Supplementary Information

General characterisation of the climate of the Galapagos archipelago

To characterise the basic climate elements of the Archipelago, data of the four weather stations Baltra, San Cristóbal, Bellavista and Puerto Ayora were evaluated. Data of the Stations Bellavista and Puerto Ayora were downloaded from the website `https://www.darwinfoundation.org/en/datazone/climate/puerto-ayora` and the data of the stations Baltra and San Cristóbal originates from METAR.
Additionally, datasets of the sea surface temperature (SST) [53] and of the trade wind temperature inversion [54] were used. The spatial and temporal resolution is the same as for the cloud mask data.
The altitude and width of the trade wind temperature inversion layer were calculated based on the monthly mean ERA5 data of temperature and geopotential [54]. The horizontal spatial resolution of this data set was $0.25° \times 0.25°$, whereas the vertical resolution is based on 37 pressure levels from 1 hPa to 1000 hPa [54].

Table S1: Coordinates of the weather stations.

Station	Longitude [°]	Latitude [°]	Altitude [m]
Baltra	-90.15	-0.27	44
Bellavista	-90.328160	-0.692384	223
Puerto Ayora	-90.302647	-0.743708	2
San Cristóbal	-89.614306	-0.904056	6

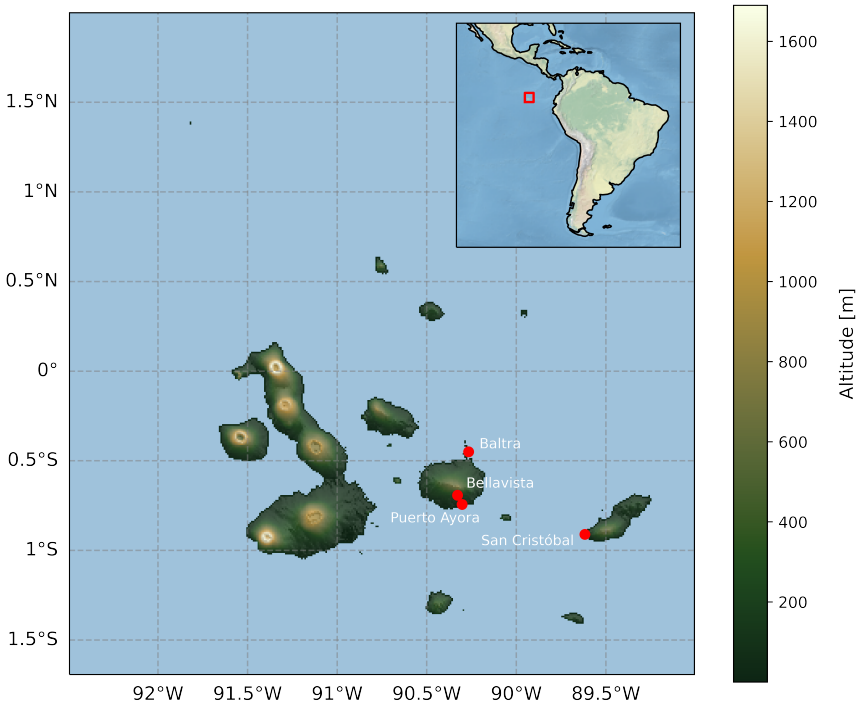

Figure S1: Map of the Galapagos Archipelago with the weather stations.

