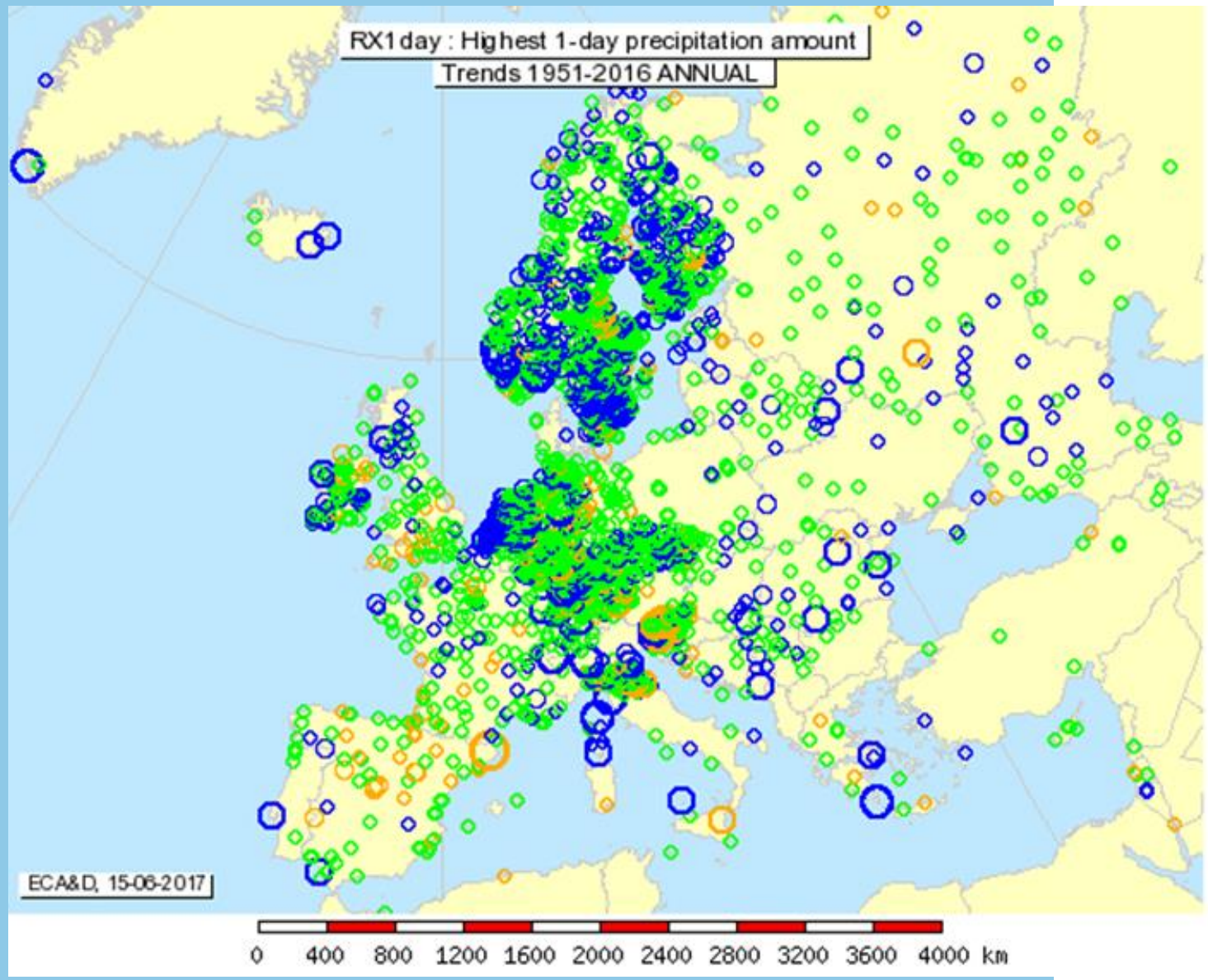
- More practical guidelines

- Financed by CEDR (Conference of European Directors of Roads

