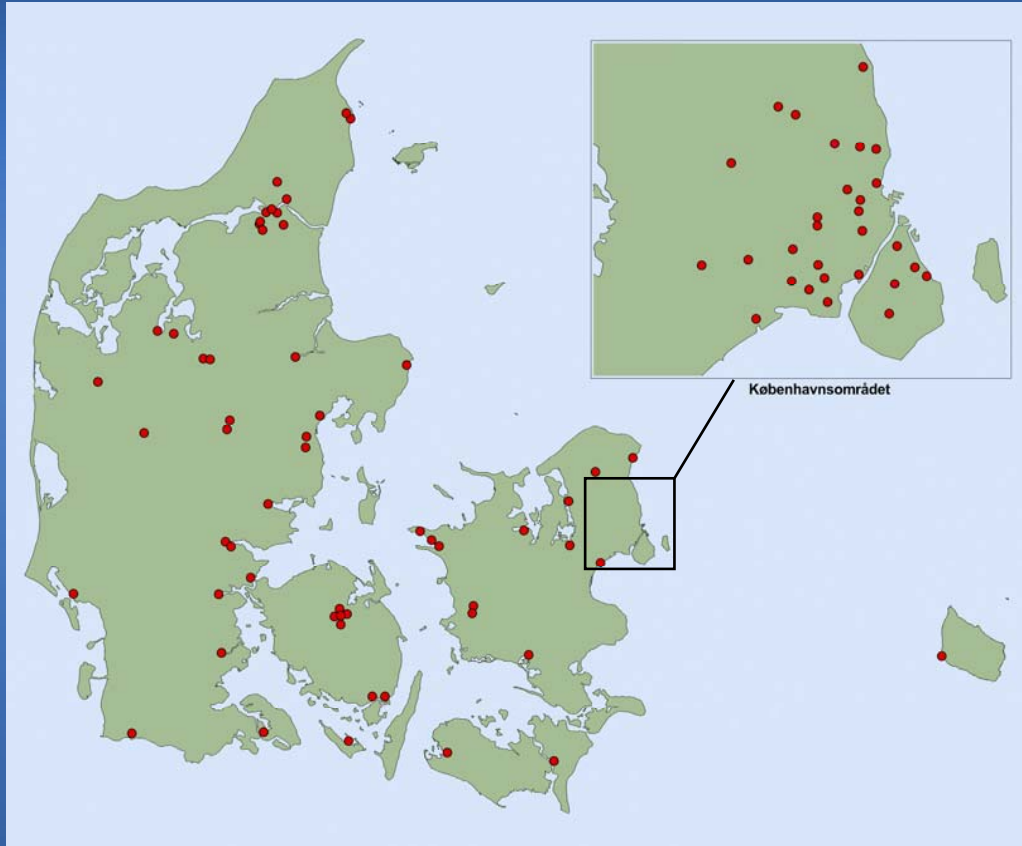


Hvordan ændrer ekstrem regn sig?