Climate Statistics

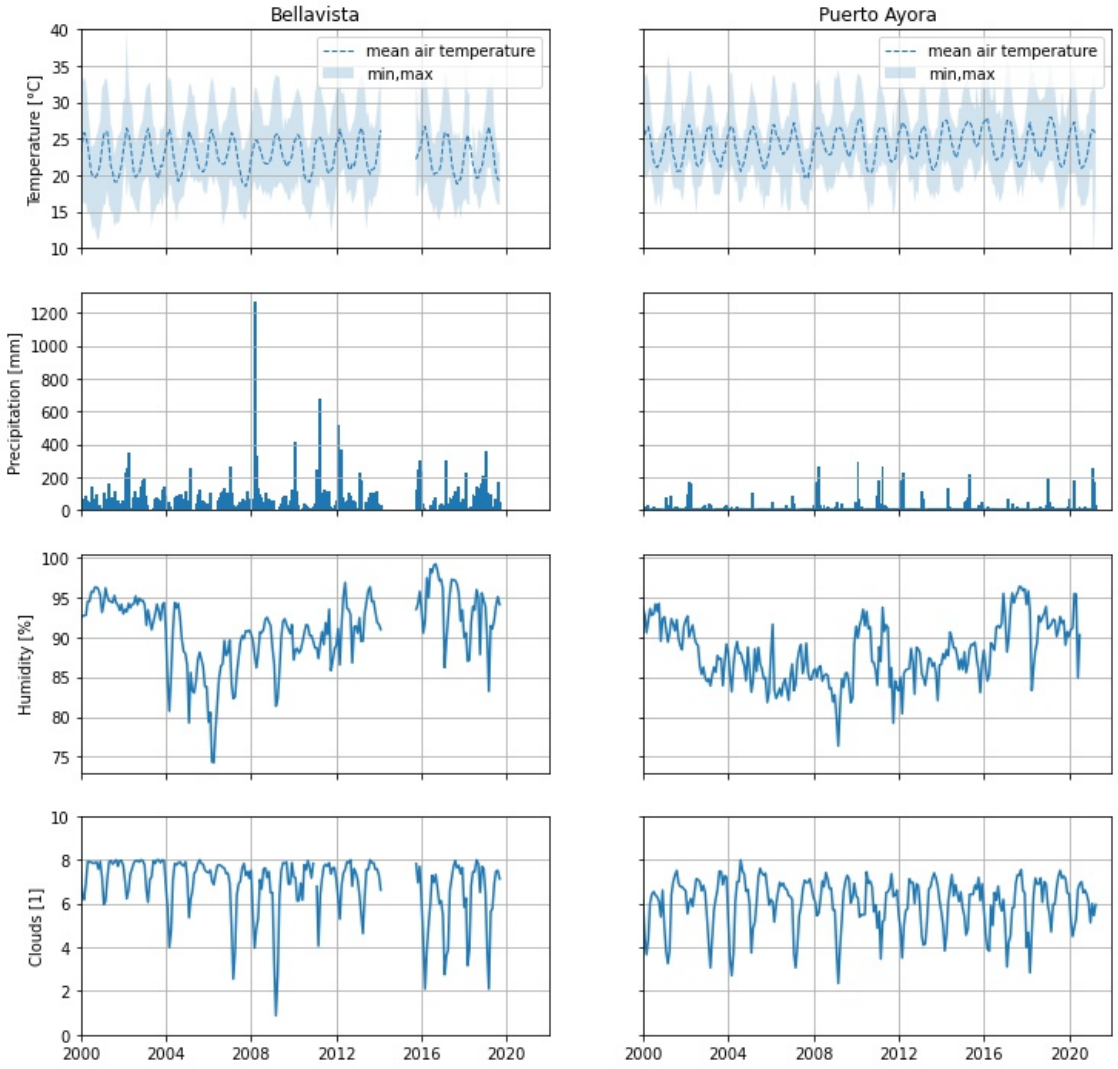

Figure S2: General climate statistics of Bellavista and Puerto Ayora.

