Greining á kerfisbundnum mun í úrkomumælingum í flóknu landslagi á Seyðisfirði

Páll Ágúst Þórarinsson

Leiðbeinendur:
Guðrún Nína Petersen (Veðurstofa Íslands)
Anna Sjöblom (UNIS/Uppsala University)

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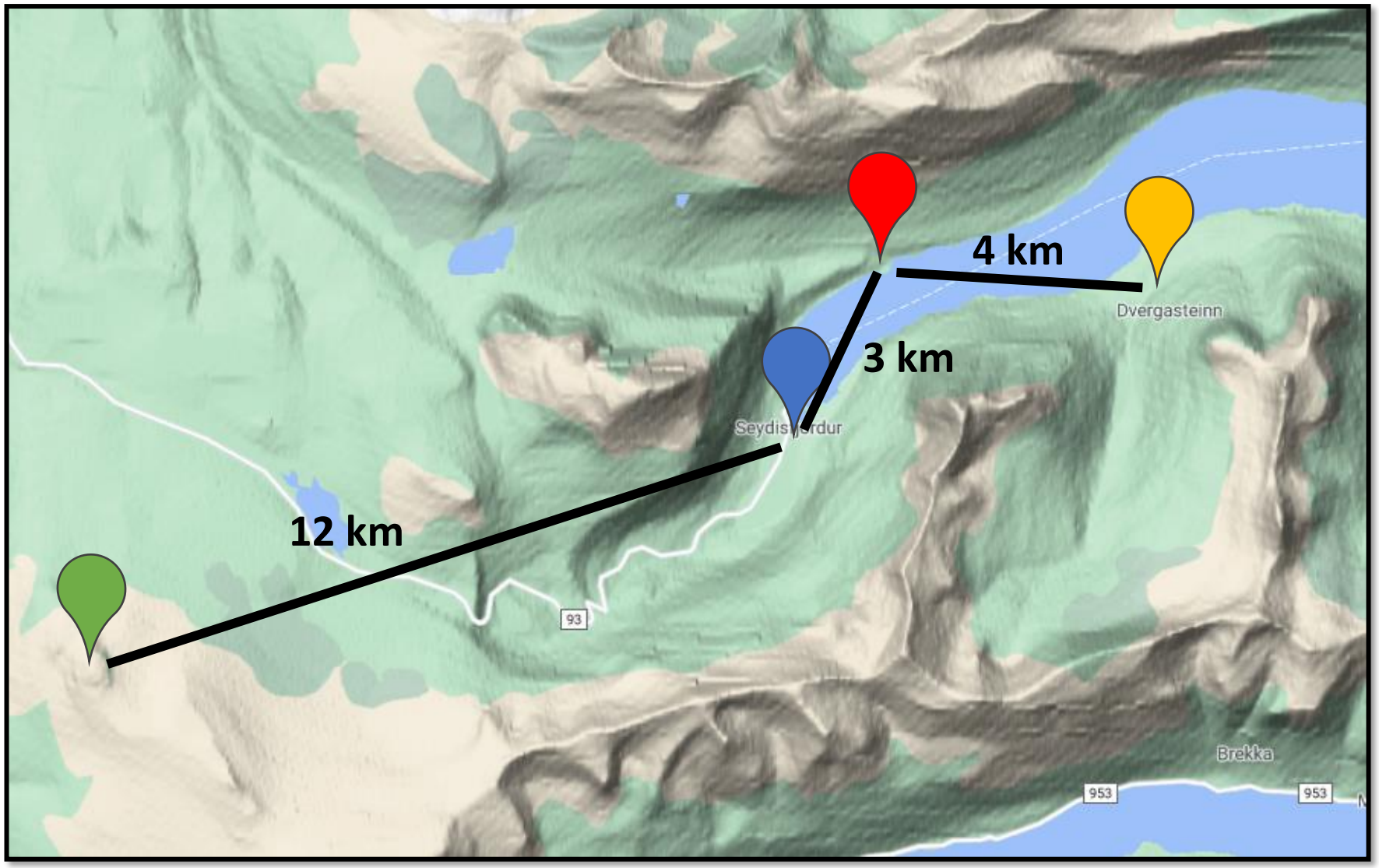

- Seyðisfjörður
  - Vippumælir
- Vestdalur
  - Vigtuð fata
- Hánefsstaðir
  - Brúsi
- Gagnheiði
  - Vindagögn

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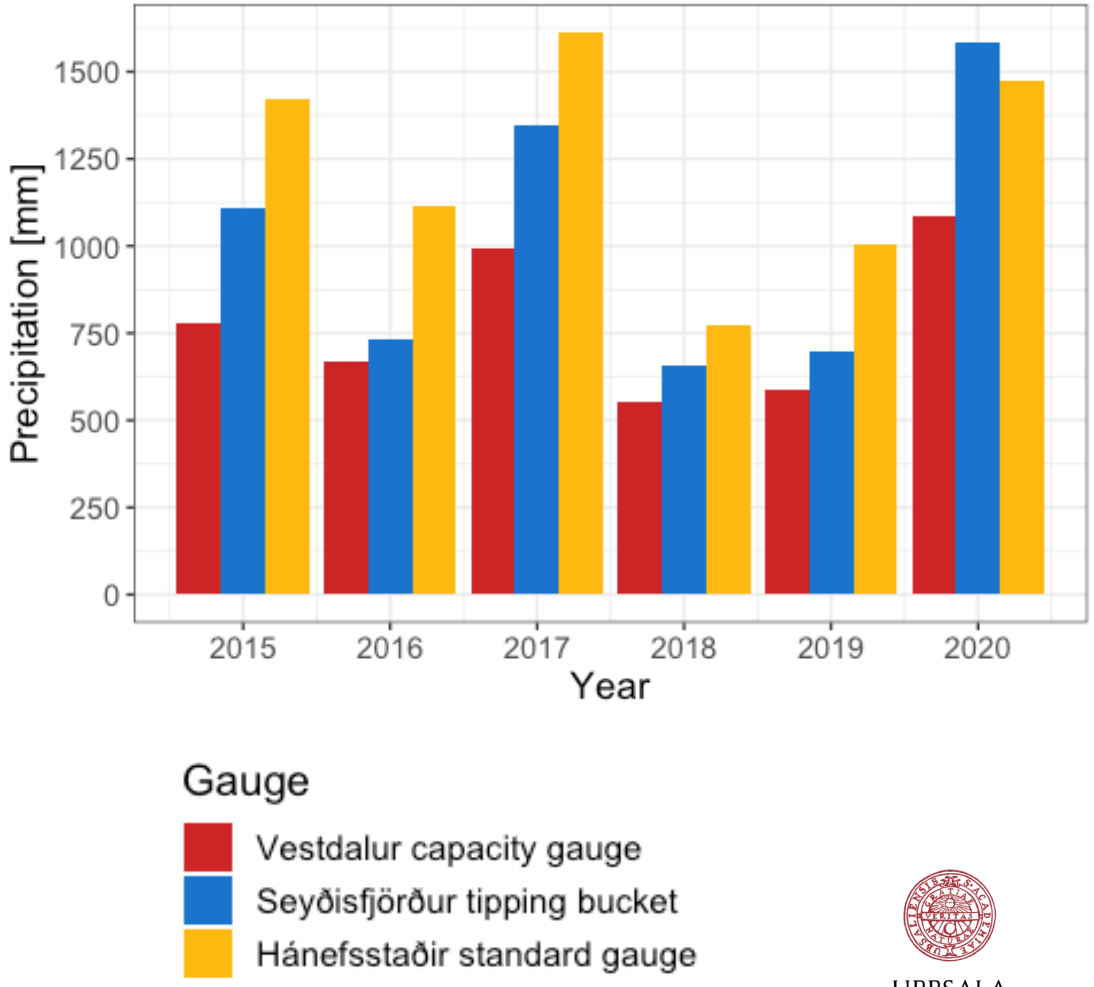
Munur á uppsafnaðri ársúrkomu (regn)

Hvernig getur munur í uppsafnaðri úrkomu milli mæla á Seyðisfirði verið skýrður?

- Er kerfisbundinn munur milli mæliaðferða?
- Er hann vegna landslagsins?
- Er hægt að tengja hann við stöðu veðrakerfanna yfir N-Atlantshafinu?



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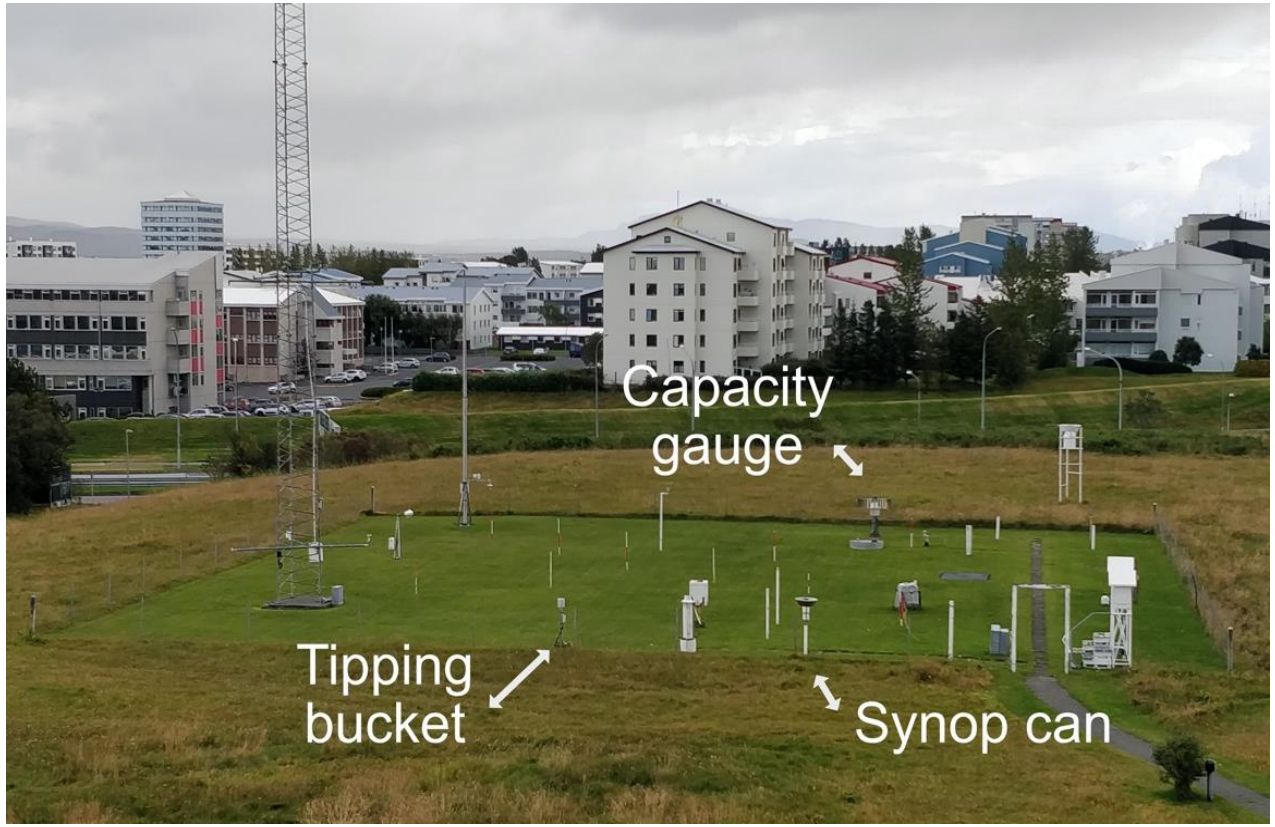
Samanburður í Reykjavík

- Sömu mælar og á Seyðisfirði, hér allir á sama stað
- Sama uppsetning (vind vörn o.fl.)
- 6-9% vanmat hjá vippumæli m.v. hina tvo