Henrik Madsen
DHI
hem@dhigroup.com

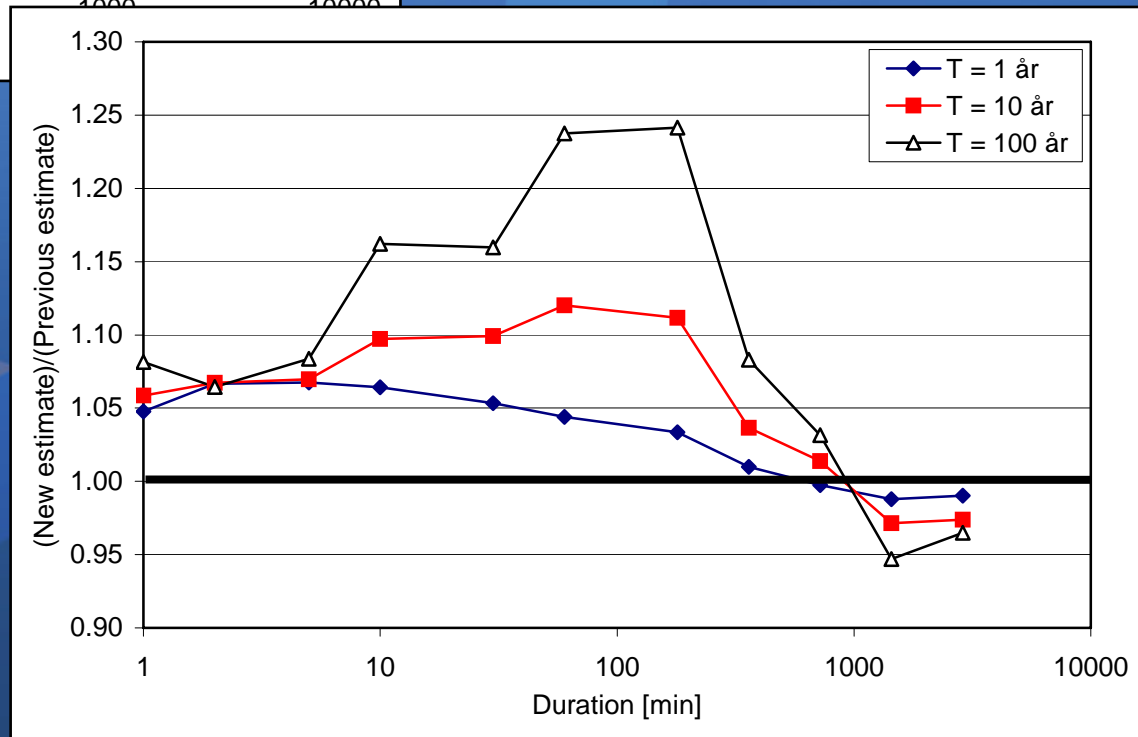
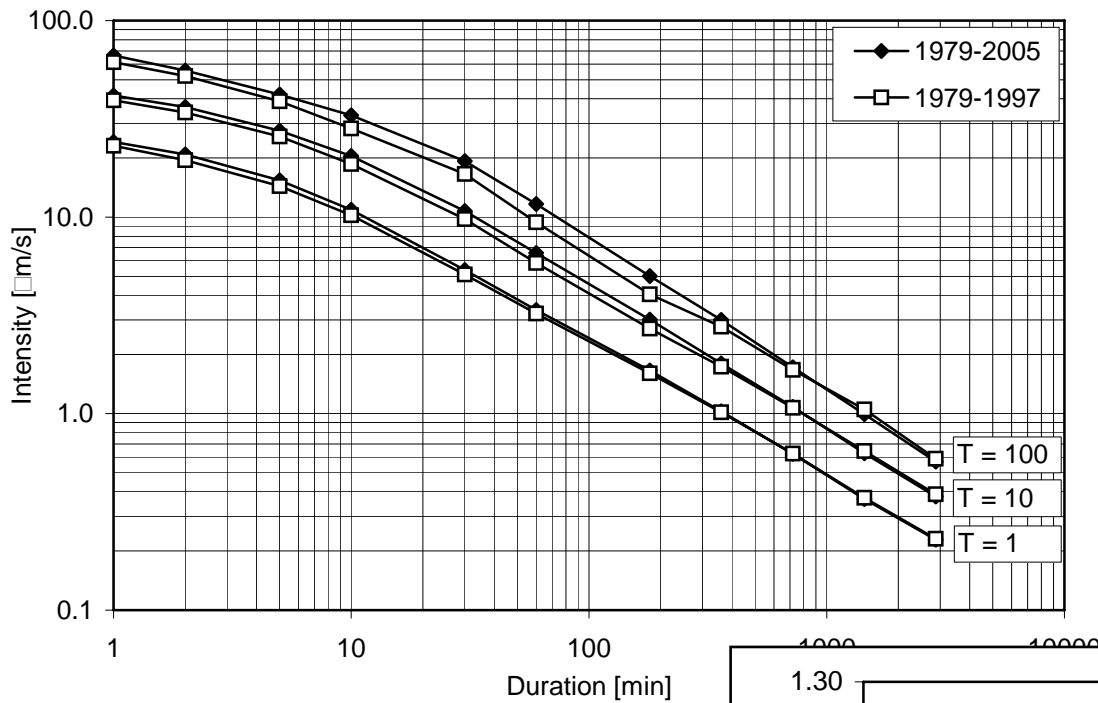


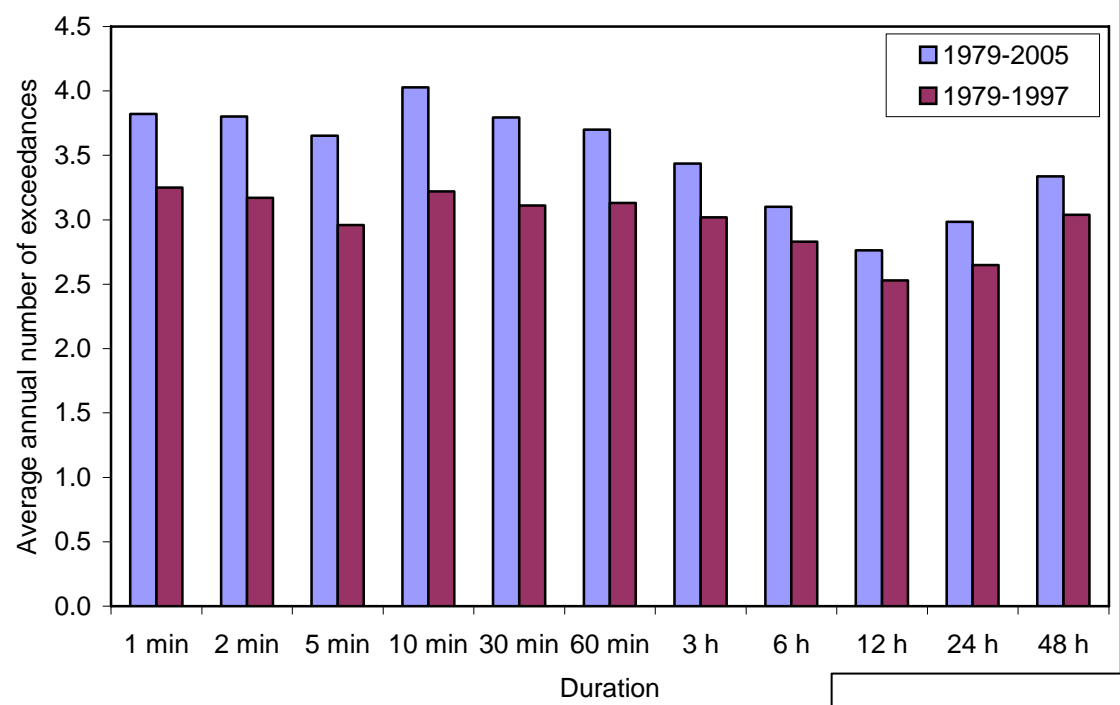
Hydrologidag 2010, 26. oktober 2010, Odense