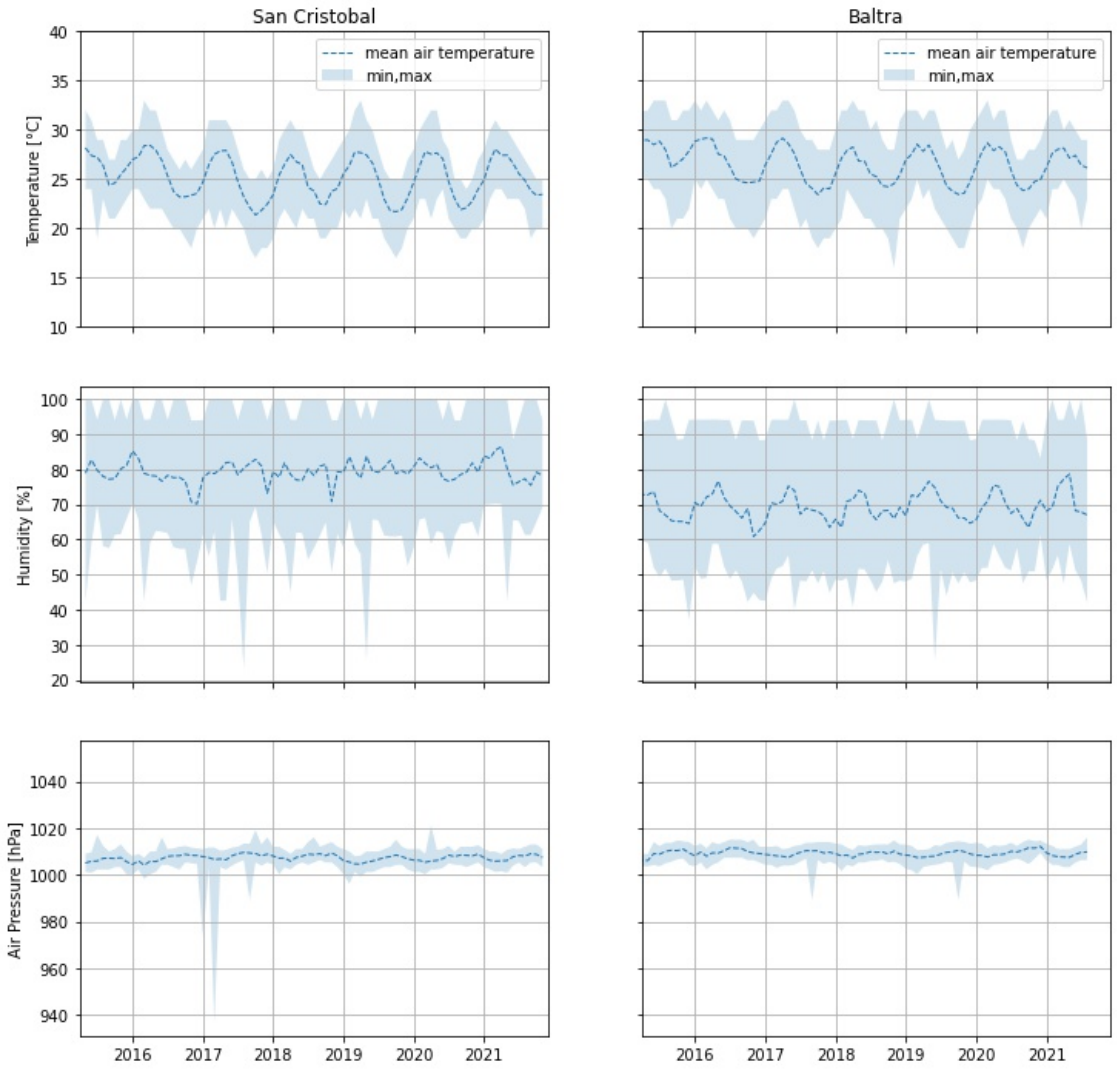

Figure S3: General climate statistics of San Cristóbal and Baltra.

