



Supplement of

Enhanced evaluation of hourly and daily extreme precipitation in Norway from convection-permitting models at regional and local scales

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Table S1. The information for the ten hourly rain gauges.

Name	Station ID	Longitude (°E)	Latitude (°N)	Elevation(m)	Region
Østre Toten - Apelsvoll	SN11500	10.8695	60.7002	264	East
Ås - Rustadskogen	SN17870	10.8107	59.6703	120	East
Kise in Hedmark	SN12550	10.8055	60.7733	128	East
Løken i Volbu	SN23500	9.063	61.122	521	East
Særheim	SN44300	5.6508	58.7605	87	South
Stryn - Kroken	SN58900	6.5585	61.9157	208	West
Fureneset	SN56420	5.0443	61.2928	7	West
Kvithamar	SN69150	10.8795	63.4882	27	Middle
Tjøtta	SN76530	12.4255	65.8295	21	Middle
Tromsø - Holt	SN90400	18.9095	69.6538	20	North

Table S2. The information for the 192 daily rain gauges.

ID	Name	Longitude (°E)	Latitude (°N)	Elevation (m)	Region	ID	Name	Longitude (°E)	Latitude (°N)	Elevation (m)	Region
SN420	HEGGERISET -	11.9963	61.6848	481	East	SN32780	HØIDALEN I	9.2668	59.144	113	South
SN31080	TESSUNGDALEN -	8.7033	60.1293	762	East	SN36490	BØYLEFOSS	8.717	58.597	63	South
SN33250	RAULAND	8.0317	59.7057	719	East	SN38800	TOVDAL	8.2295	58.794	220	South
SN13420	VENABU	10.1082	61.6513	930	East	SN37230	TVEITSUND	8.5187	59.026	252	South
SN12600	VEA	10.67905	60.953	161	East	SN39220	MESTAD I	7.89	58.215	151	South
SN31570	MØSVATN - HAUG	8.1342	59.8143	945	East	SN38380	DOVLAND	8.0392	58.523	259	South
SN100	PLASSEN	12.5039	61.1349	333	East	SN36560	NELAUG	8.63	58.658	142	South
SN22730	HEDAL I VALDRES II	9.7238	60.6197	474	East	SN34800	TØRDAL -	8.7742	59.148	235	South
SN1230	HALDEN	11.388	59.1223	3	East	SN35090	EIKELAND	9.098	58.804	42	South
SN31410	RJUKAN	8.6663	59.88	258	East	SN38600	MYKLAND	8.2888	58.633	245	South
SN32850	KVITSEID - MOEN	8.473	59.4058	76	East	SN36200	TORUNGEN FYR	8.7893	58.399	12	South
SN14050	SJOA	9.5562	61.6757	330	East	SN43810	MAUDAL	6.3675	58.765	311	South
SN18700	OSLO - BLINDERN	10.72	59.9423	94	East	SN42520	RISNES I	6.9443	58.658	348	South
SN3780	IGSI I HOBØL	11.0468	59.636	144	East	SN42810	TONSTAD -	6.709	58.664	55	South
SN20520	LUNNER	10.5753	60.295	372	East	SN44560	SOLA	5.637	58.884	7	South
SN24600	GRIMELI I	9.5958	60.137	367	East	SN43010	EIK - HOVE	6.5045	58.507	65	South
SN4780	GARDERMOEN	11.0802	60.2065	202	East	SN41770	LINDESNES FYR	7.048	57.982	16	South
SN24960	GOL - STAKE	8.9478	60.7188	542	East	SN44480	SØYLAND I	5.9817	58.686	263	South
SN34900	POSTMYR I	8.7687	59.2647	464	East	SN42720	BAKKE	6.657	58.412	75	South
SN25100	HEMSEDAL - HØLTO	8.5285	60.8703	648	East	SN44800	SVILAND	5.9202	58.819	230	South
SN5350	NORD-ODAL	11.558	60.3883	147	East	SN44520	HELLAND I	6.0135	58.755	288	South
SN1950	ØRJE	11.6506	59.4829	123	East	SN41860	KVINESHEI -	6.98219	58.243	317	South
SN31660	MOGEN	7.913	60.018	954	East	SN42650	FLEKKEFJORD	6.6498	58.284	5	South
SN27600	SANDEFJORD	10.2147	59.132	6	East	SN41480	ÅSERAL	7.4128	58.617	268	South
SN25320	ÅL III	8.5609	60.6391	720	East	SN44760	IMS	5.9672	58.906	2	South
SN4040	ENEBAKK - BARBØL	11.1535	59.75	164	East	SN47820	EIKEMO	6.2786	59.859	178	West
SN15430	BØVERDAL	8.2423	61.7195	700	East	SN46150	SAND I RYFYLKE	6.276	59.479	25	West
SN29600	TUNHOVD	8.7511	60.4629	870	East	SN47450	STRAUMØY	5.4335	59.653	36	West
SN4740	UKKESTAD	11.051	60.1742	187	East	SN48500	ROSENDAL	6.02637	59.991	75	West
SN7660	ÅKRESTRØMMEN	11.2042	61.696	260	East	SN57810	SVELGEN II	5.2983	61.771	16	West
SN6440	VERMUNDSJØEN	12.369	60.6925	276	East	SN40420	BYKLE - KULTRAN	7.3438	59.351	594	West
SN60	LINNES	12.499	61.5581	564	East	SN53160	JORDALEN -	6.7243	60.9	614	West
SN19710	ASKER	10.4358	59.8558	163	East	SN52930	BREKKE I SOGN	5.425	60.959	240	West
SN22840	REINLI	9.4905	60.8346	628	East	SN52170	EKSINGEDAL	6.1469	60.803	450	West
SN12550	KISE PA HEDMARK	10.8055	60.7733	128	East	SN41550	LJOSLAND -	7.3501	58.788	504	West
SN11710	EINAVATN	10.6408	60.5951	406	East	SN55670	VEITASTROND	7.034	61.478	172	West
SN37500	FOLDSÆ	8.1517	59.3242	492	East	SN52990	ORTNEVIK	6.134	61.11	4	West
SN13140	FÅVANG -	10.1902	61.4567	187	East	SN58480	OLDEDALEN	6.8088	61.694	44	West
SN11900	BIRI	10.5954	60.9518	190	East	SN53130	FRESVIK	6.9345	61.069	32	West
SN23720	VANG I VALDRES	8.569	61.124	489	East	SN48450	HUSNES	5.76946	59.864	13	West
SN23560	BEITO	8.8557	61.2433	754	East	SN47090	SKJOLD - FRØVIK	5.6257	59.503	5	West
SN27800	HEDRUM	9.9641	59.196	31	East	SN50150	HATLESTRAND	5.9032	60.045	45	West
SN1650	STRØMSFOSS SLUSE	11.6599	59.3006	113	East	SN52860	TAKLE	5.3813	61.027	38	West
SN24210	SOKNA II	9.9267	60.238	140	East	SN58320	MYKLEBUST I	6.6092	61.708	315	West
SN18160	NORDSTRAND	10.7912	59.873	118	East	SN57940	ÅLFOTEN II	5.6674	61.832	24	West
SN27770	STOKKE - SOLLI	10.2022	59.2752	90	East	SN58780	NORDFJORDEID -	6.0392	61.918	34	West