- SVK regnmålersystem oprettet i 1979
- Nedbør intensiteter for varigheder mellem 1 min og 48 h
- SVK Skrift 26:
 - Periode: 1979-1997
 - 41 stationer (650 stationsår)
- SVK Skrift 28:
 - Periode: 1979-2005
 - 66 stationer (1251 stationsår)
- MSc + PhD projekt:
 - Periode: 1979-2009
 - 70 stationer (1428 stationsår)

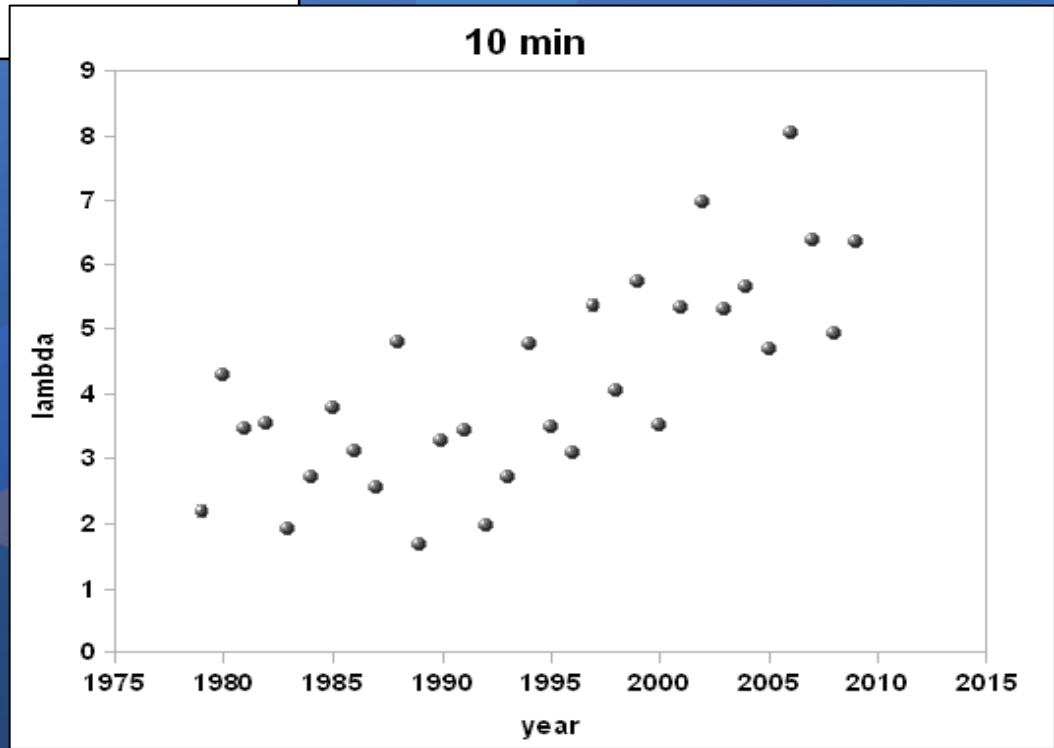
Sammenligning af IDF kurver Skrift 26 og Skrift 28