Wind Statistics

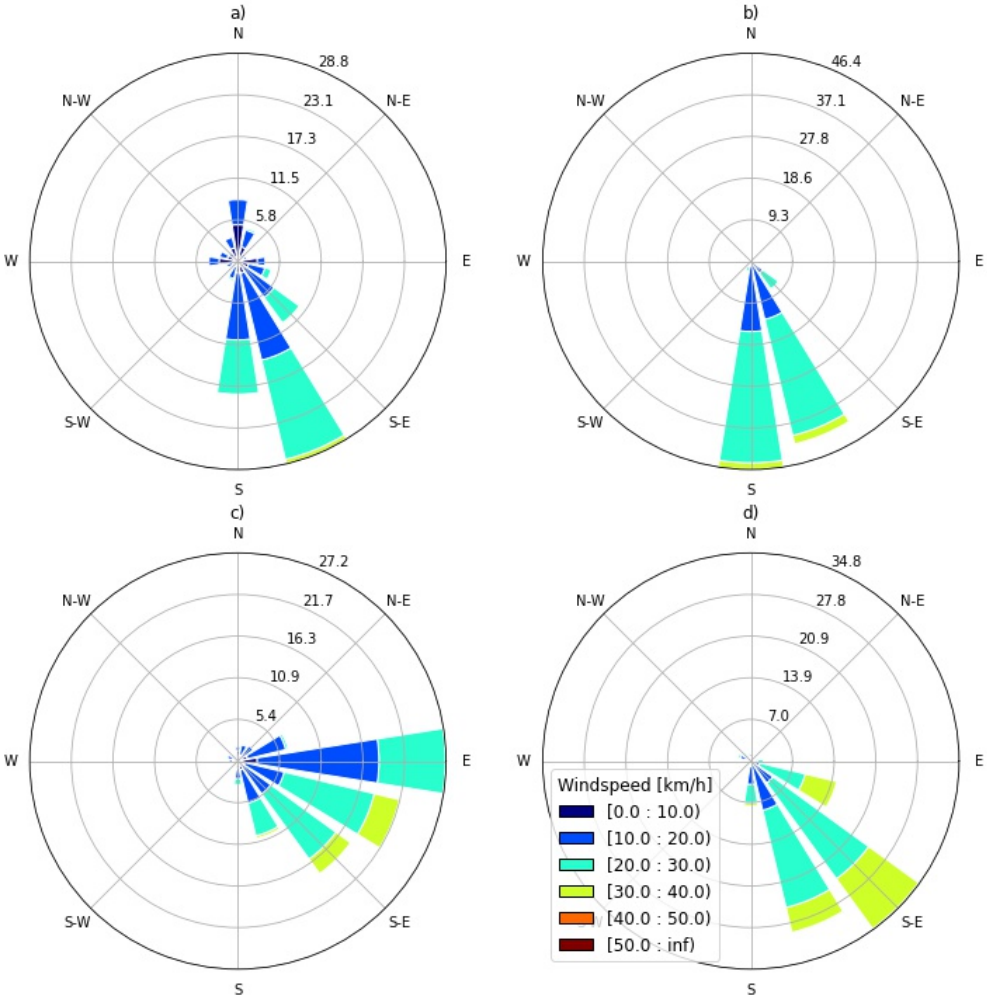

Figure S4: Seasonal wind statistics of the stations San Cristóbal during hot season a) and cool season b) and from the weather station Baltra, also for the hot season c) and the cool season d).