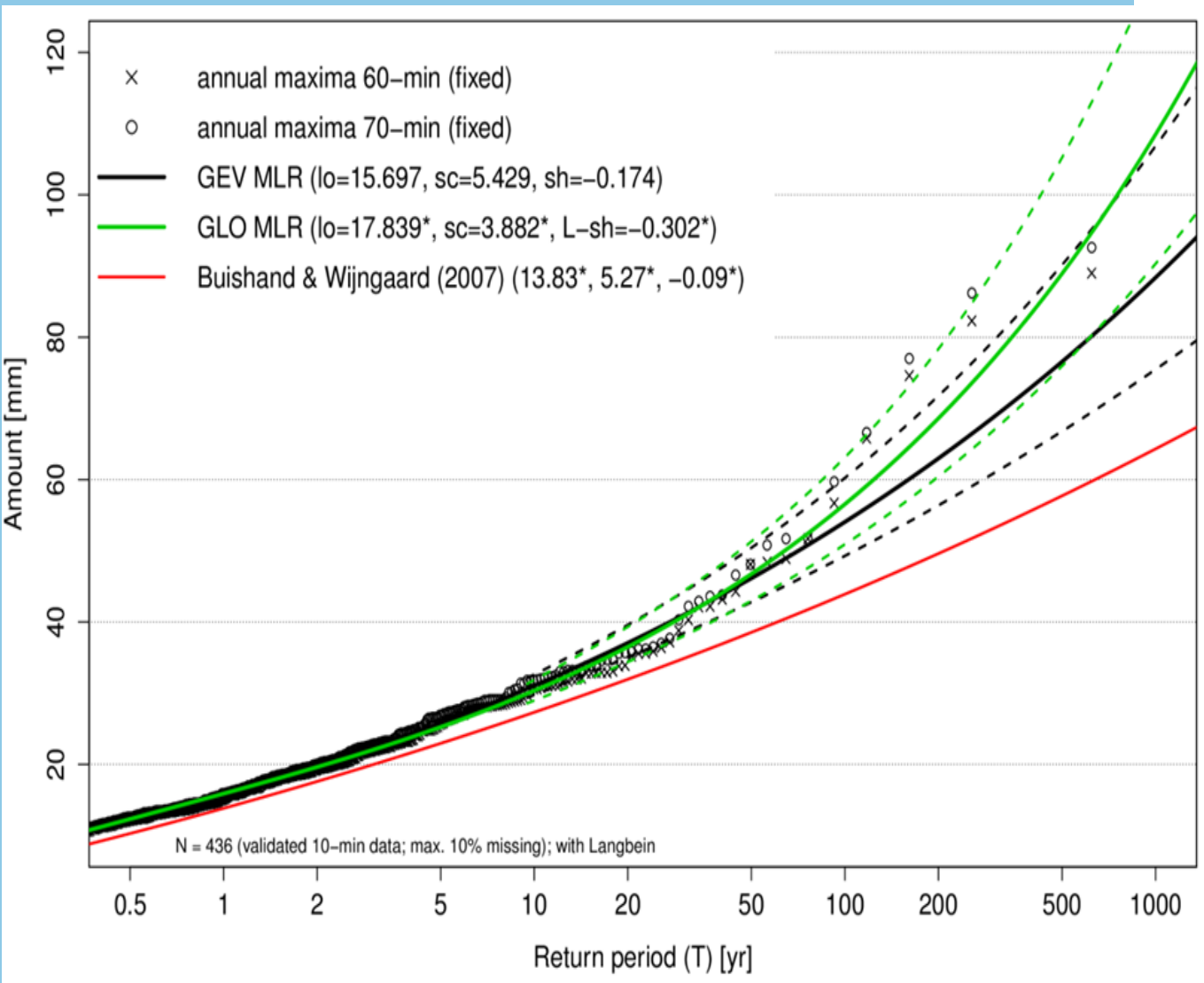
- Multidisciplinary

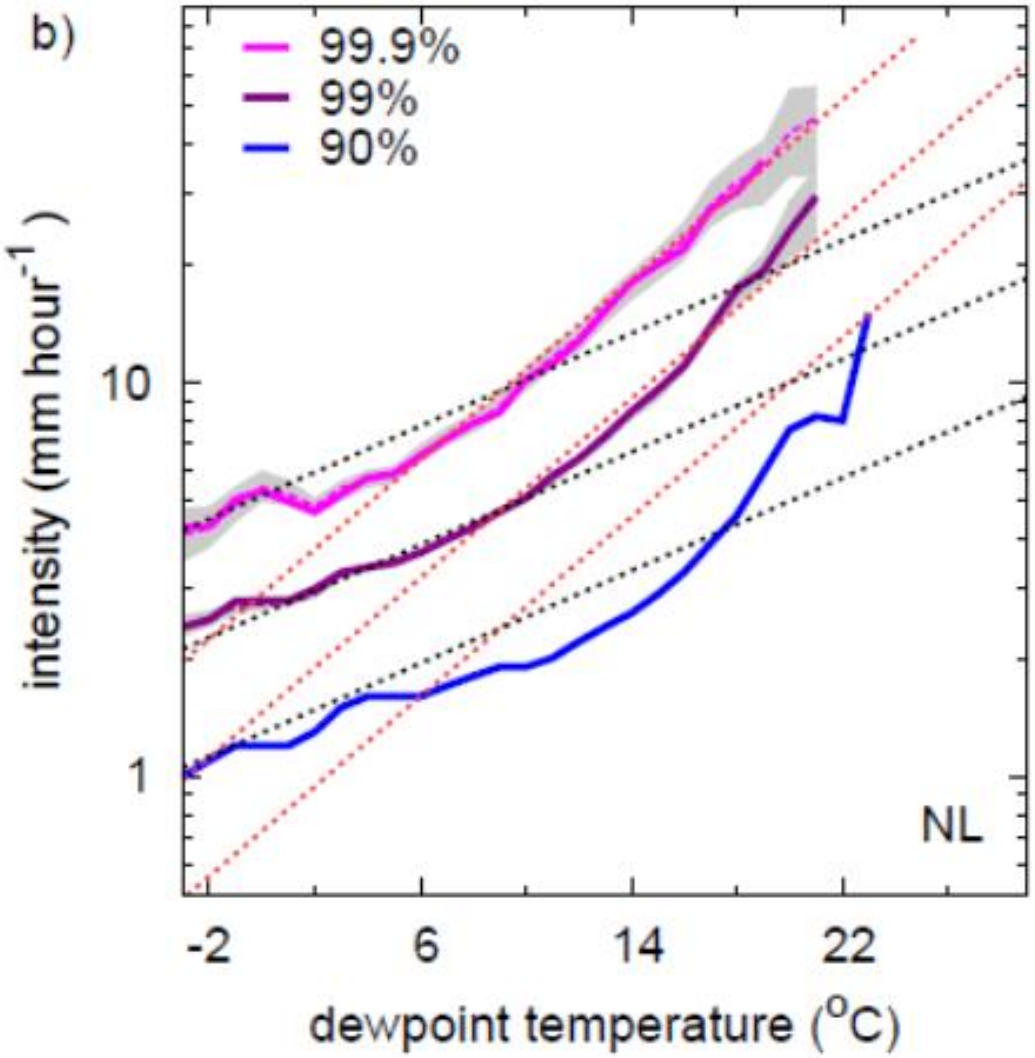


Trend in highest 1-day rain-fall extremes: 1951-2016