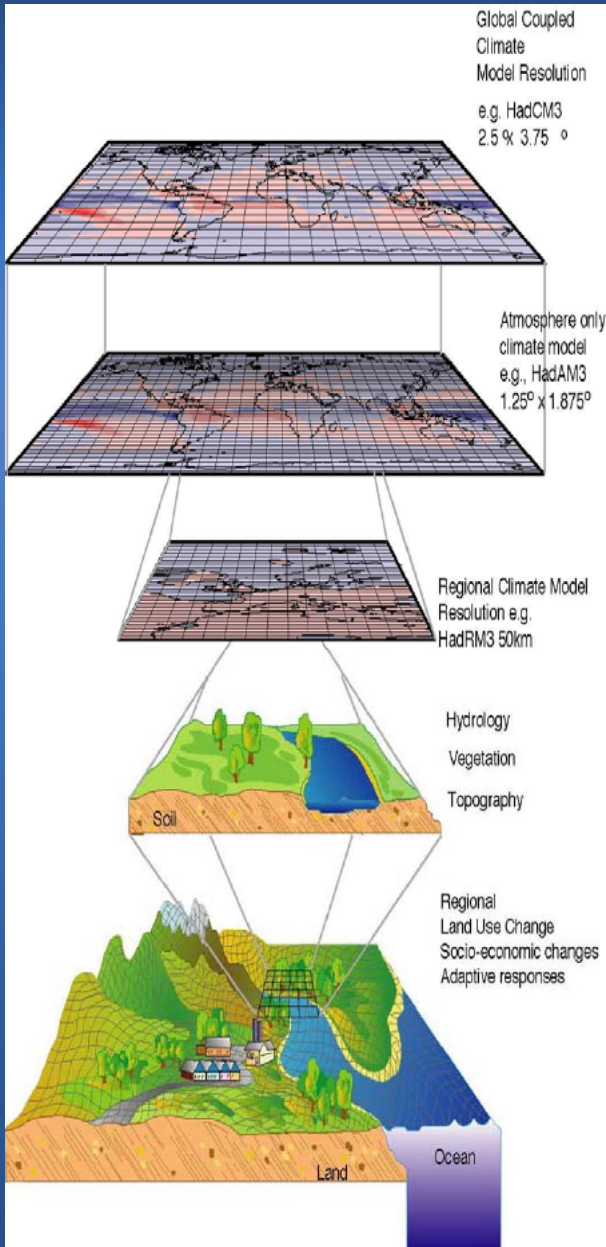


Ændringer i antal ekstreme hændelser

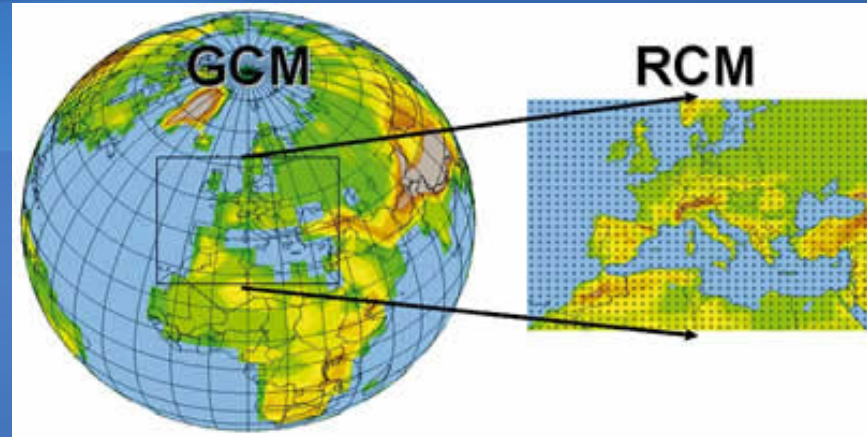
- Statistisk signifikant stigning
- Ca. 2% per år
- Mindst stigning for store varigheder



Ida Bülow Gregersen, Statistiske trends i observeret ekstrem regn, MSc Thesis, 2010



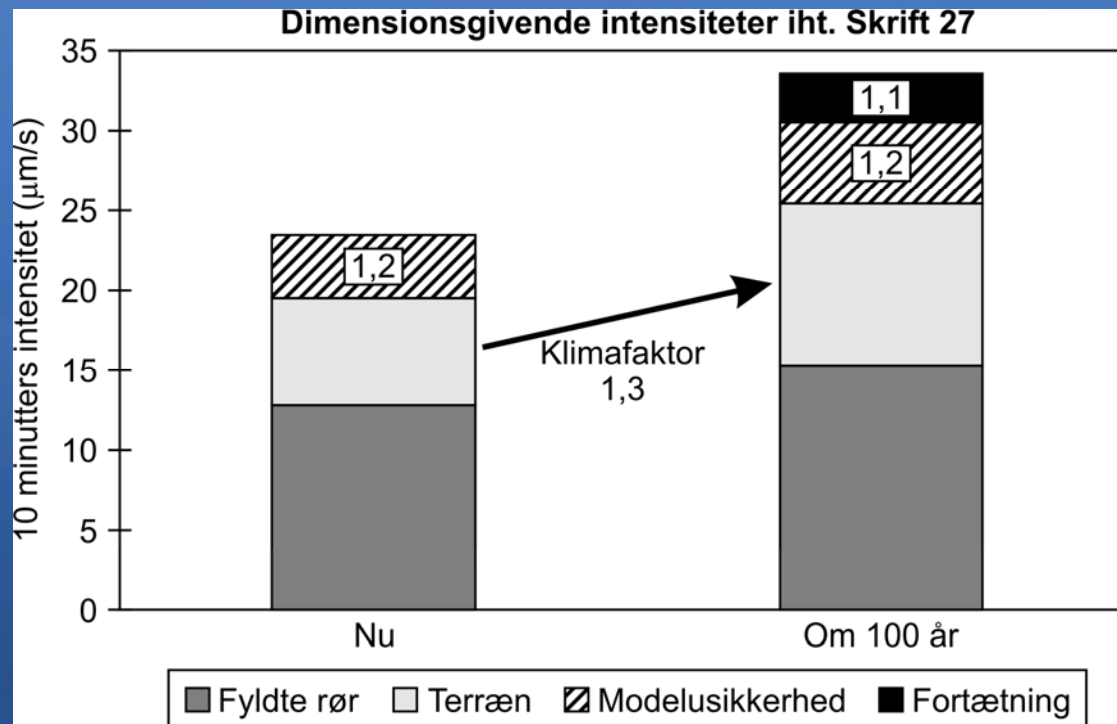
Dynamisk nedskalering



Statistisk nedskalering

- Skalering spatialt + temporalt
- Statistisk justering af klimamodel output

Gentagelsesperiode [år]	2	10	100
Klimafaktor (100 år)	1.2	1.3	1.4
Simpel fremskrivning af observeret trend	2	2	2