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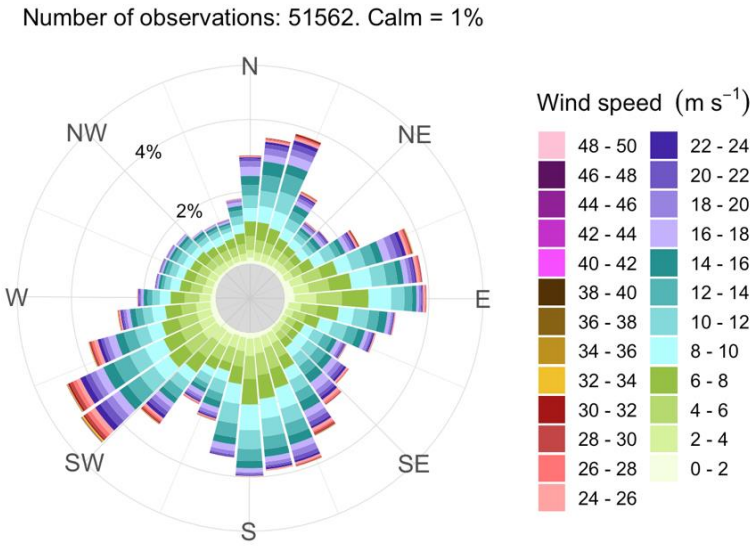
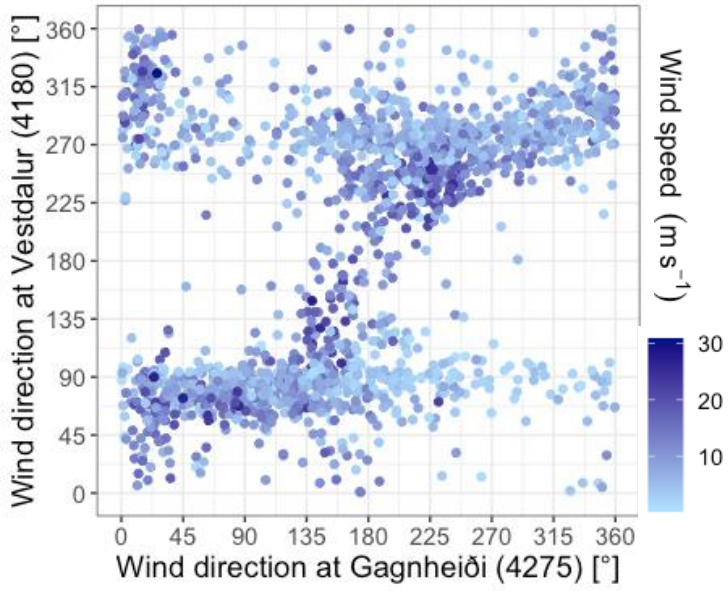
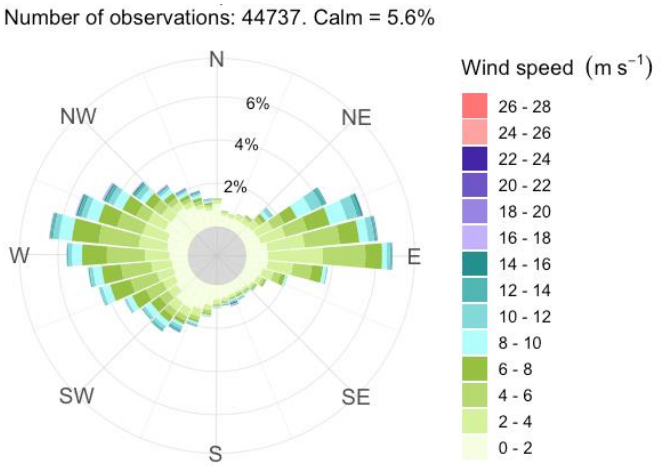
Áhrif landslagsins á flæði lofts

Gagnheiði 949 m y.s.





Vestdalur 92 m y.s.



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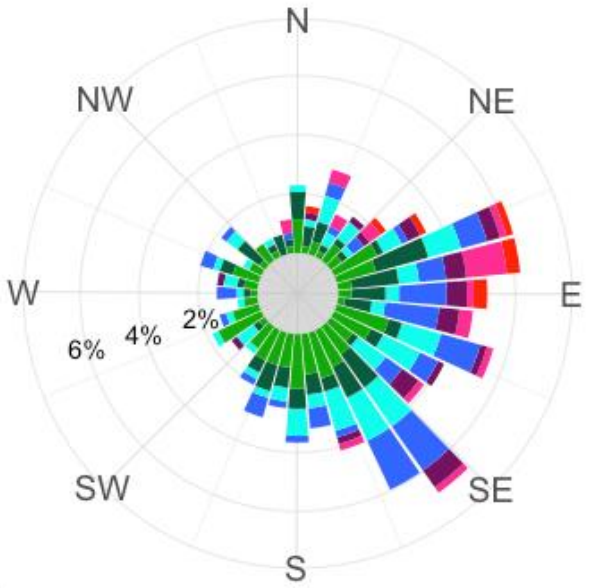
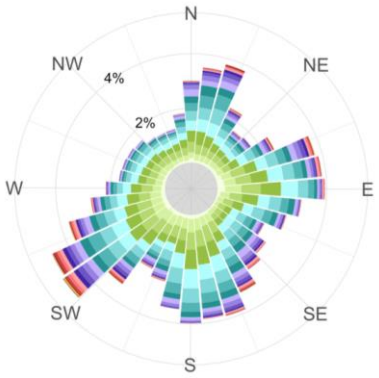
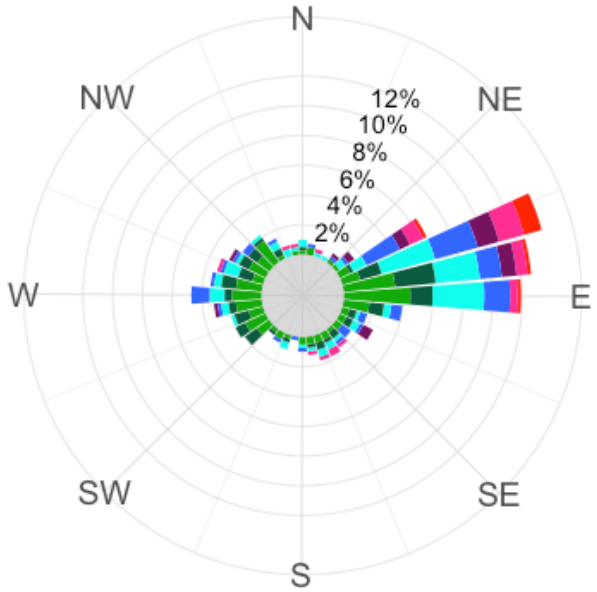
Hvaðan rignir þá?

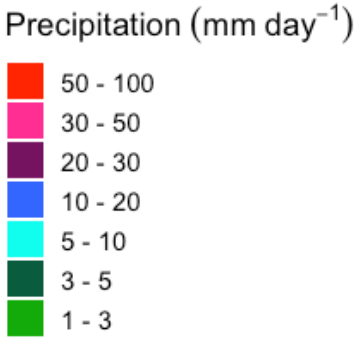
- Uppsöfnuð dagsúrkoma í mm í stað vindhraða
- Úrkoma úr Vestdal
- Blautar austlægar áttir

Vindátt frá
Gagnheiði









Vindátt frá
Vestdal

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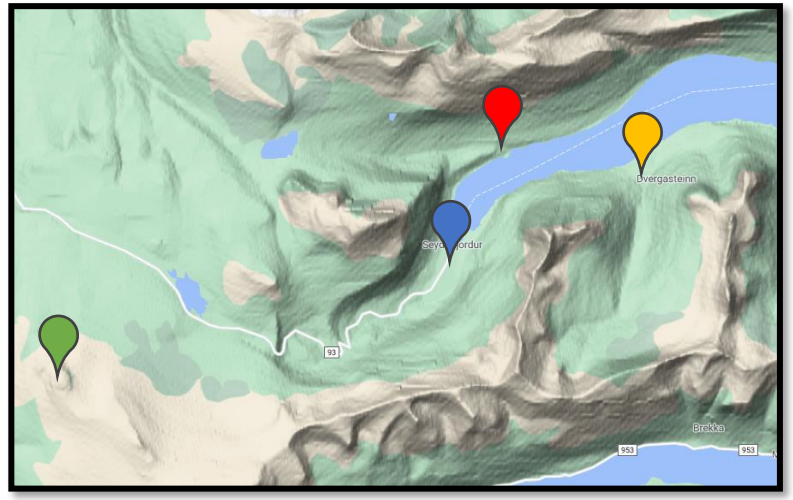
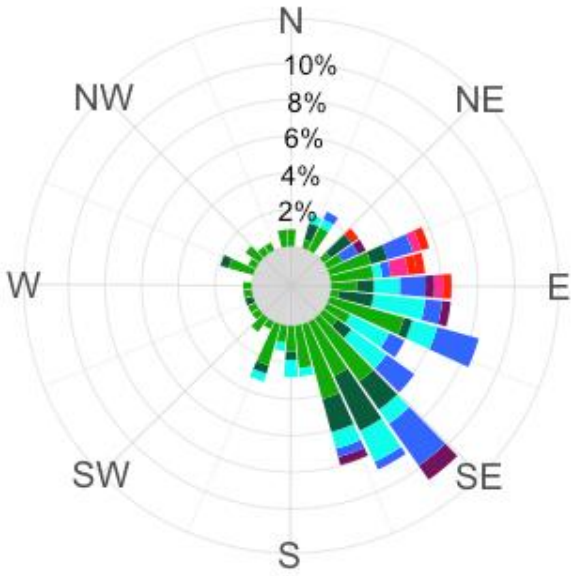
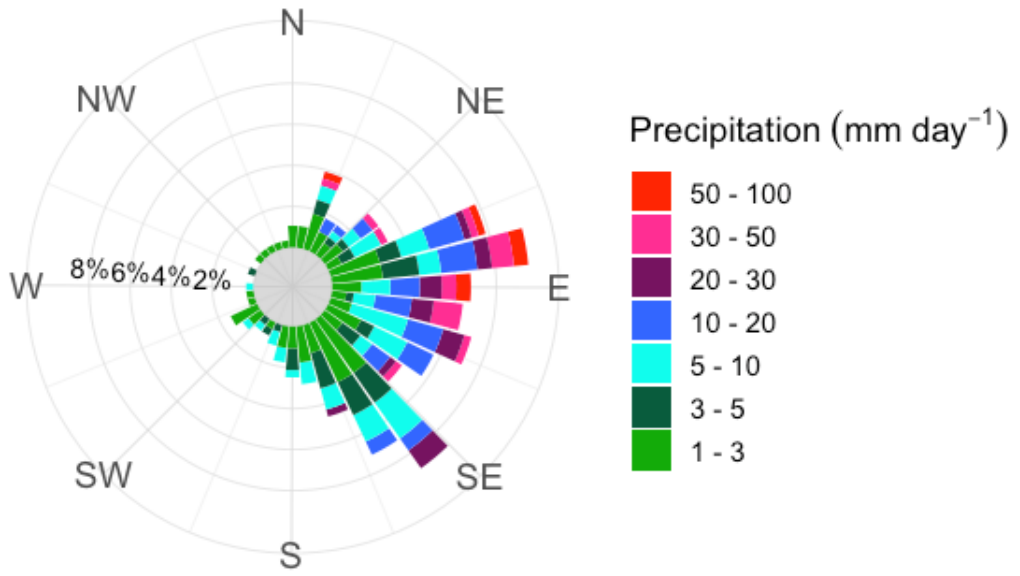
Munur milli mæla