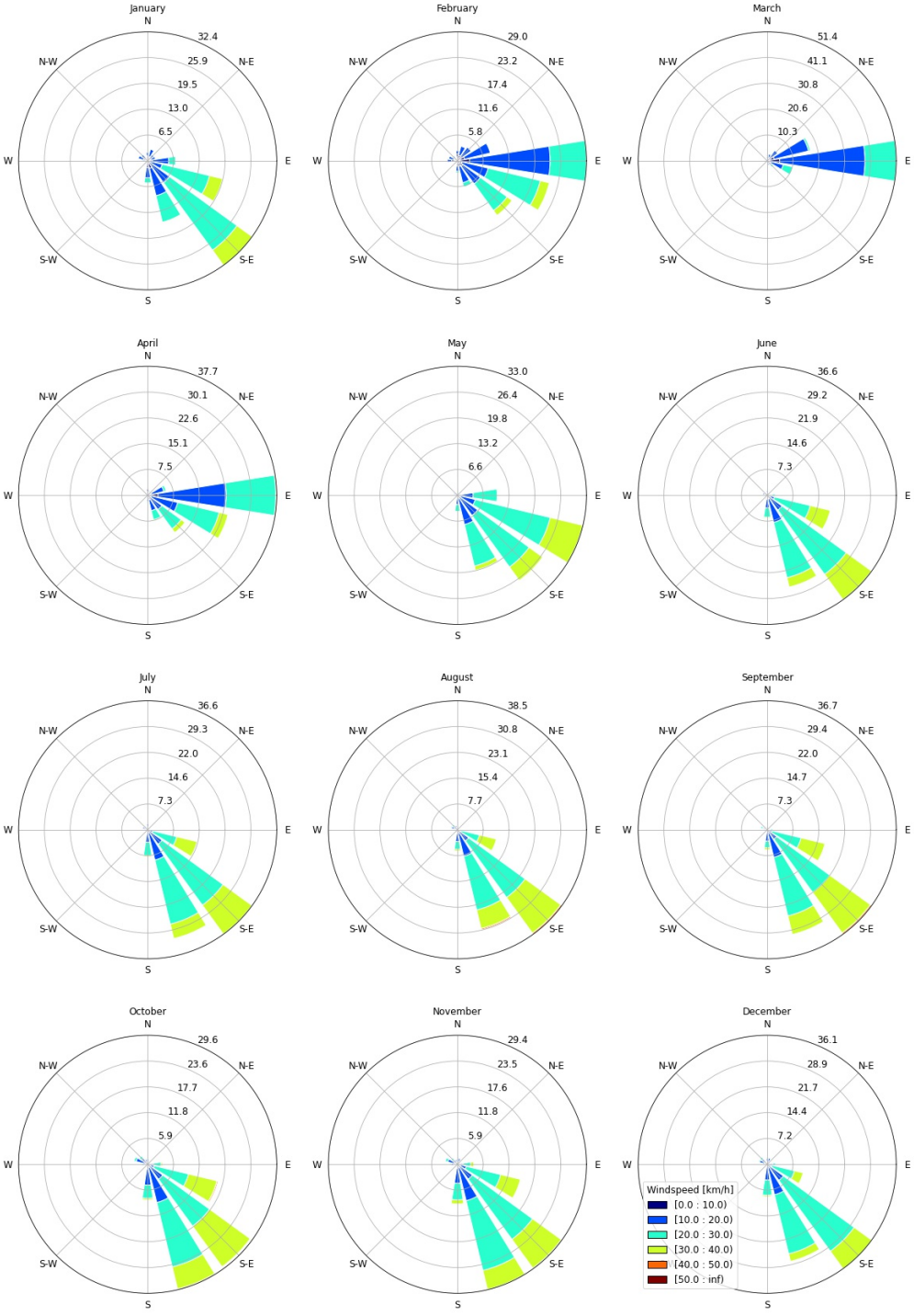

Figure S5: Monthly wind statistics of Baltra.