Changes in rainfall extremes in the Netherlands





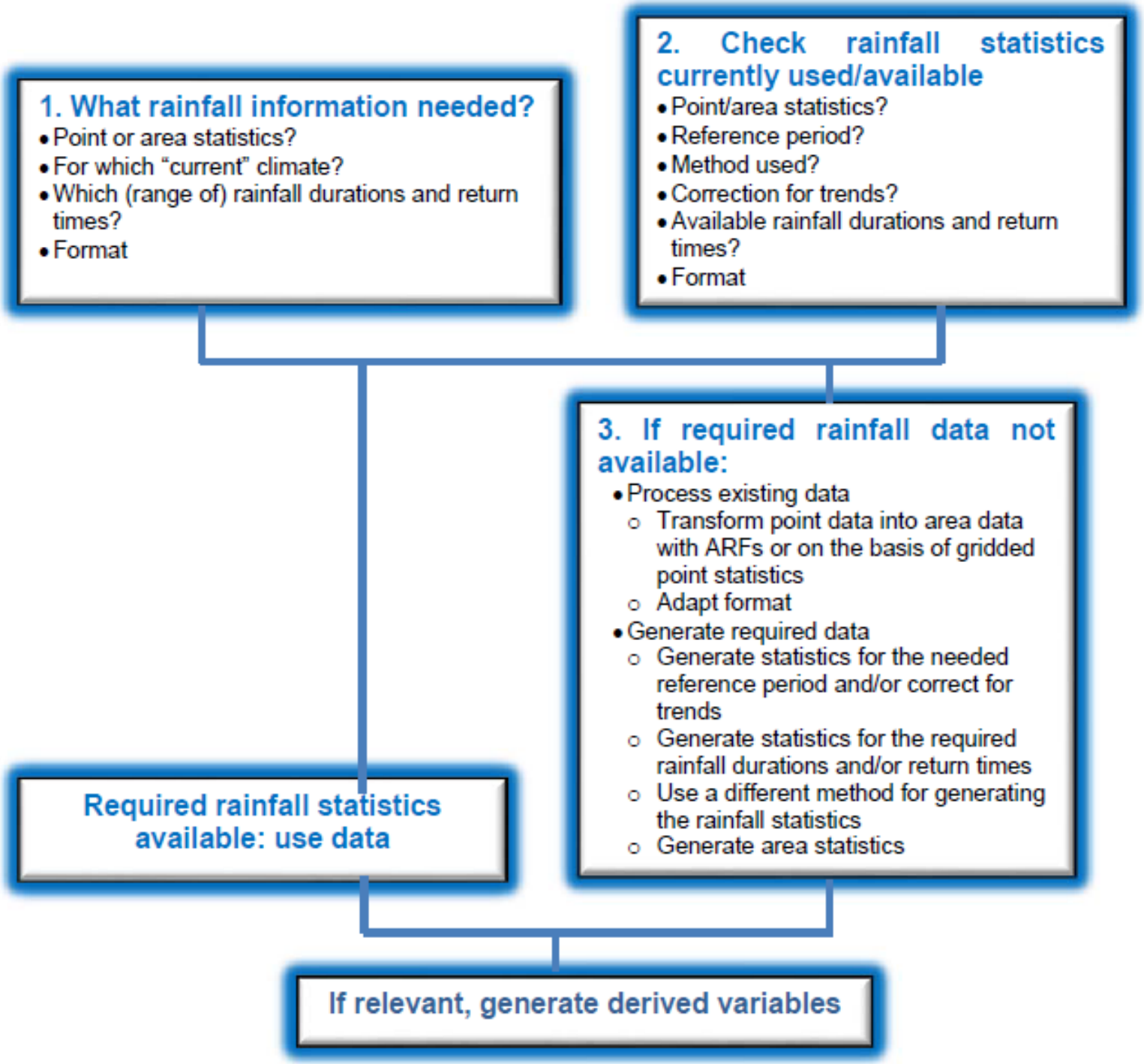
Available rainfall statistics other countries