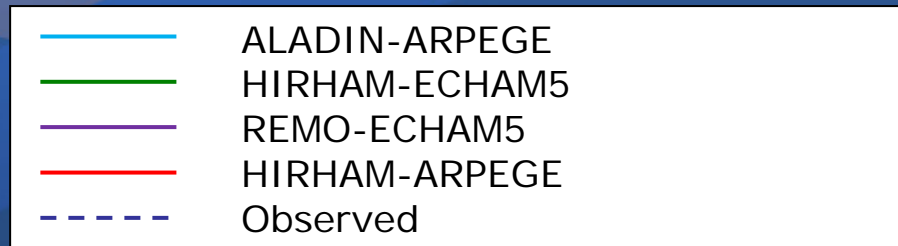
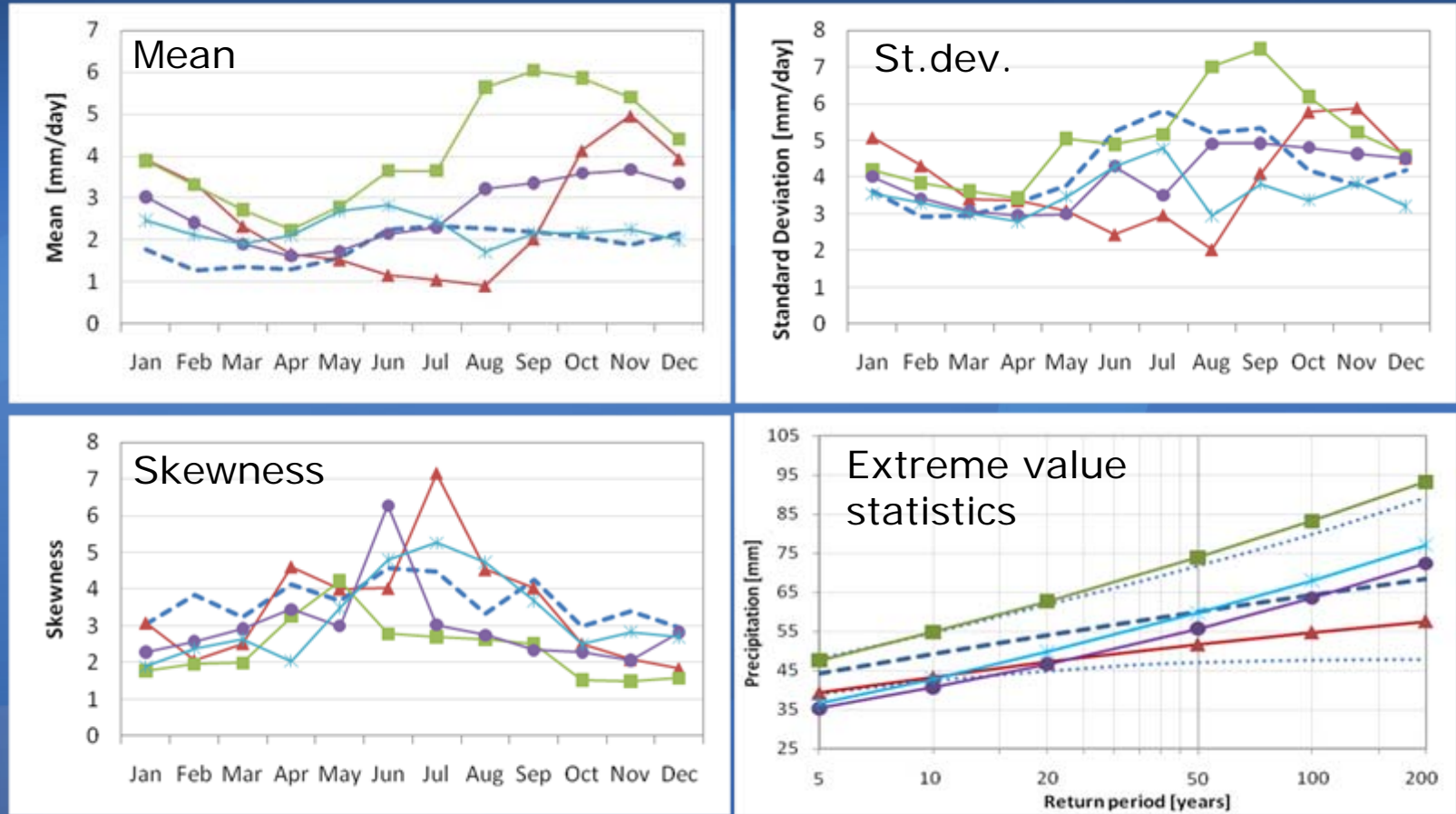
Skrift nr. 29
 Forventede ændringer i
 ekstremregn som følge
 af klimaændringer
 2008
 IDA Spildevandskomiteen