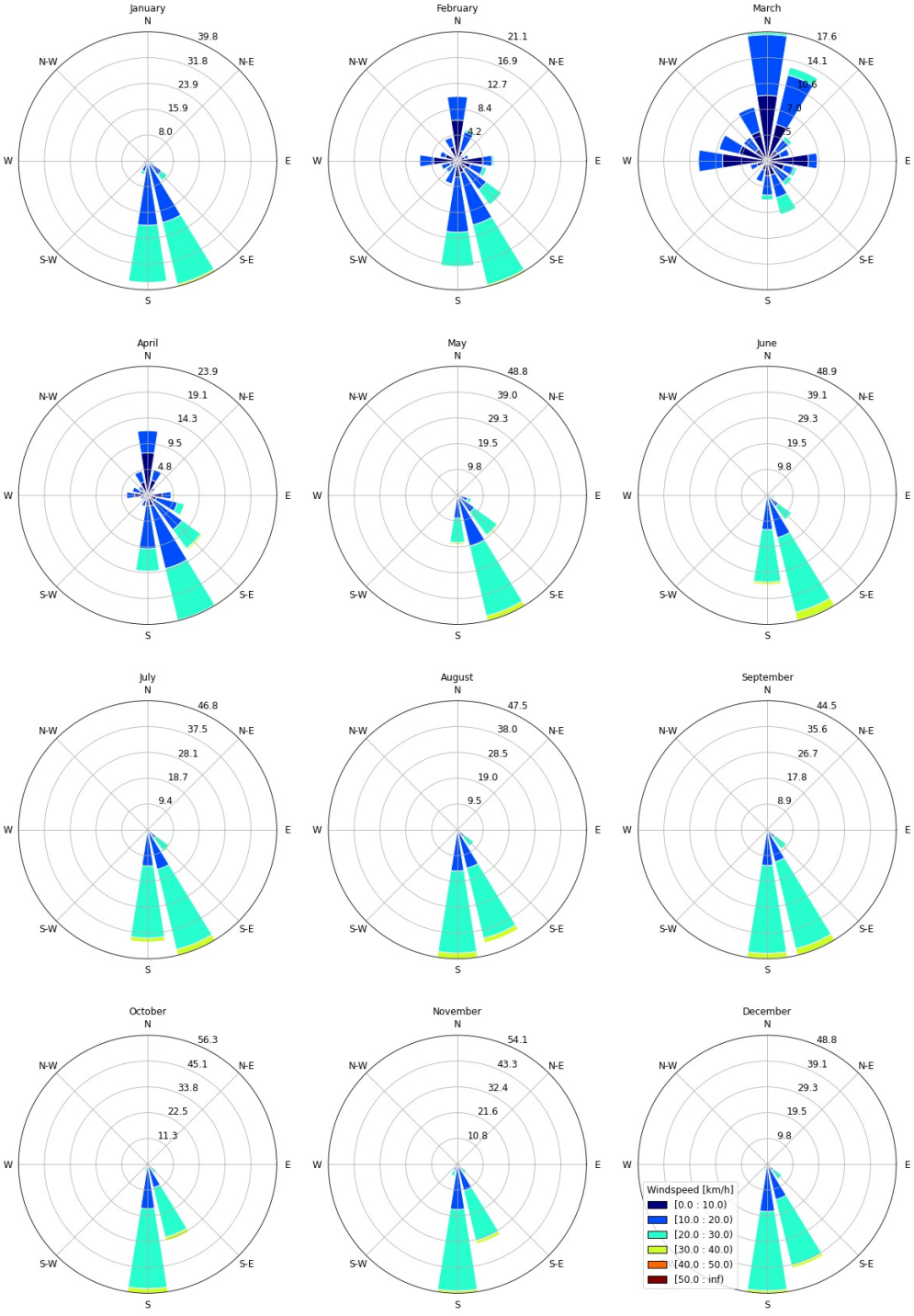

Figure S6: Monthly wind statistics of San Cristóbal.