Country	Reference period/ year*	Point/ area statistics	Rainfall durations	Return periods
Austria	? Before 2005, varying length: 1->50 years	Point	5 min - 6 days	1/1 - 1/100 years
Denmark	1979-2012	Point	1 hour - 24 hours Also > 24 hours?	2/1 - 1/100 years
France	Varies per station	Point	6 min - 48 (192) hours	1/1week 1/2 - 1/100 years
Germany	1951-2010	Point	5 min - 72 hours	1/1 - 1/100 years
Ireland	1941-2004	point	5 min - 25 days	2/1 - 1/500 years
Netherlands	2014 (1906-2014 detrended to 2014)	Point/area	2 hours - 10 days	2/1 - 1/1000 years
	2003-2016	Point	10 min – 12 hours	
Norway	Varying between stations, >= 10 years between 1967-2014	Point and area?	1 min - 24 hours	1/2 - 1/200 years
Sweden	1961-2011	Point	1 - 30 days	1/1 - 1/100 years
	1995-2008	Point	15 min - 96 hours	1/1 - 1/100 years
United Kingdom	up to max of 2006	Point + catchment ?	1 - 192 hours	2 - 10,000 years.

Required data

	Rainfall durations	Return times	Climate change
Austria	15 min-6 days	1-100 years	**No**
Denmark	?	10-25 years	Scenario A1B
France	6 min-24 hours (or 48 hours)	1-100 years	**No**, but often check with safety margin of 1.5/1.8
Germany	?	?	**No**, but recognized
Ireland	2 min-6 hours	1-100 years	+ 20 %
Netherlands	10-120 min	10-250 years	Highest scenario for around 2050 (+30%)
Norway	?	50-200 years	**No**, but may be taken into account
Sweden	?	3-200 years	**No,** but probably in future
United Kingdom	2 min up to ?	1-100 years (200 for Scotland)	+ 20 %