ENSEMBLES GCM-RCM Matrix 22/2/2010

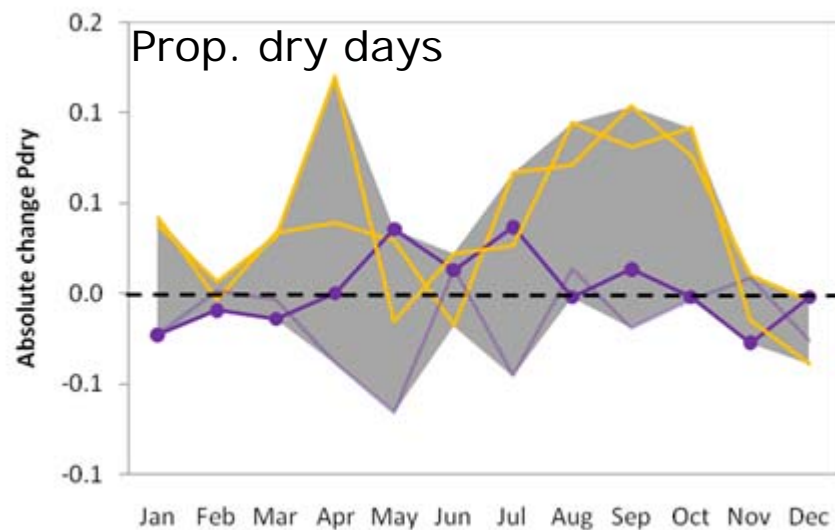
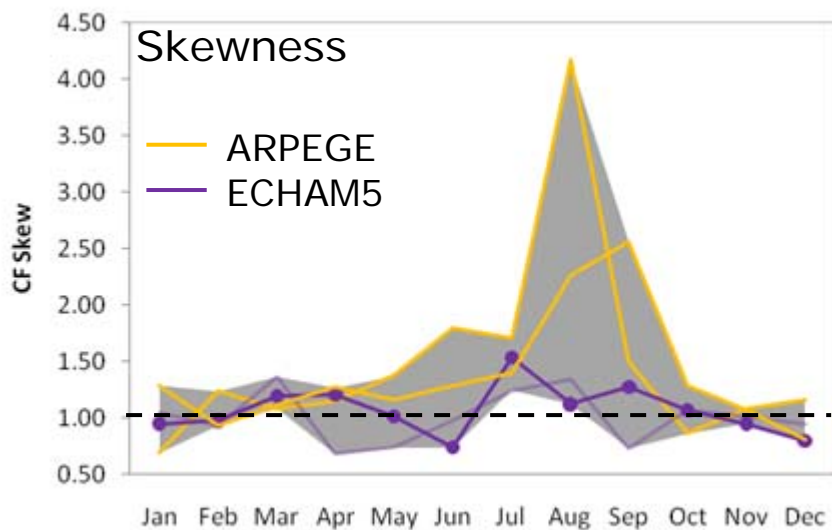
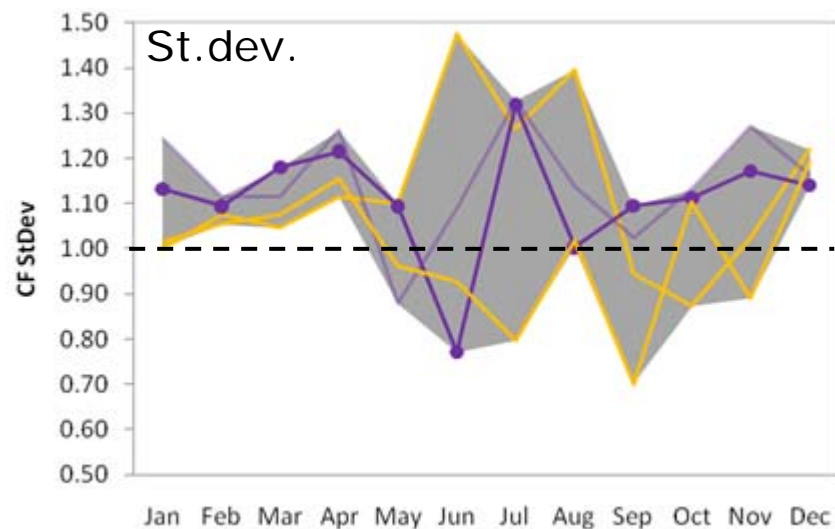
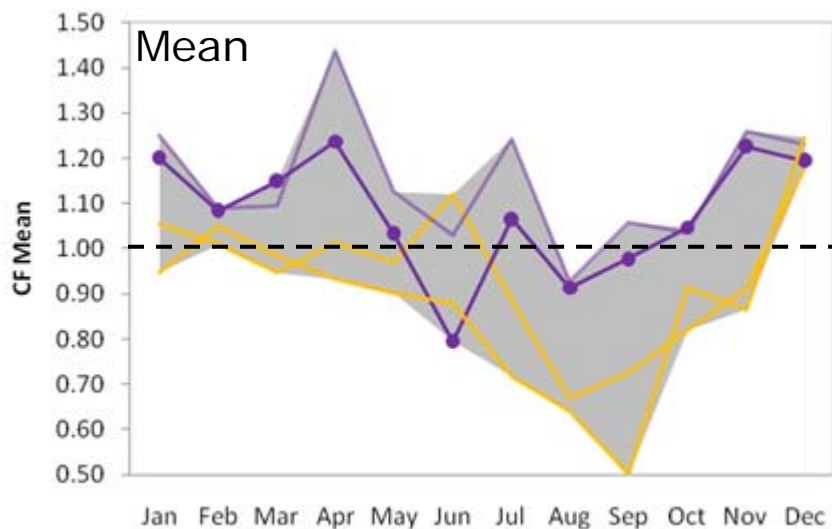
Global model/ Regional inst.	METO-HC Standard	METO-HC Low sens.	METO-HC Hi sens.	MPIMET Standard	MPIMET Ens.m. 1	MPIMET Ens.m. 2	IPSL	CNRM	NERSC	MIROC	CGCM3	Total number
METO-HC	2100	2100*	2100*	2100 (date 2010)								4
MPIMET				2100			2050*					2
CNRM								2100				1
DMI				2100*				2100 2100* (04/2010)				3
ETH	2100											1
KNMI				2100* 2100	2100*	2100*				2100*		1+4
ICTP				2100								1
SMHI		2100*		2100* 2100*					2100			3+1
UCLM	2050											1
C4I			2100*		2050 (A2)*							2
GKSS							2050*					1
METNO	2050*								2050*			1
CHMI								2050* (12/2009)				1
OURANOS**											2050*	1
VMGO**	2050*											1
Total (1951- 2050)	5	2	2	7+2	0+1	0+1	2	3	3	0+1	1	25+5