Trade Wind Inversion Layer

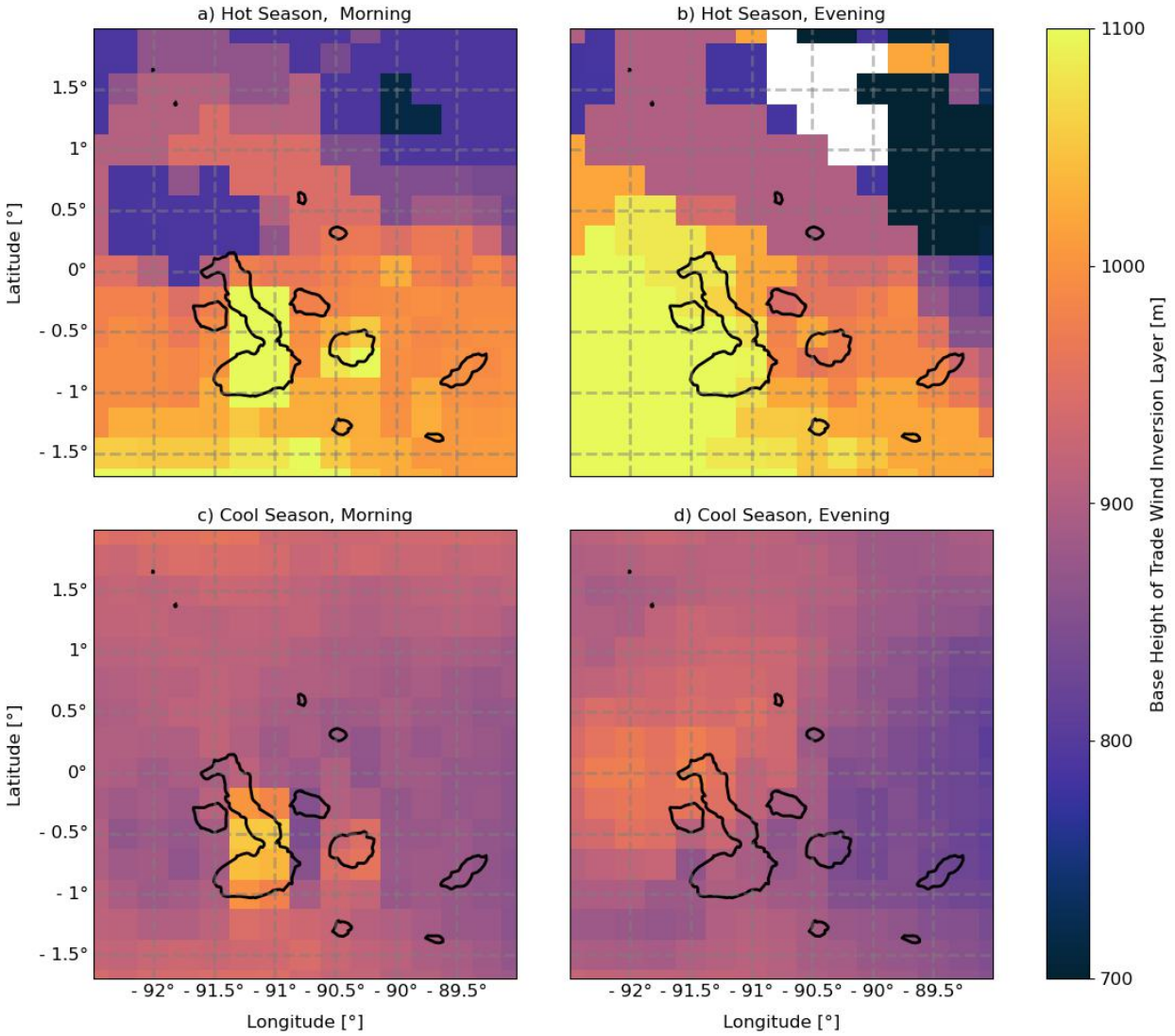

Figure S7: Mean base height of the trade wind inversion layer (2000-2021). The inversion layer rarely forms during the hot season. For the morning and evening of the hot season, only 16 of 110 data sets each showed an inversion layer, which occurred only partially and did not cover the entire study area. Therefore, the mean altitude does not reflect the typical situation in the hot season. [54]

Sea Surface Temperature

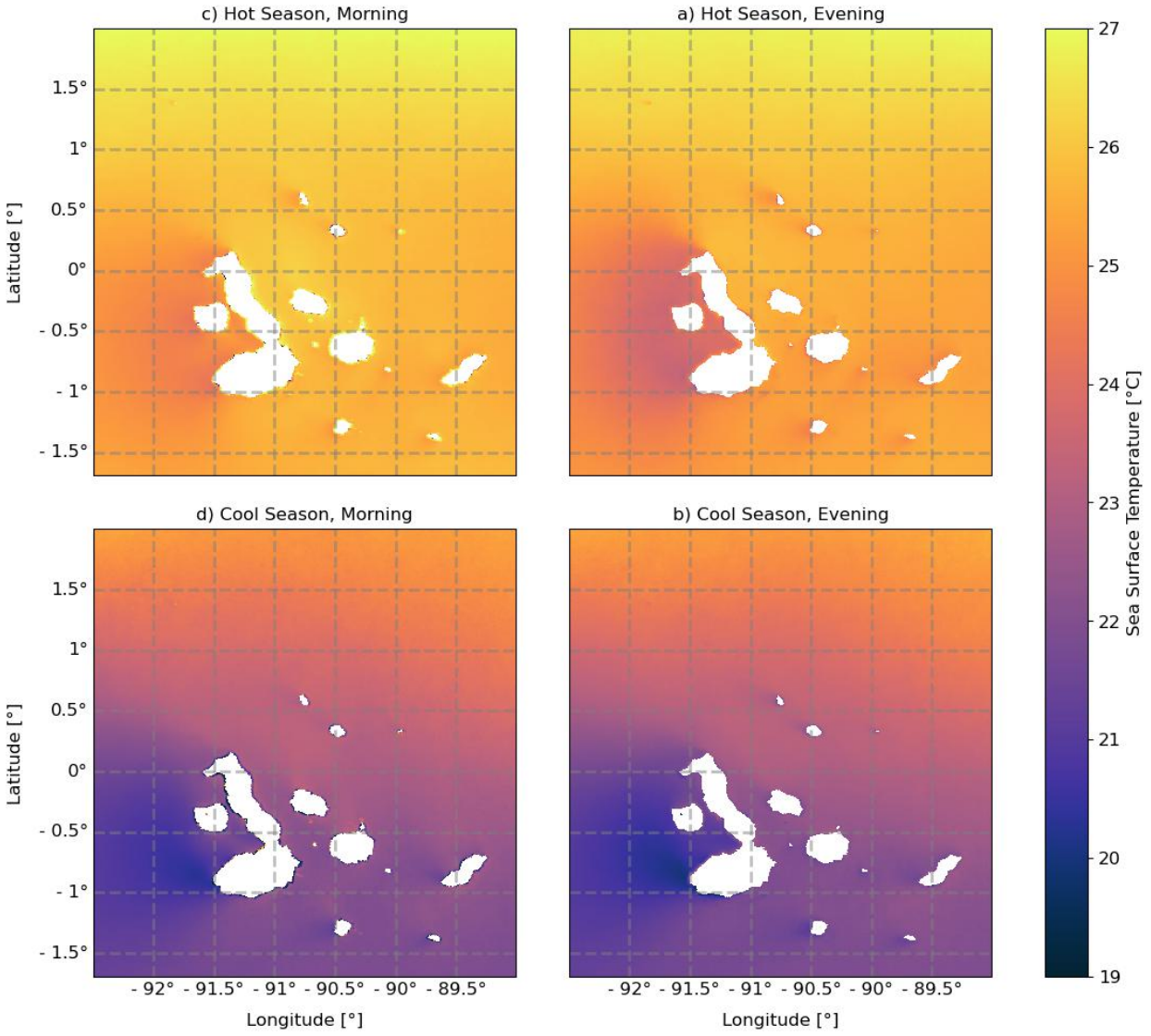

Figure S8: The averaged sea surface temperature (2000-2021) for the hot and cool season, for the morning and the evening overpass. [53]

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Table S2: Monthly temperature anomalies of SST in Nino 1+2 [55]. Values written in bold fonts are used for the definition of the investigated ENSO events.