Protocol for the current climate

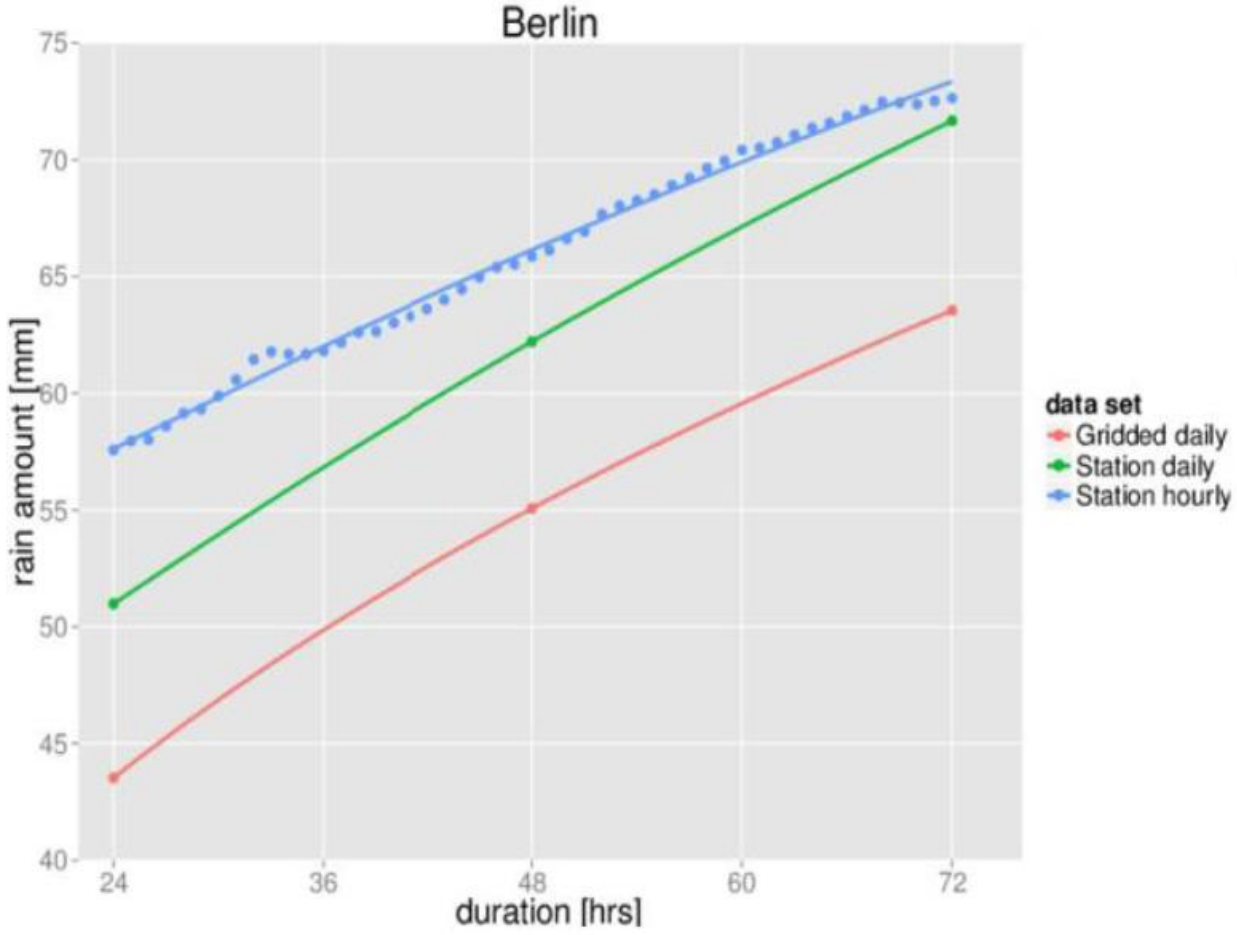


Reference period

- When using data from 1906-2004 with linear trend, representative for climate around 1960