Munur á dagsúrkomu milli Vestdals og Seyðisfjarðar með Vindátt frá Gagnheiði



Munur á dagsúrkomu milli Vestdals og Hánefsstaða með vindátt frá Gagnheiði



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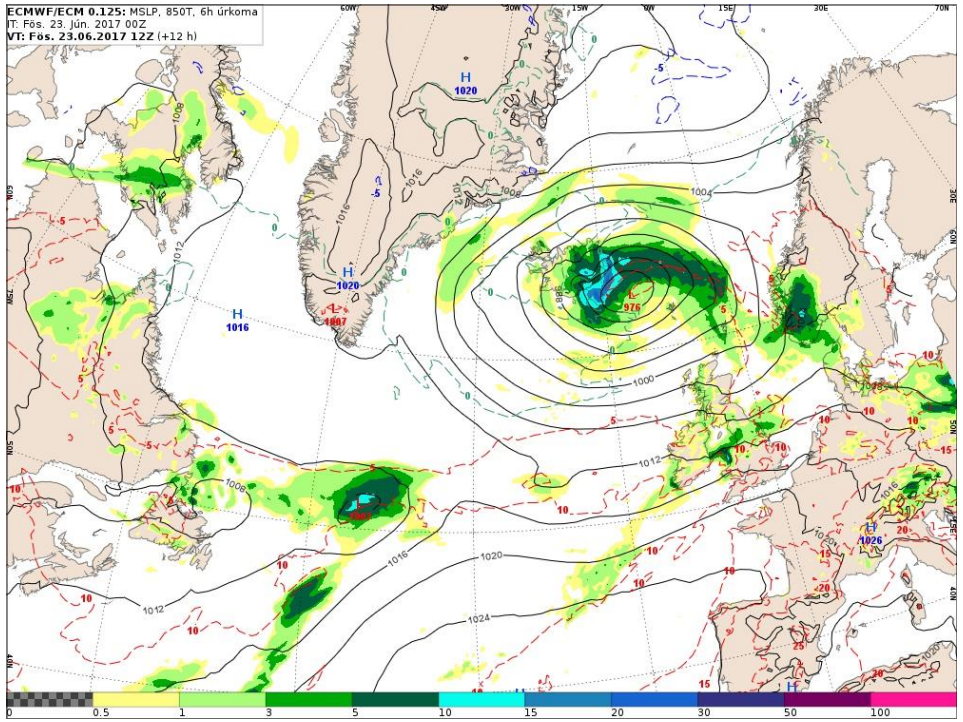
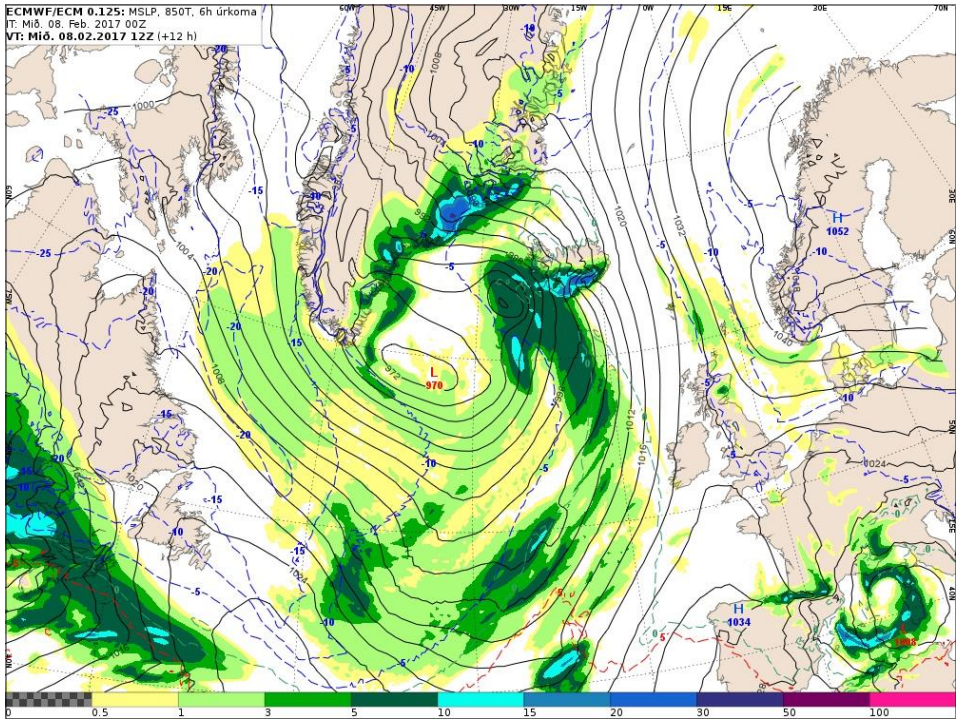
Veður þar sem mikill munur mældist

2017-06-23



69,7 mm dag^{-1} munur

2017-02-08



26,4 mm dag^{-1} munur

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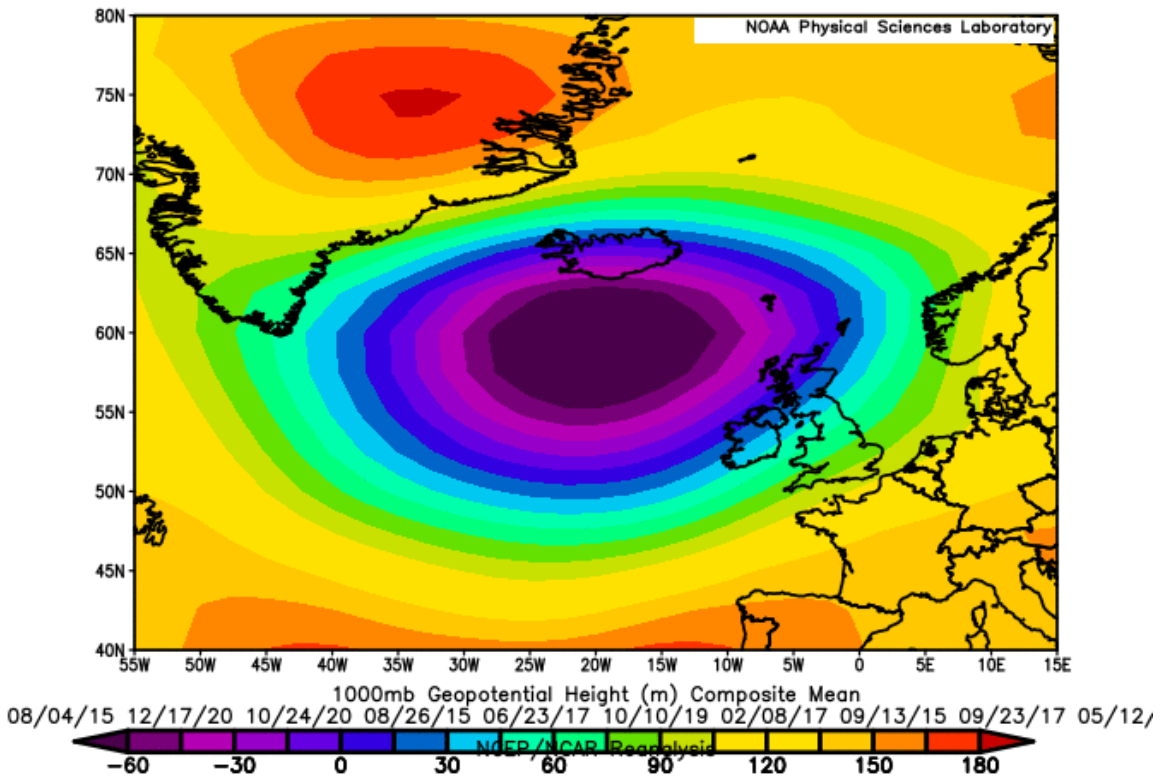
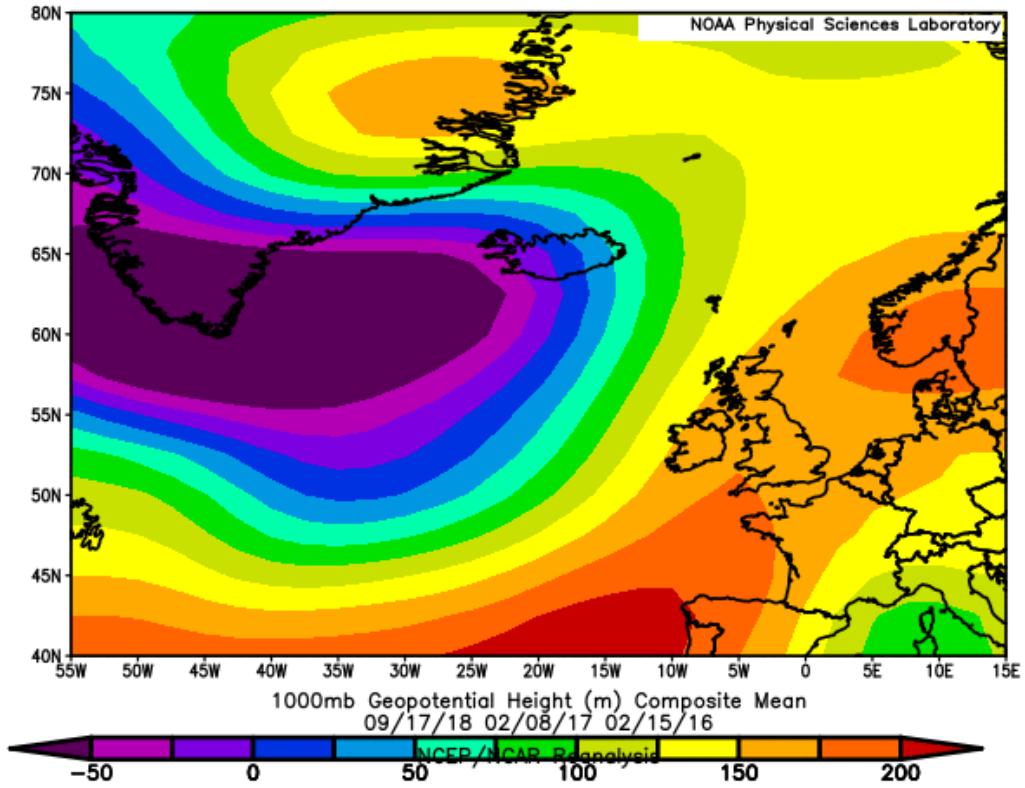
Meðal staða veðrakerfanna





(Kalney et al., 1996)

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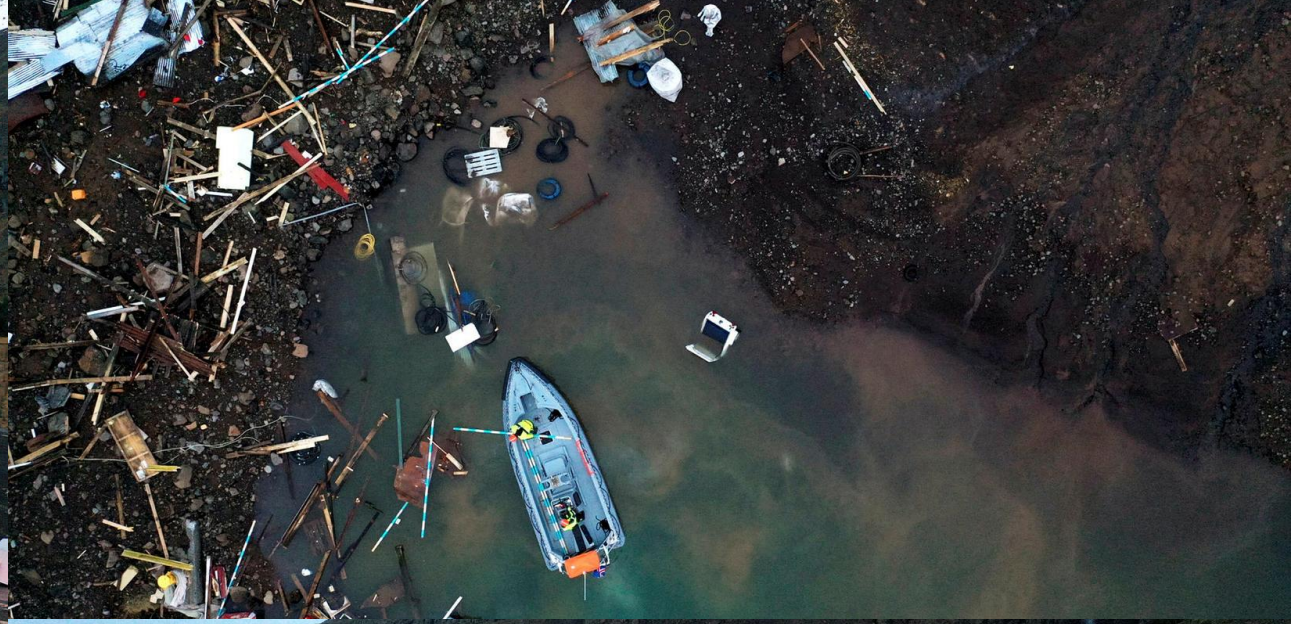
Samantekt

- Kerfisbundið vanmat vippumælisins er lítið
- Flókið landslagið hefur áhrif á flæði loftsins og úr hvaða áttum rignir
- Mikils muns í regnmælingum má vænta í tveimur þemum
  - 20-36% munur að meðaltali
  - Allt að 80 mm dag^{-1} munur, jafnvel yfir 100 mm dag^{-1}
- Atburðir með miklu regni en litlum mun er fáir og minni (3% af heild)
  - Mikið regn → mikill munur
- Mögulegur úrkomuskuggi í Vestdal í norðlægari áttum



Future outlook

- Further case studies
  - Using theory with blocked / unblocked situation
- Investigate better systematic difference in tipping bucket
  - High / low amount events: is there a difference in performance
- Verify precipitation shadow suggested
- Compare with model data
- Usable elsewhere in the world
  - Same instruments, similar terrain and midlatitudes

References

Kalnay, E. et al., 1996. The NCEP/NCAR Reanalysis 40-year Project. *Bulletins of the American Meteorological Society,* 3(77), pp. 437-471.