Red: Online now; *: non-contractual runs; **: affiliated partners without obligations; underscore: 50km resolution; (in parantheses): Expected date. For partner acronym explanations, see the participant list. **NOTE** that all partners also did an ERA-40 driven analysis 1951(1961)-2000

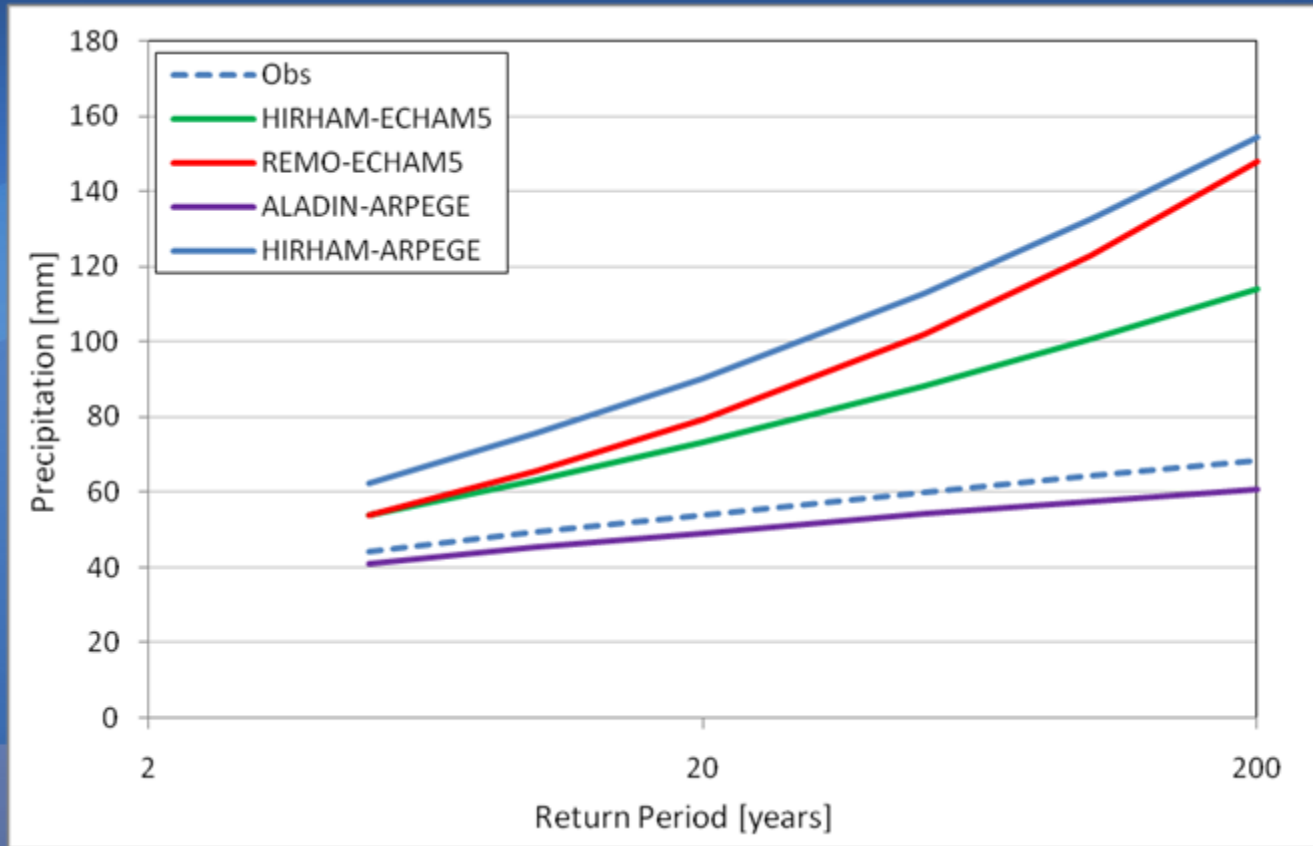
Klimamodeller sammenlignet med observationer