Table S2. Continue.

ID	Name	Longitude (°E)	Latitude (°N)	Elevation (m)	Region	ID	Name	Longitude (°E)	Latitude (°N)	Elevation (m)	Region
SN56780	SYGNA	5.7265	61.3435	45	West	SN60500	TAFJORD	7.4218	62.231	11	Middle
SN56520	HOVLANDSDAL	5.4342	61.232	85	West	SN60400	NORDDAL	7.2392	62.248	28	Middle
SN56850	VIKSDALEN I	6.1983	61.3262	243	West	SN73500	NORDLI - HOLAND	13.718	64.446	433	Middle
SN50540	BERGEN - FLORIDA	5.3327	60.383	12	West	SN59900	SÆBØ	6.4657	62.203	21	Middle
SN53700	AURLAND	7.201	60.9027	15	West	SN63530	HAFSÅS	8.9773	62.51	698	Middle
SN56400	YTRE SOLUND	4.6693	61.007	3	West	SN73250	SØRLI	13.765	64.243	370	Middle
SN55730	SOGNDAL -	6.9335	61.3348	421	West	SN69960	BURAN	11.5436	63.72	182	Middle
SN46300	SULDALSVATN	6.809	59.5887	333	West	SN78350	BARDAL	13.3917	66.218	39	Middle
SN51250	ØVSTEDAL	5.9647	60.6887	316	West	SN76100	ØKSNINGØY	12.3745	65.125	24	Middle
SN52750	FRØYSET	5.2108	60.8462	13	West	SN72650	OVERHALLA -	11.8397	64.482	26	Middle
SN54600	MARISTOVA	8.036859	61.1099	806	West	SN61040	HILDRE	6.3187	62.602	13	Middle
SN57850	DAVIKNES	5.5333	61.8986	78	West	SN69100	VÆRNES	10.9305	63.46	12	Middle
SN57480	BOTNEN I FØRDE	6.0586	61.5349	237	West	SN60620	GRØNNING	7.5135	62.329	312	Middle
SN52400	EIKANGER - MYR	5.3742	60.6268	72	West	SN73800	TUNNSJØ	13.6506	64.684	376	Middle
SN57390	SKEI I JØLSTER	6.4873	61.5722	205	West	SN65230	HEMNE - LENES	9.0115	63.261	45	Middle
SN57990	GJENGEDAL	5.9468	61.6594	230	West	SN75100	LIAFOSS	11.9547	64.838	44	Middle
SN55550	HAFSLO	7.1887	61.2925	246	West	SN80200	LURØY	13.1848	66.389	115	Middle
SN46450	RØLDAL	6.8238	59.8305	388	West	SN71900	BESSAKER	10.3257	64.245	12	Middle
SN57660	EIMHJELLEN	5.8157	61.6407	176	West	SN58960	HORNINDAL	6.6502	62.003	349	Middle
SN53070	VIK I SOGN III	6.5813	61.0728	65	West	SN70930	SNÅSA - NAGELHUS	12.4393	64.249	107	Middle
SN47890	OPSTVEIT	6.016924	59.8578	38	West	SN71280	LEKSVIK - MYRAN	10.6075	63.686	138	Middle
SN56320	LAVIK	5.5413	61.1124	26	West	SN59250	REFVIK	5.0878	61.999	3	Middle
SN68270	LØKSMYR	10.4369	63.2315	173	Middle	SN71810	ÅFJORD - MOMYR	10.523	64.1	280	Middle
SN8720	ATNSJØEN	10.1398	61.8902	749	Middle	SN71200	MOSVIK -	10.998	63.813	39	Middle
SN770	ELLEFSPLASS	11.4525	62.204	713	Middle	SN61820	ERESFJORD	8.105	62.663	14	Middle