Basic data used for statistics

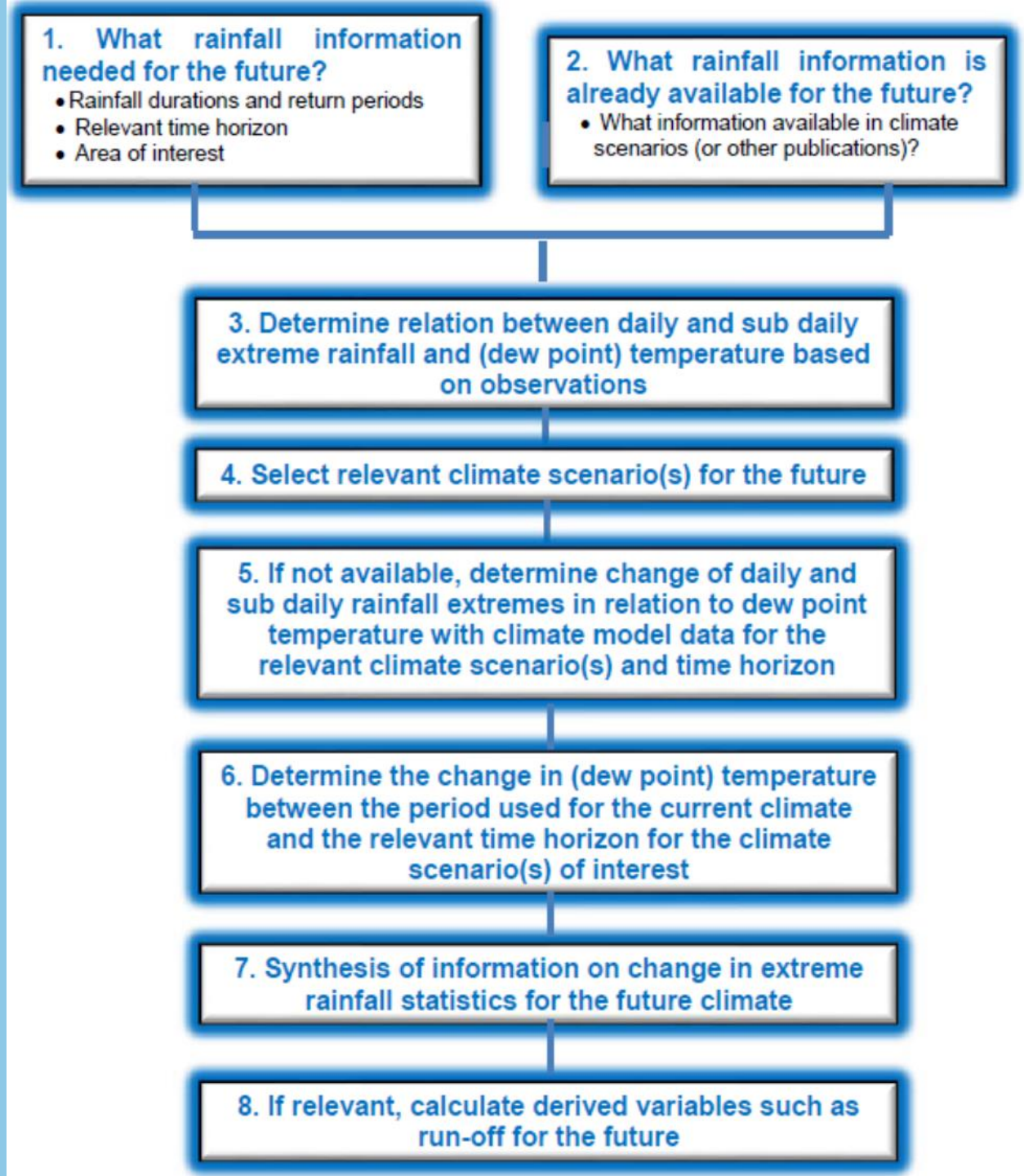
- IDF-curves 1/10 years
- Different results with different basic data