SMHI, 2017. *Normal uppskattad årsnederbörd, medelvärde 1961-1990.* [Online] Available at: Kalnay, E. et al., 1996. The NCEP/NCAR Reanalysis 40-year Project. Bulletins of the American Meteorological Society, 3(77), pp. 437-471.

World, Y., 2017. *How the North Atlantic Oscillation affects European and Atlantic weather.* [Online] Available at: https://www.yachtingworld.com/weather/how-the-north-atlantic-oscillation-affects-european-and-atlantic-weather-105954

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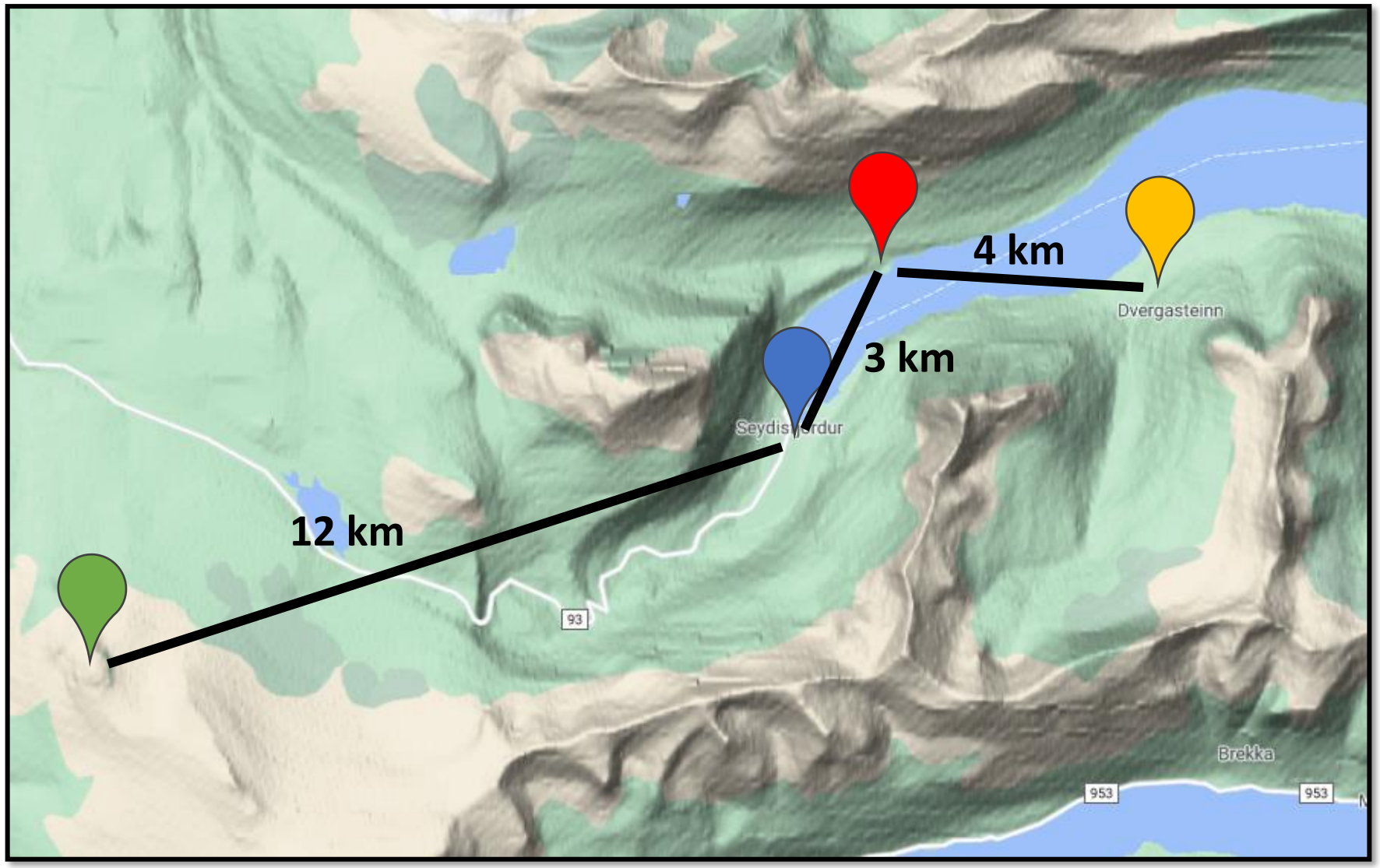

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Figure 3: Annual precipitation distribution

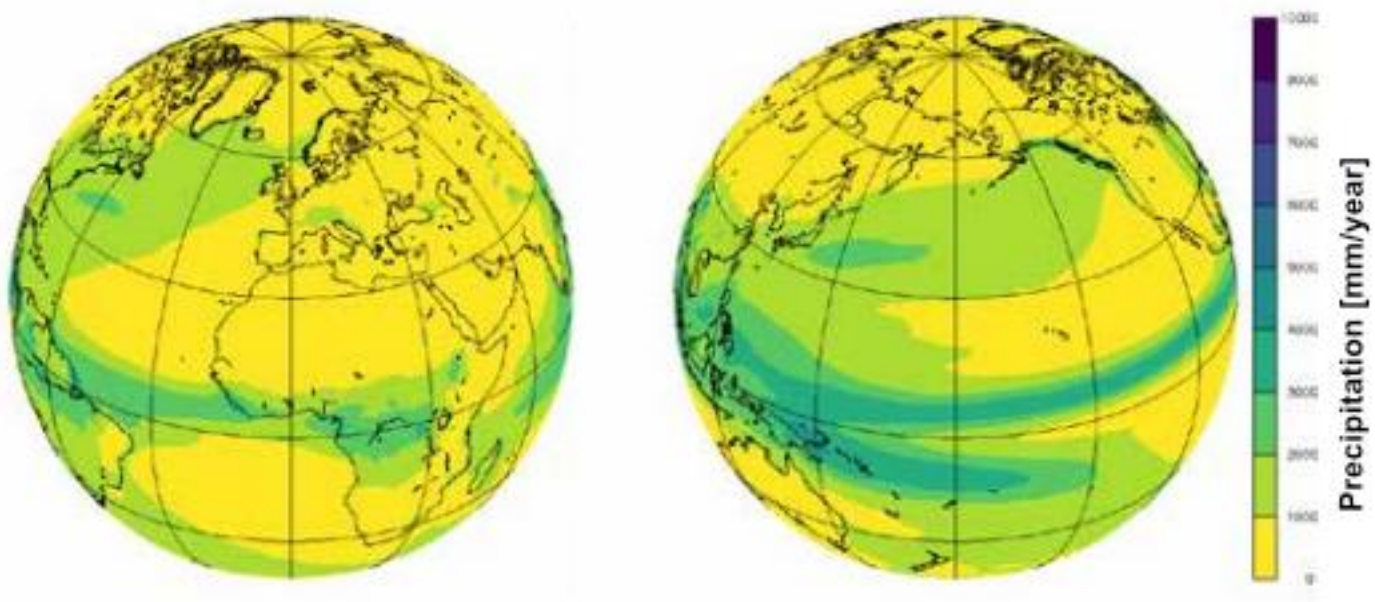

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Figure 4: Tipping bucket gauge

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Figure 5: Geonor capacity gauge

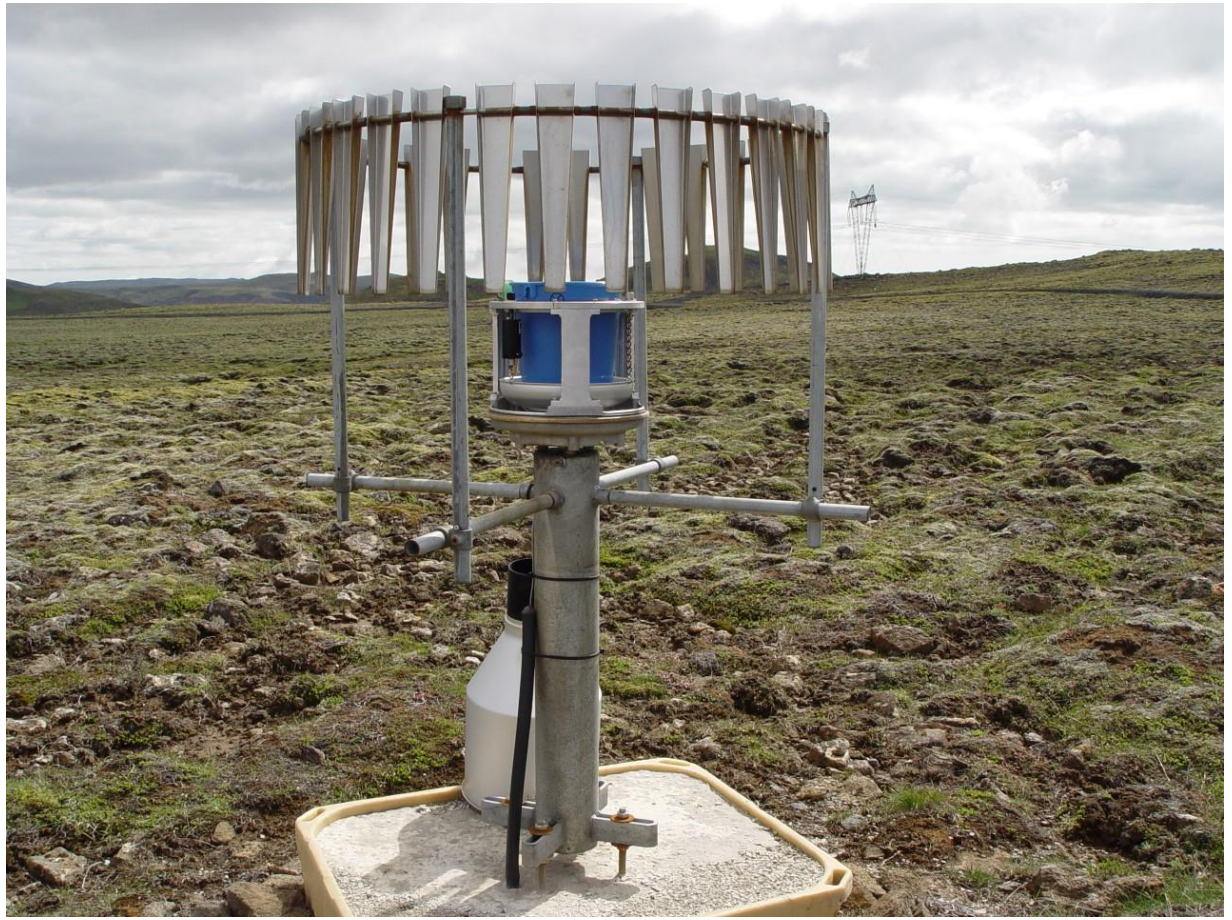

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Figure 6: Airflow over raingauge opening