SN63750	MJØEN	9.6591	62.574	512	Middle	SN63100	ØKSENDAL	8.4218	62.686	47	Middle
SN10600	AURSUND	11.4534	62.6737	685	Middle	SN62900	EIDE PÅ NORDMØRE	7.3896	62.891	49	Middle
SN810	TUFSINGDAL -	11.732	62.2776	687	Middle	SN62700	HUSTADVATN	7.2436	62.909	80	Middle
SN730	VALDALEN	12.1722	62.0758	794	Middle	SN82290	BODØ VI	14.3816	67.272	16	North
SN16610	FOKSTUGU	9.2862	62.1133	973	Middle	SN82840	STYRKESNES -	15.4953	67.526	27	North
SN9870	BLANKTJERNMOEN	10.428	62.4343	692	Middle	SN88660	BOTNHAMN	17.9175	69.521	6	North
SN68420	AUNET	11.5669	63.0556	302	Middle	SN92910	SOPNESBUKT	22.3243	70.052	8	North
SN15480	SKJÅK II	8.4672	61.8777	374	Middle	SN80610	MYKEN	12.486	66.763	17	North
SN15660	SKJÅK	8.1706	61.9013	432	Middle	SN89350	BARDUFOSS	18.5437	69.058	76	North
SN16790	LESJA - SVANBORG	8.919	62.1057	551	Middle	SN92350	NORDSTRAUM I	21.8958	69.836	20	North
SN68840	STUGUDAL - KÅSEN	11.8626	62.8952	730	Middle	SN83300	STEIGEN	15.1123	67.923	31	North
SN14550	PRESTSTULEN	9.0084	61.9225	823	Middle	SN88100	BONES I BARDU	18.2442	68.646	230	North
SN15730	BRÅTÅ - SLETTOM	7.8955	61.8957	664	Middle	SN98550	VARDØ RADIO	31.0962	70.371	10	North
SN78370	BJERKA - VALLA	13.8067	66.1415	20	Middle	SN82530	KJERRINGØY - OS	14.8402	67.539	15	North
SN63580	ÅNGÅRDSVATNET	9.1967	62.6708	596	Middle	SN80740	REIPÅ	13.646	66.904	9	North
SN67150	LEINSTRAND	10.2733	63.3281	13	Middle	SN90490	TROMSØ - LANGNES	18.9133	69.677	8	North
SN78250	LEIRFJORD	12.9097	66.0668	53	Middle	SN83520	TØMMERNESET	15.859	67.892	70	North
SN70820	UTGÅRD	11.729	64.1163	50	Middle	SN84190	SKJOMEN - STIBERG	17.5145	68.208	29	North
SN66620	RENNEBU -	9.8354	62.864	223	Middle	SN86500	SORTLAND	15.4157	68.703	3	North
SN76250	SØMNA - STEIN	12.1643	65.2965	19	Middle	SN90450	TROMSØ	18.9368	69.654	100	North
SN71550	ØRLAND III	9.6105	63.7045	10	Middle	SN90650	GRUNNFJORD -	19.573	70.008	7	North
SN75020	OTTERØY	11.28055	64.5228	36	Middle	SN96970	SIRBMA	27.4018	70.019	51	North
SN77850	SUSENDAL	14.2457	65.3675	498	Middle	SN93900	SIHCCAJAVRI	23.5387	68.755	382	North
SN60990	VIGRA	6.115	62.5617	22	Middle	SN93700	KAUTOKEINO	23.0335	68.997	307	North
SN79480	MO I RANA III	14.1542	66.307	41	Middle	SN97350	CUOVDDATMOHKKI	24.4312	69.37	286	North