Scenarios other countries

Country	Reference period	Time horizons	Scenarios	Averages		Extremes		
				Per yr	Per sea-son	Multiple days	Daily	Sub-daily
Austria	1971-2000	2021-2050 2071-2100	RCP4.5, RCP8.5	Yes	Yes	Per month	yes	No
Denmark	1986-2005	2081-2100	RCP2.6, rcp4.5, rcp6.0, RCP8.5	Yes	Yes	-	-	-
	1961-1990	2021-2050, 2071-2100	A1B (ensemble average)	-	-	-	yes	-
	1979-2012	50 and 100 years ahead	RCP4.5, RCP8.5	Yes?	?	?	yes	yes
France	1976-2005	2021-2050, 2041-2070, 2071-2100	RCP 2.6, RCP4.5, RCP8.5	Yes	Yes	Per month	yes	No
Germany	1971-2000	2031–2060, 2041-2070, 2051-2080, 2061-2090	RCP2.6, RCP8.5 (A1b)	No	Yes	No	yes	No
	1951- 2006	2021-2050, 2071-2100	A1B (range ensemble)	Yes	Yes	No	No?	No
Ireland	1961-1980 and 1981-2000	2021-2040, 2041-2060, 2021-2060	Low-medium (RCP45, B2) and high (RCP85, A1B and A2)	Yes	Yes	No	yes	No
Netherlands	1981-2010	Around 2030, 2050, 2085	4 scenarios (global temperature + circulation)	Yes	Yes	Yes?	yes	yes
Norway	1971-2000	2031-2060, 2071-2100	RCP4.5, RCP8.5 (percentiles)	Yes	Yes	No	yes	yes
Sweden	1971-2000 (1961-1990?)	2011-2040, 2041-2070, 2071-2100	RCP2.6, RCP4.5, RCP8.5 (and 2C and A1b)	Yes	Yes	Max 7-day precip.	yes	No
United Kingdom	1961–1990	2010 to 2099 as overlap-ping 30-year time periods	Low, medium and high	Yes	Yes	Per month	yes	Yes?

Protocol for the future climate



Time horizon

culvert with expected life cycle of 50 years: relevant time horizon current year + 50 = about 2070

Over/underestimation current practice?

Expected temperature change 4 °C and +30% advised for climate change? comparable climate as Netherlands? 10-14% per °C increase for extreme hourly rainfall → 40-56% increase

Which scenario to use for the future?

- Not possible to indicate which scenario is most probable: depends on socio-economic and technical developments
- What is most probable is in general not the most relevant

WATCH

WATer management for road authorities in the face of climate CHange

The protocol for use of rainfall data offers:

- a systematic way of checking the climate data to be used for the design of roads
- Guidance and examples for the different steps
- Overview of available data on rainfall extremes in several European countries