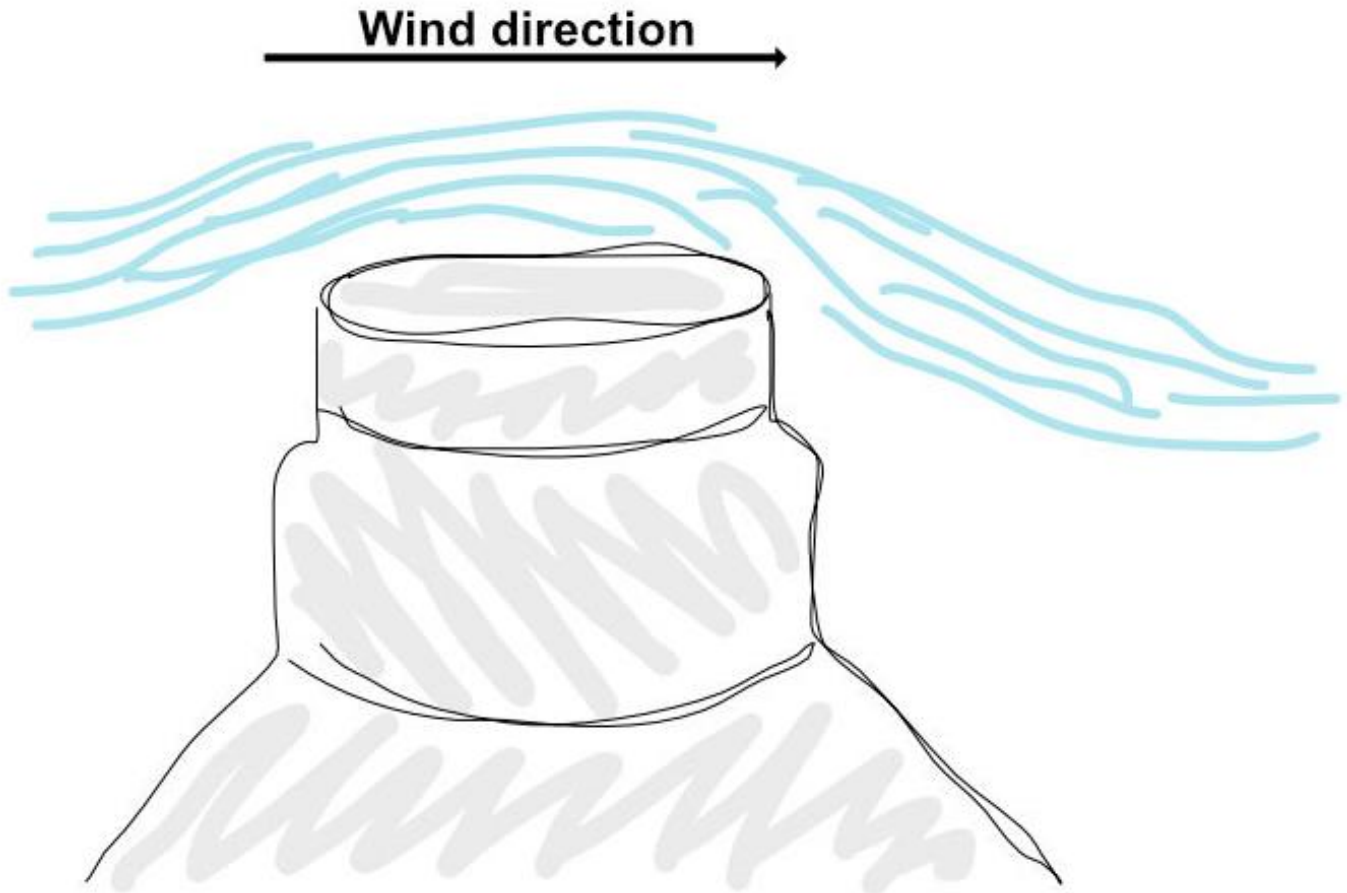

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Figure 8: map and locations

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Figure 9: Monthly rain in Reykjavík 2019

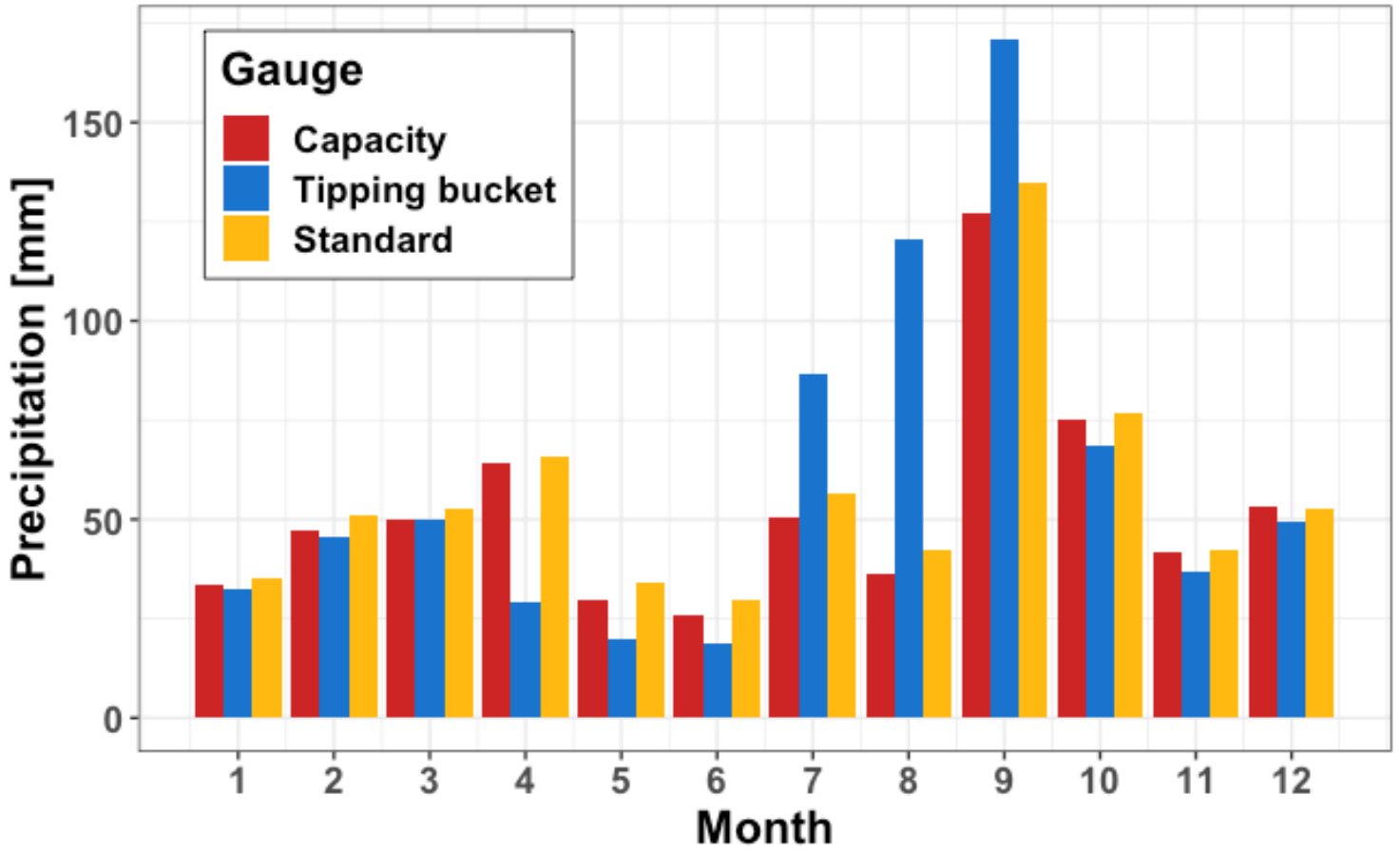

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Figure 10: Reykjavík precipitation type

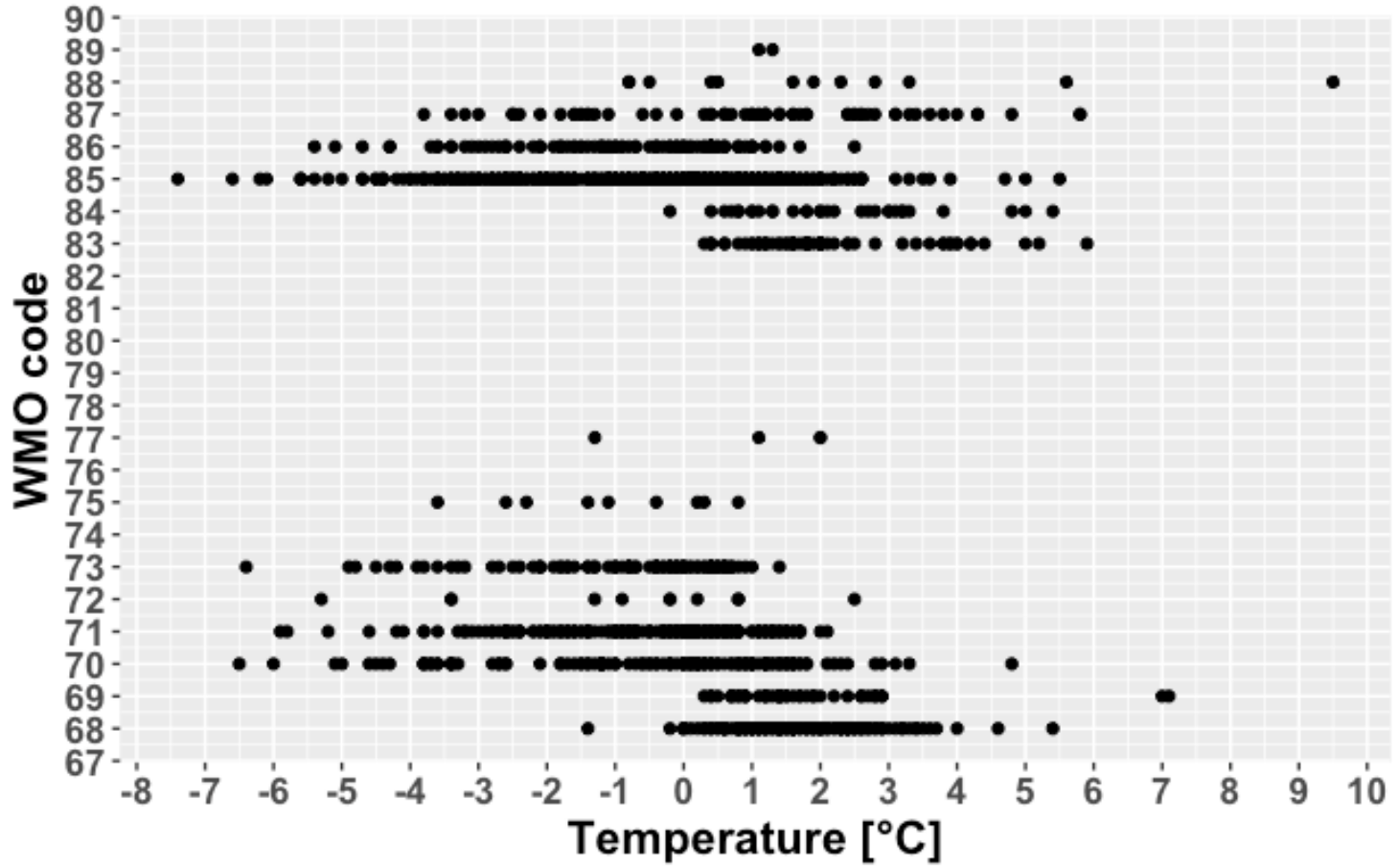

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Figure 11: Reykjavík automatic precipitation measurements

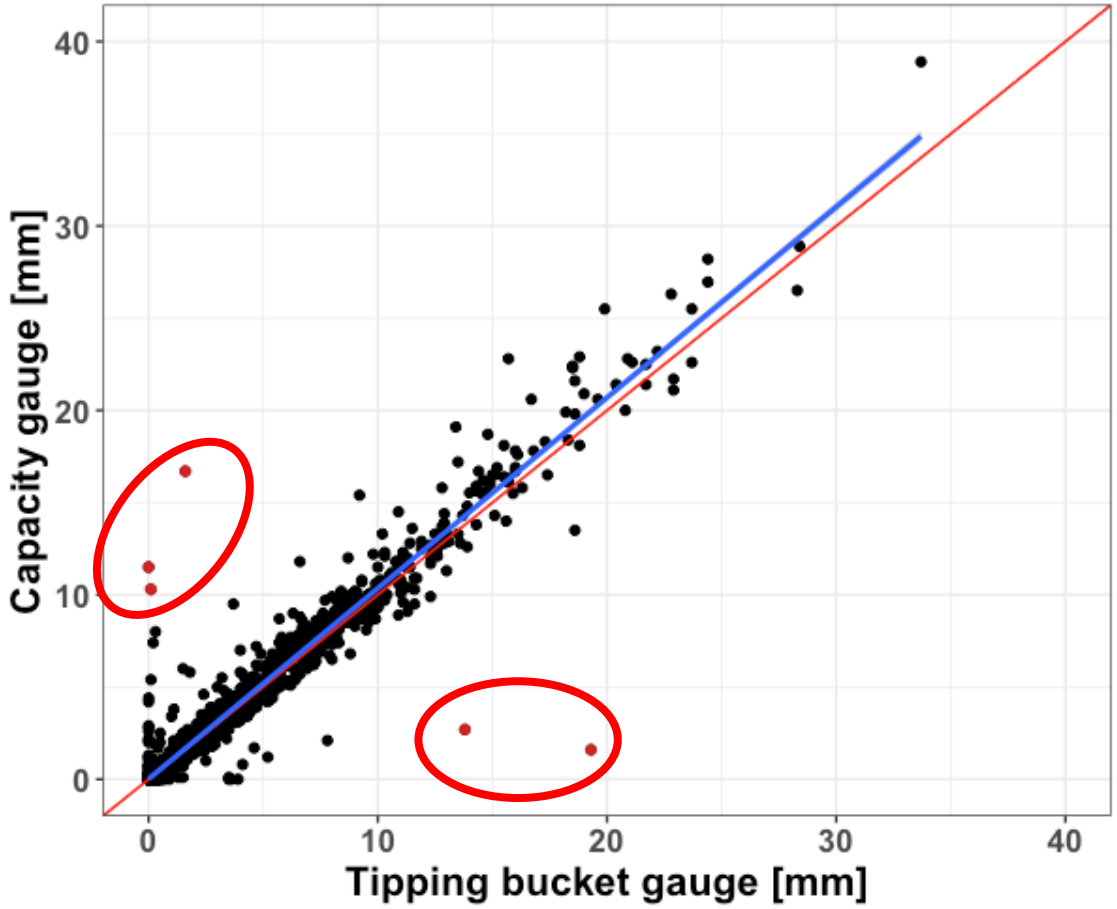

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Figure 12: Reykjavík automatic precipitation measurements in high wind