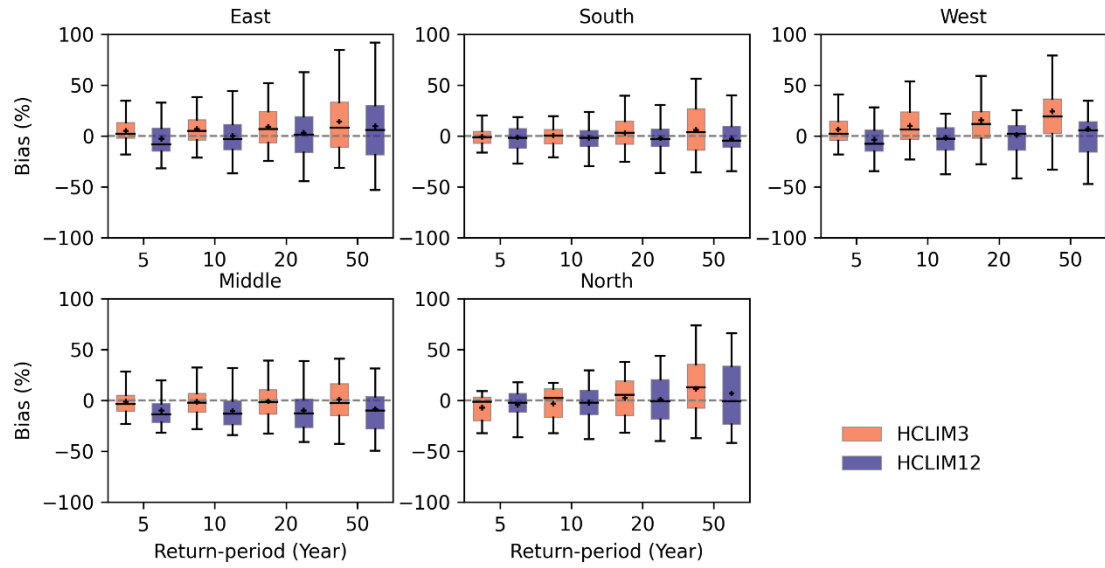


Figure S1: Bias of return-levels in the present-day for HCLIM3 and HCLIM12 relative to observation for 5-, 10-, 20-, and 50-year return periods in the 192 daily rain-gauges. Return periods of 5-, 10-, 20-, and 50-year are calculated on the basis of station-scale GEV. The bias of return-levels for 192-rain-gauges are statistics by regions.