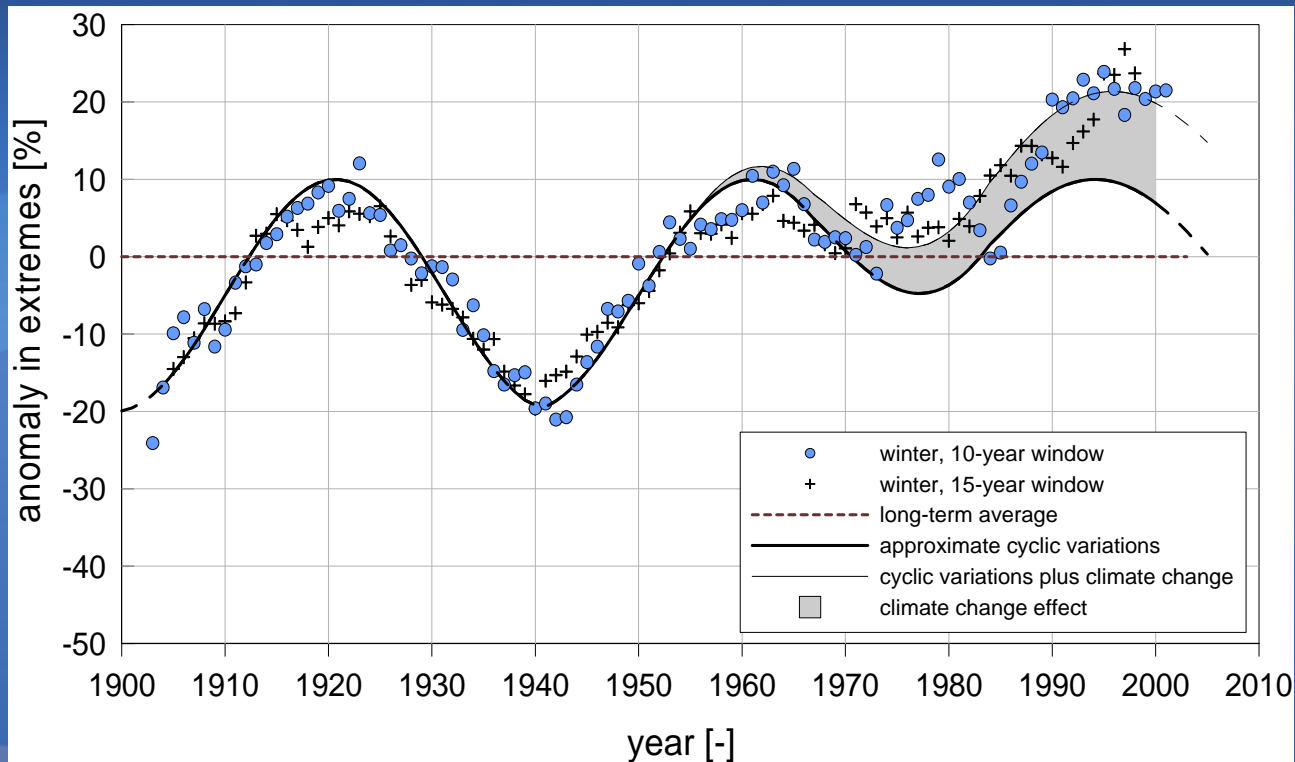
Klimamodel projektioner - ændringer (2070-2100)



Nedskaleret ekstrem regn (2070-2100)



Gentagelsesperiode [år]	10	100
Klimafaktor – range	0.9 - 1.5	0.9 - 2.1
Klimafaktor – middel	1.3	1.6
Klimafaktor Skrift 29	1.3	1.4
Simpel fremskrivning af observeret trend	2	2



Anomaly in quantiles of 10 minutes rainfall extremes at Uccle, Brussels, in the winter season, for moving windows of 10 and 15 years in comparison with the full period 1898-2005 (Ntegeka & Willems, 2008)

- Observeret ændringer i ekstrem regn i Danmark i de seneste 30 år
 - 10 års regn: +10%
 - 100 års regn: +20%
- Estimerede fremtidige ændringer baseret på klima model projektioner – konsistent med observationer?
 - 10 års regn: +30% i 2100 (Skrift 29 og ENSEMBLES data)
 - 100 års regn: +40% i 2100 (Skrift 29), +60% (ENSEMBLES data)
- Brug af klima model projektioner kræver statistisk nedskalering
 - Skalering til passende spatial og temporal skala
 - Statistisk justering af klima model output
- Store usikkerheder – og vigtigt at tage dem i regning
 - Klima scenario
 - GCM/RCM model projektion
 - Statistisk nedskalering
- Igangværende forskningsaktivitet under CRES - Centre for Regional Change in the Earth System (<http://cres-centre.dk>)