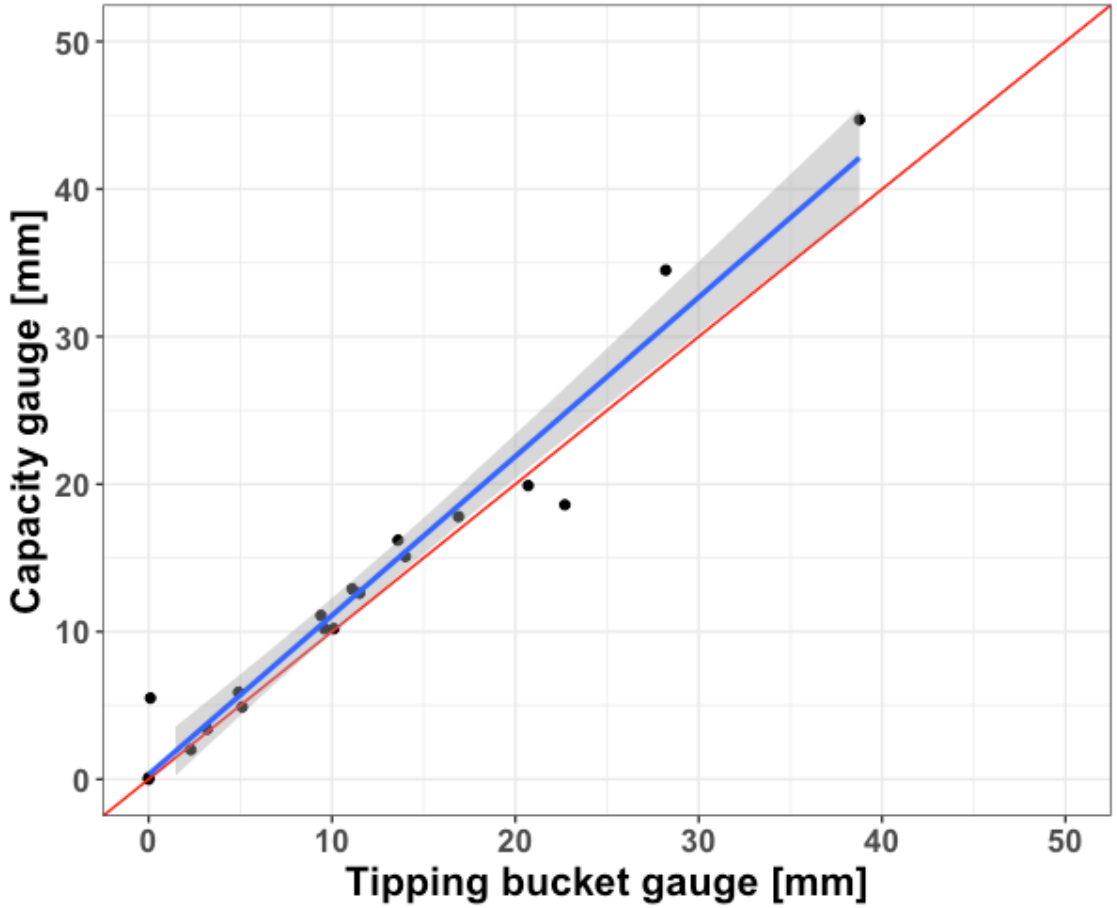

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Figure 13: Data retrievel from Seyðisfjörður

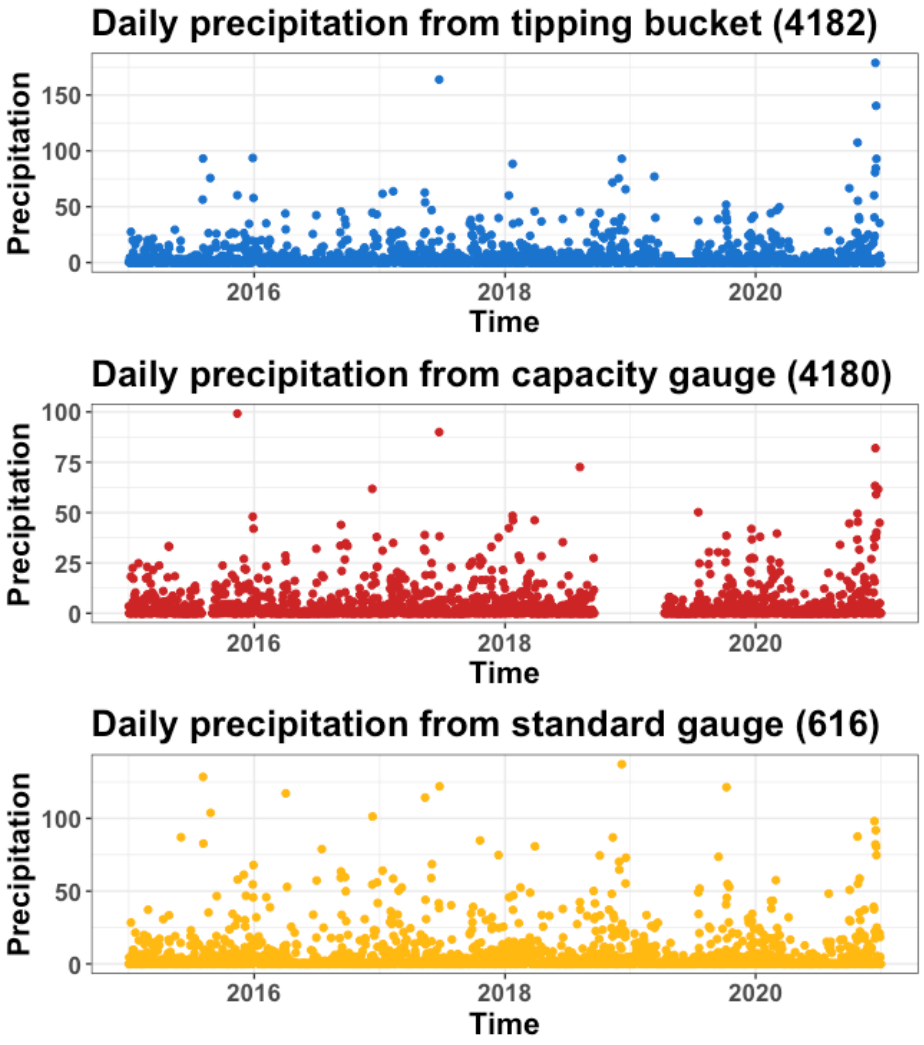

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Figure 14: Wind roses for automatic stations

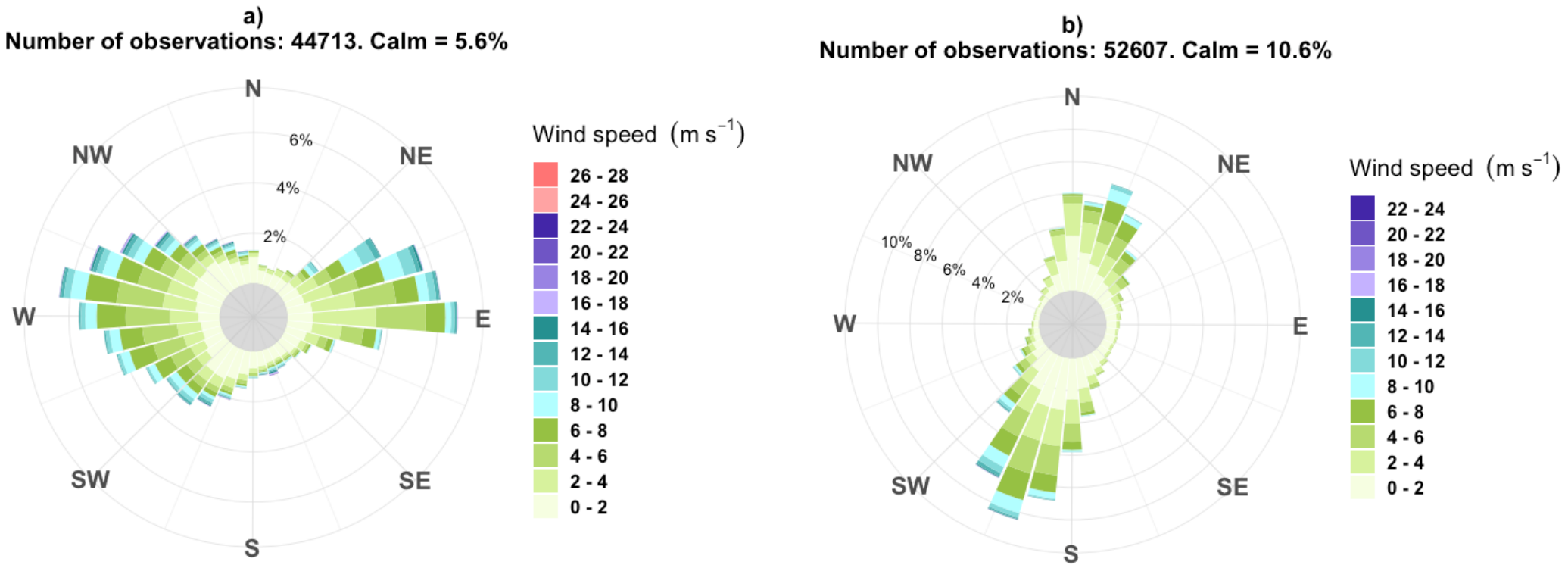

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Figure 15: wind roses for wind > 8 m s^{-1}