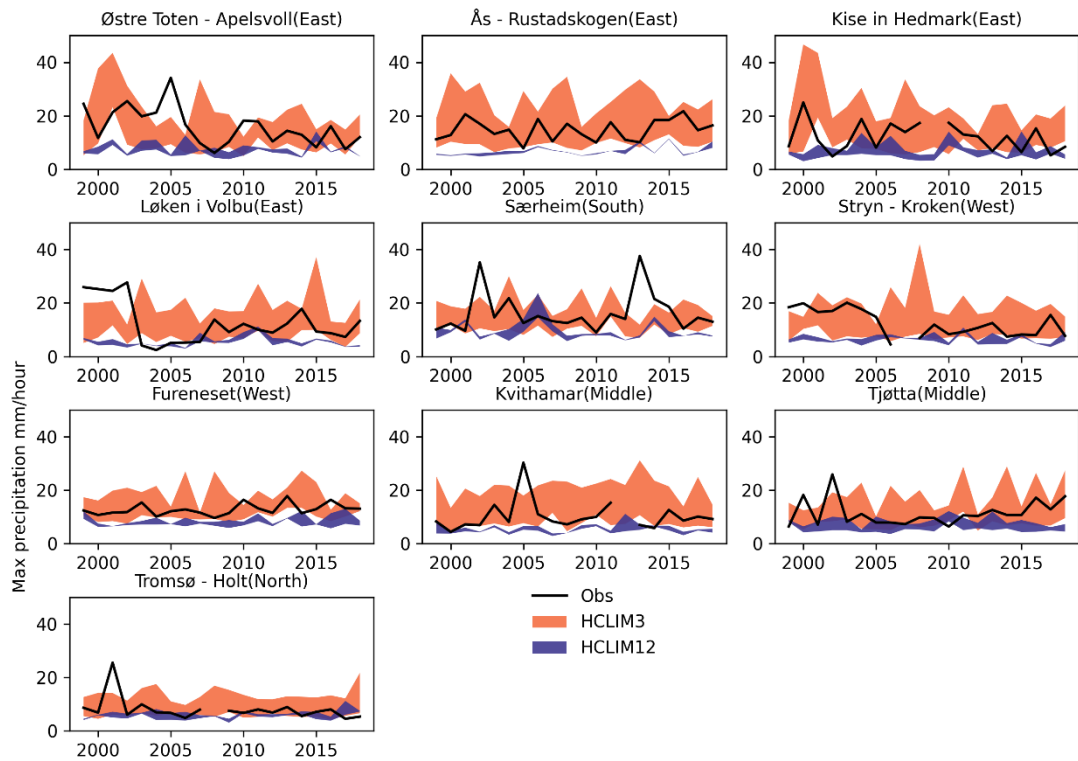


Figure S2: Time evolution of annual maximum hourly precipitation from observation, HCLIM3 and HCLIM12 during 1999-2018 at 10 hourly rain-gauges. Grids within a 12 km radius of each station are extracted for HCLIM3 and HCLIM12 to calculate the range band.

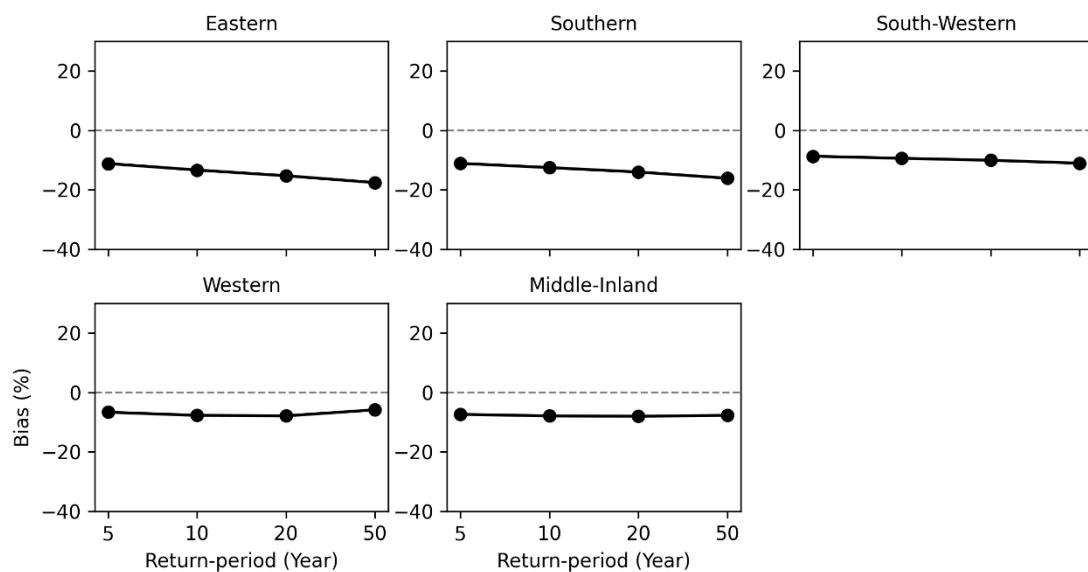


Figure S3: Percentage bias of extreme daily precipitation exceeding the 5-year to 50-year return periods over five regions between SeNorge and daily in-situ observations from 194 stations during 1999-2018. Return periods of 5-, 10-, 20-, and 50-year are calculated on the basis of GEV.