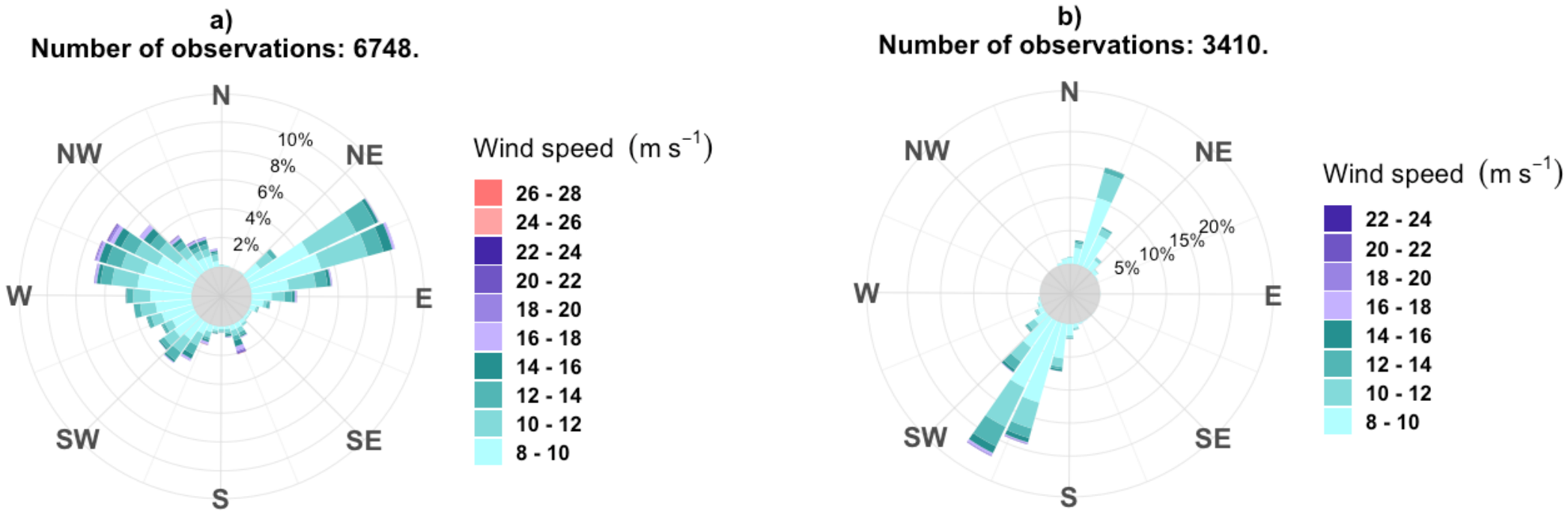

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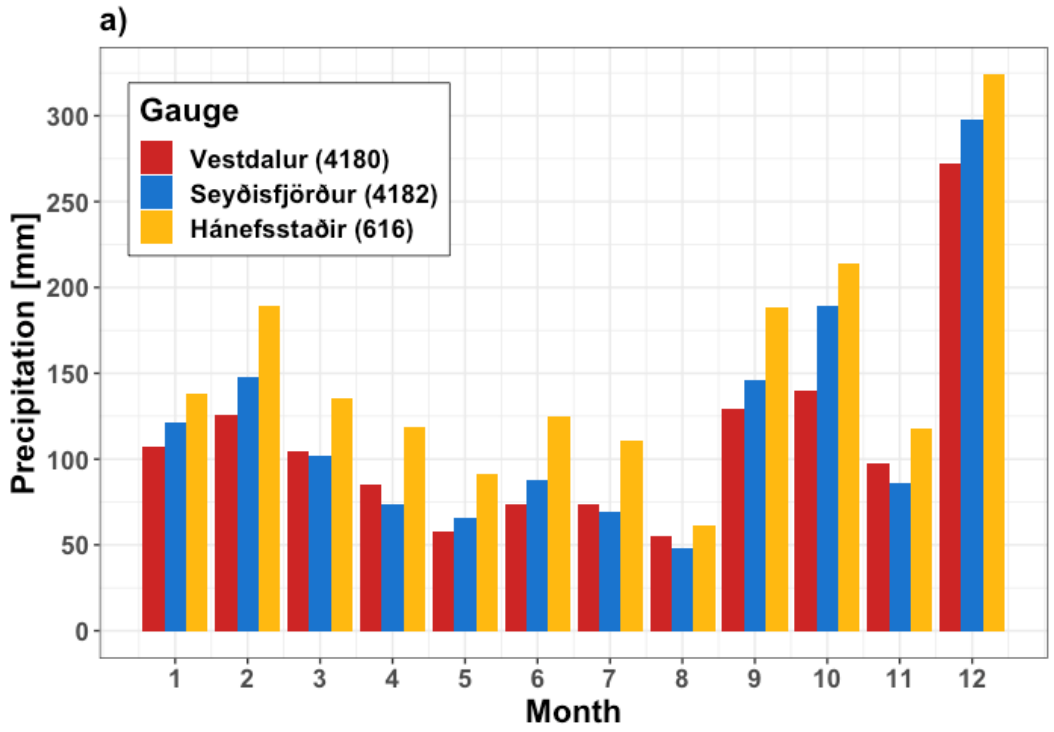
Figure 16: Average monthly precipitation and temperature



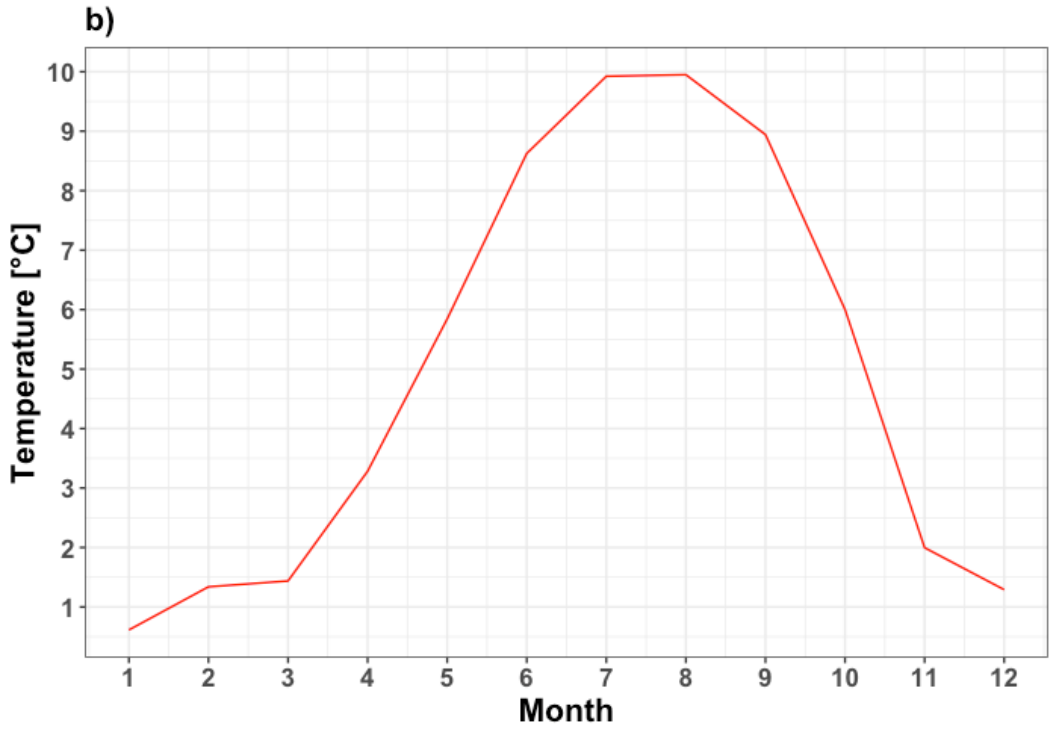


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Figure 17: Automatic rain measurements

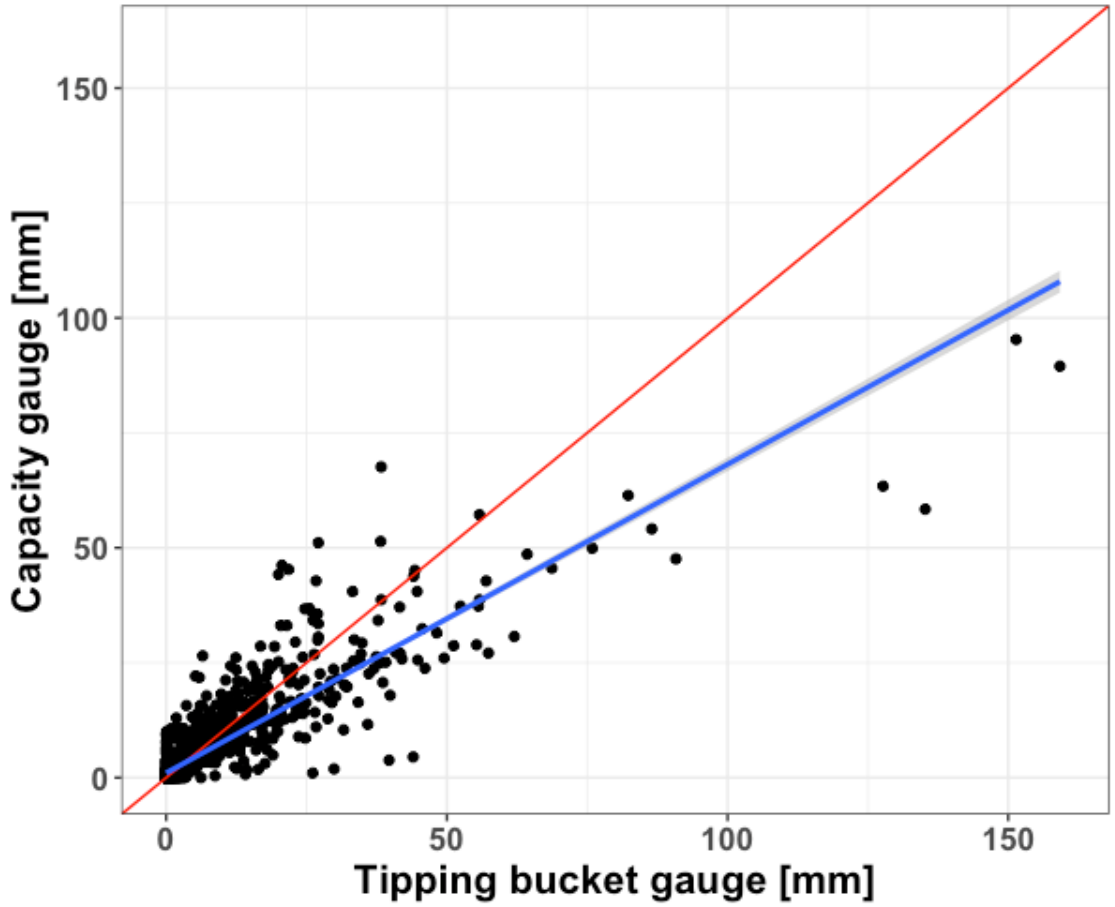

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Figure 18: Ratio of annual precipitation

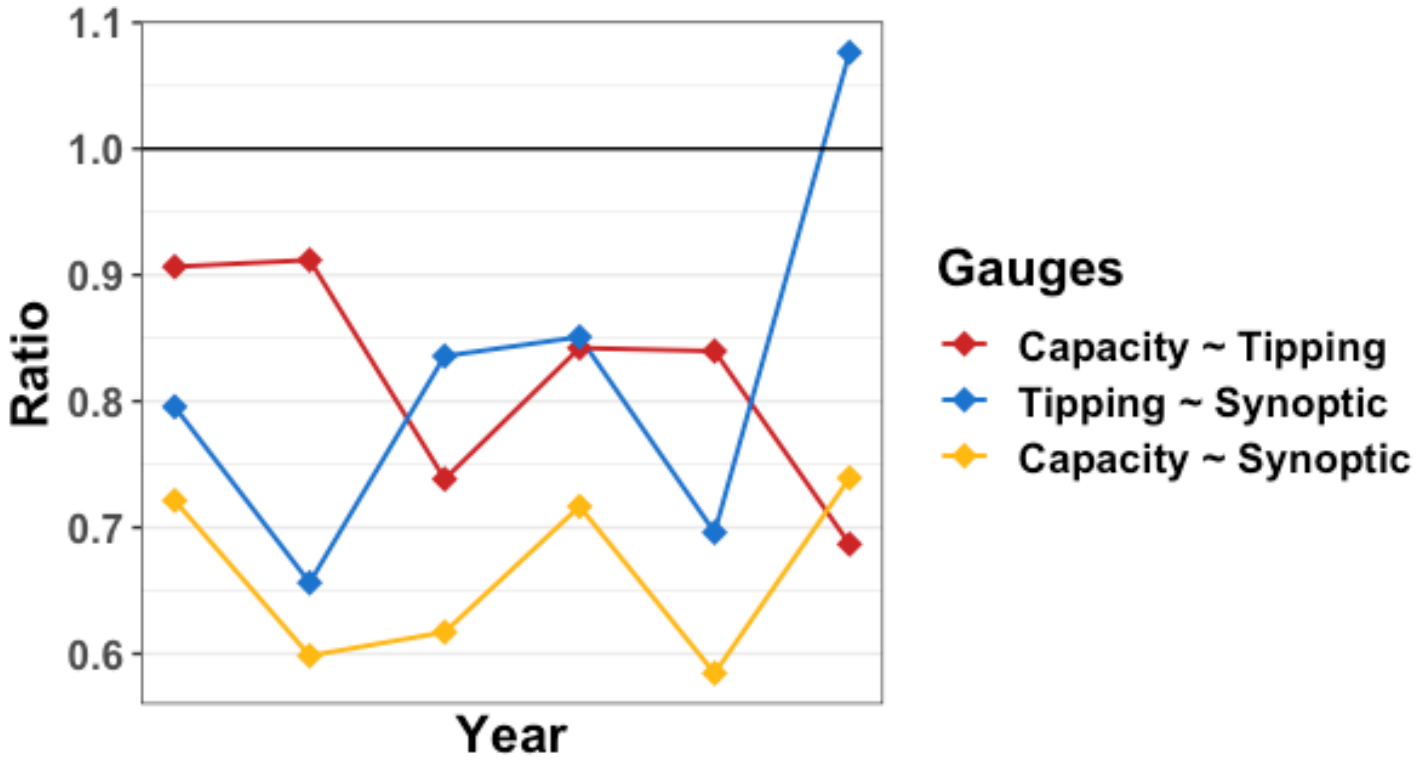

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Figure 19: Precipitation roses for automatic stations

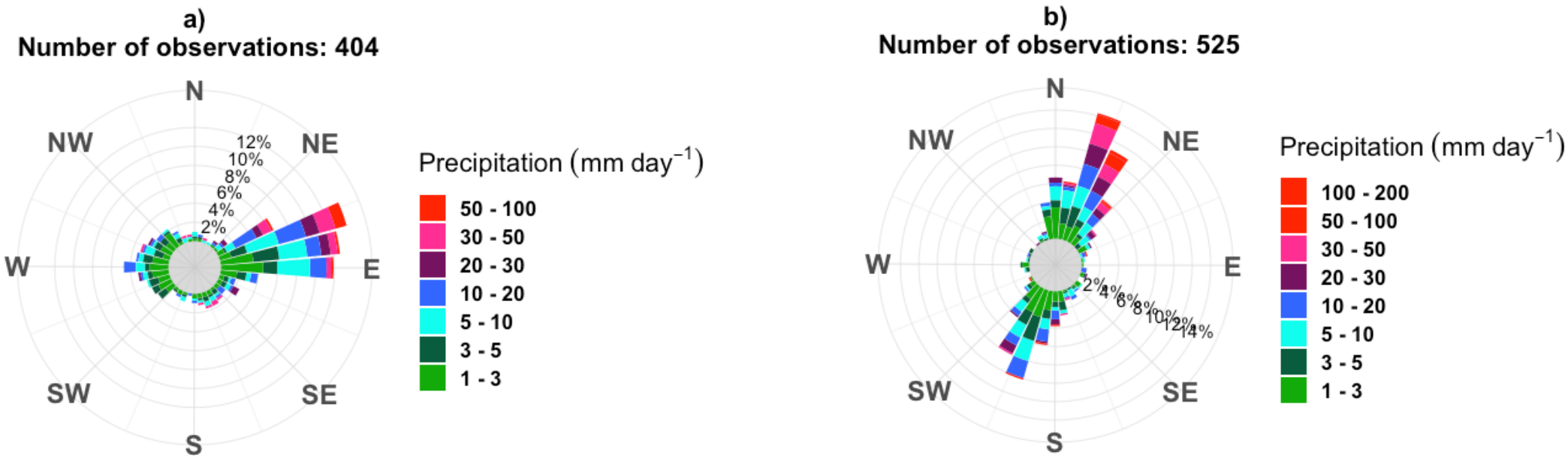

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Figure 20: Precipitation roses with wind from Gagnheiði mountain station

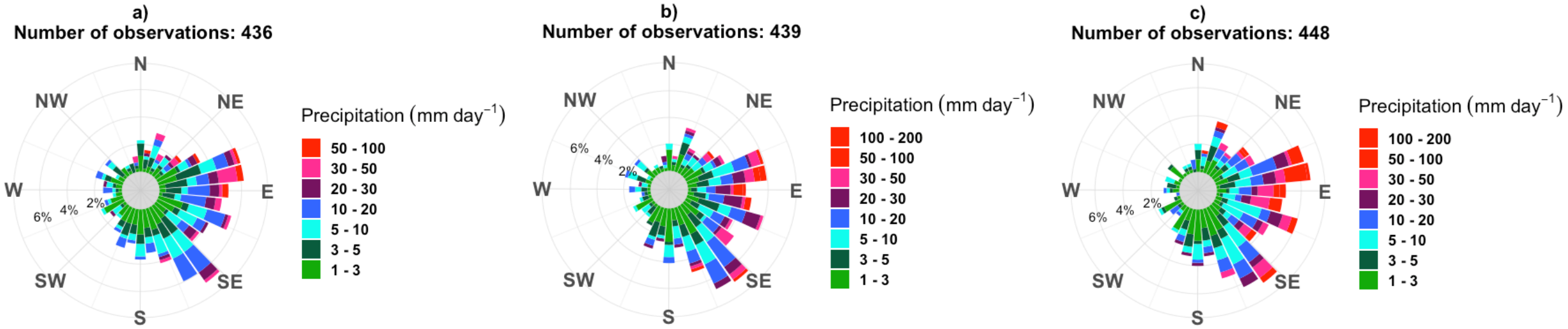

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Figure 21: difference precipitation roses

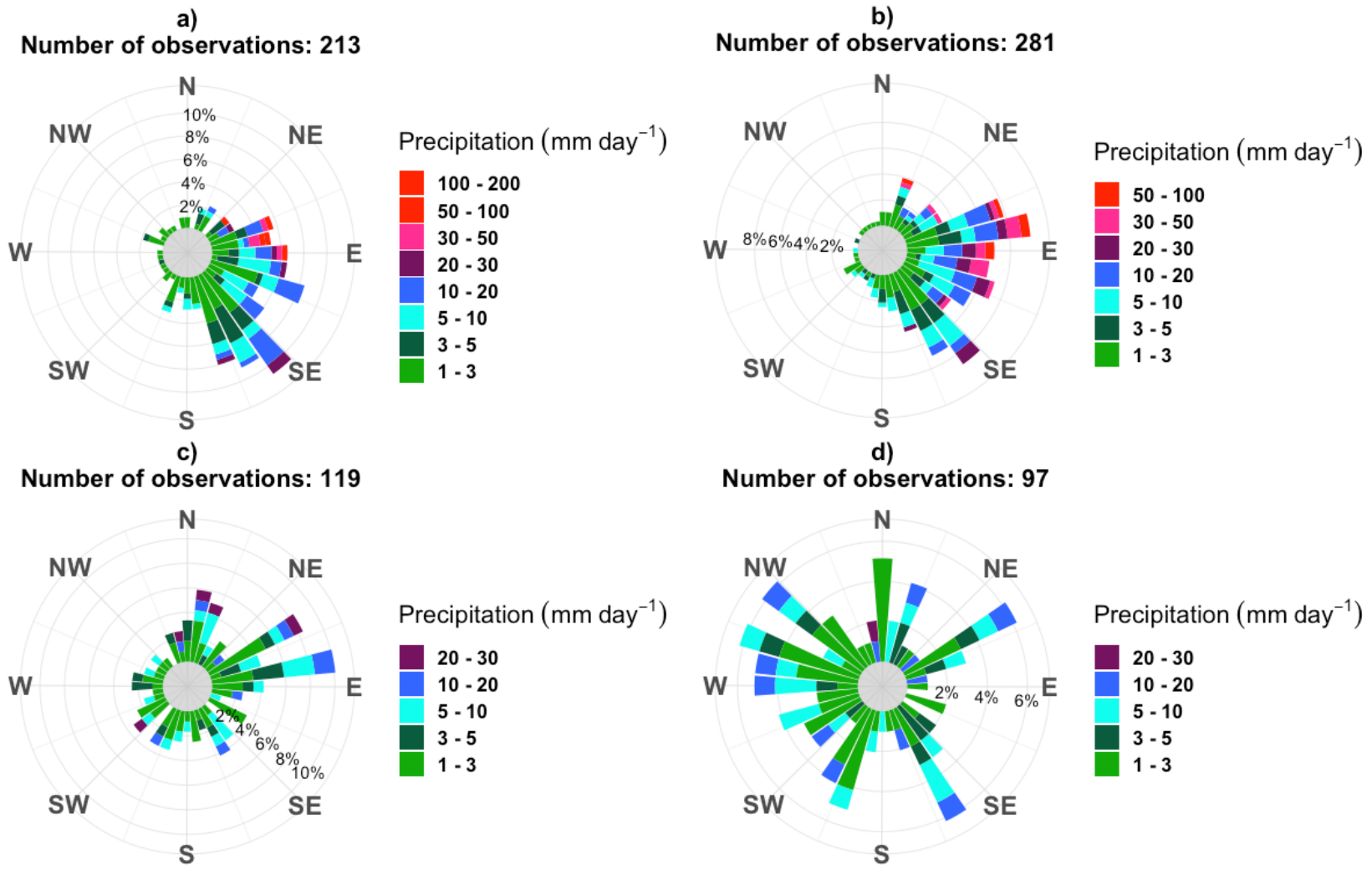

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Figure 23: Gagnheiði wind projection

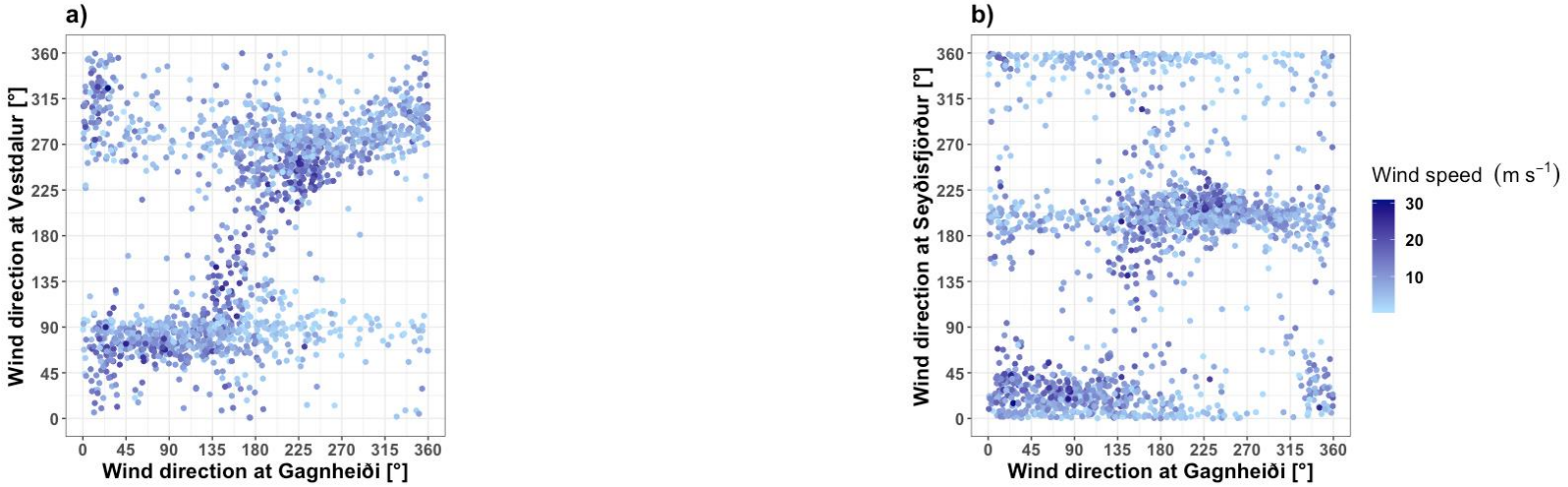

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Table 2: instrument info

Station (station number)	Station height [m a.s.l.]	Starting year	Instrument	Instrument height [m a.g.l.]
Seyðisfjörður (4182)	37	2014	Young 5106 anemometer	10.0
			Logan 4159 temperature meter	2.0
			Lambrecht 15183H tipping bucket rain gauge	1.5
Vestdalur (4180)	92	1995	Young Anemometer	10.0
			Logan 4159 temperature meter	2.0
			Geonor capacity rain gauge	1.5
Hánefsstaðir (616)	51	2002	Standard accumulation rain gauge	1.5
Gagnheiði (4275)	949	1993	Hydrotech WD3/WS3 anemometer	10.0
			Logan 4159 temperature meter	2.0
Dalatangi (4193)	10	1994	Hydrotech WD3/WS3 anemometer	10.0
			Logan 4159 temperature meter	1.5
Dalatangi (620)	9.0	1938	Standard accumulation rain gauge	1.5

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Table 3: the WMO weather codes

Code	68	69	70	71	72	73
Type	Sleet, light	Sleet, Medium to heavy	Snow, light intermittent	Snow, light continuous	Snow, medium intermittent	Snow, medium continuous
Code	74	75	76	77	78	79
Type	Snow, heavy intermittent	Snow, heavy continuous	Diamond dust	Snow grains	Isolated star-like snow crystals	Ice pellets
Code	83	84	85	86	87	88
Type	Shower(s) of rain and snow mixed, light	Shower(s) of rain and snow mixed, moderate or heavy	Snow shower(s), light	Snow shower(s), moderate or heavy	Shower(s) of snow pellets or small hail, light	...with or without rain or rain and snow mixed, moderate or heavy
Code	89	90				
Type	Shower(s) of hail, with or without rain, or	...rain and snow mixed, not associated with thunder, moderate or heavy				

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Table 4: Reykjavík 10-year data

10-years	Slope	Standard deviation	R^2 (correlation)
Capacity ~ Tipping bucket	1.06	0.005	0.93
Standard ~ Tipping bucket	1.09	0.005	0.92
Standard ~ Capacity	1.02	0.002	0.98

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Table 8: Reykjavík 10-year high wind data

Spring	Slope	Standard deviation	R^2 (correlation)
Capacity ~ Tipping bucket	1.05	0.01	0.94
Standard ~ Tipping bucket	1.10	0.01	0.93
Standard ~ Capacity	1.03	0.004	0.99

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