Year	January	February	March	April	May	June	July	August	September	October	November	December
2000	-0.76	-0.62	-0.47	-0.04	-0.40	-0.38	-0.28	-0.57	-0.23	-0.27	-1.19	-0.96
2001	-0.63	-0.48	0.17	0.18	-0.71	-0.85	-0.58	-0.84	-1.13	-1.13	-0.89	-1.02
2002	-0.78	-0.07	0.77	0.82	0.63	0.38	-0.23	-0.26	0.20	0.37	0.97	1.10
2003	0.13	-0.12	-0.07	-0.56	-1.65	-1.35	-1.01	0.01	-0.45	0.23	0.28	0.22
2004	-0.21	-0.07	-0.74	-0.57	-1.59	-1.07	-0.78	-0.75	-0.27	0.15	0.72	0.36
2005	-0.02	-0.94	-1.46	-0.42	-0.38	-0.77	-0.35	-0.40	-0.74	-1.27	-1.43	-0.92
2006	-0.37	0.22	-0.29	-1.50	-0.56	-0.21	0.20	0.70	0.97	1.05	0.79	0.71
2007	0.66	0.11	-0.64	**-1.22**	**-1.79**	**-1.61**	**-0.98**	**-1.20**	**-0.97**	**-1.52**	**-1.73**	**-1.66**
2008	-0.48	0.22	0.39	0.41	0.54	0.55	0.99	1.40	1.02	0.35	-0.28	-0.45
2009	-0.17	-0.68	-0.81	0.41	0.34	0.65	0.75	0.84	0.51	0.32	0.33	0.60
2010	0.28	0.12	0.07	-0.11	0.24	0.01	-1.03	-1.31	-1.22	-1.28	-1.31	-0.90
2011	-0.48	-0.16	-0.88	-0.19	0.11	0.30	0.10	-0.21	-0.74	-0.78	-0.57	-0.68
2012	-0.18	0.36	0.16	0.90	0.87	1.02	0.40	0.07	0.06	-0.37	-0.41	-0.85
2013	-0.68	-0.73	-0.67	-1.23	-1.58	-1.91	-1.60	-1.16	-0.77	-0.75	-0.56	-0.44
2014	-0.01	-0.61	-0.31	-0.03	1.06	1.54	0.98	0.89	0.80	0.69	0.80	0.41
2015	-0.16	-0.53	0.09	1.00	**1.55**	**2.19**	**2.54**	**1.65**	**2.28**	**2.12**	**2.28**	**2.21**
2016	**1.79**	1.30	1.35	0.45	0.49	0.64	0.25	0.24	0.57	0.34	0.12	0.43
2017	0.93	1.36	1.61	1.05	0.21	-0.24	-0.32	-0.34	-0.81	-0.81	-1.20	-1.42
2018	-1.12	-0.97	-1.35	-1.03	-0.75	-0.72	-0.40	-0.27	-0.08	0.16	0.81	1.05
2019	0.83	0.52	0.12	0.30	0.20	-0.34	-0.69	-0.76	-0.71	-0.74	-0.11	-0.04
2020	-0.37	0.02	-0.06	0.28	-0.14	-0.70	-1.28	-1.05	-1.22	-0.60	-0.58	-0.60
2021	-0.88	-0.86	-0.75	-0.94	-0.79	-0.37	-0.21	-0.29	-0.70	-0.87	-1.12	-1.69

Results Random Forest Regression

RF Regression - evening hot season

Average baseline error: 260.08
Mean Absolute Error of Cloud Freq.: 0.06
Accuracy: 88.55%
Variable: altitude Importance: 0.63
Variable: aspect Importance: 0.37

RF Regression - morning hot season

Average baseline error: 260.06
Mean Absolute Error of Cloud Freq.: 0.08
Accuracy: 84.84%
Variable: altitude Importance: 0.57
Variable: aspect Importance: 0.43

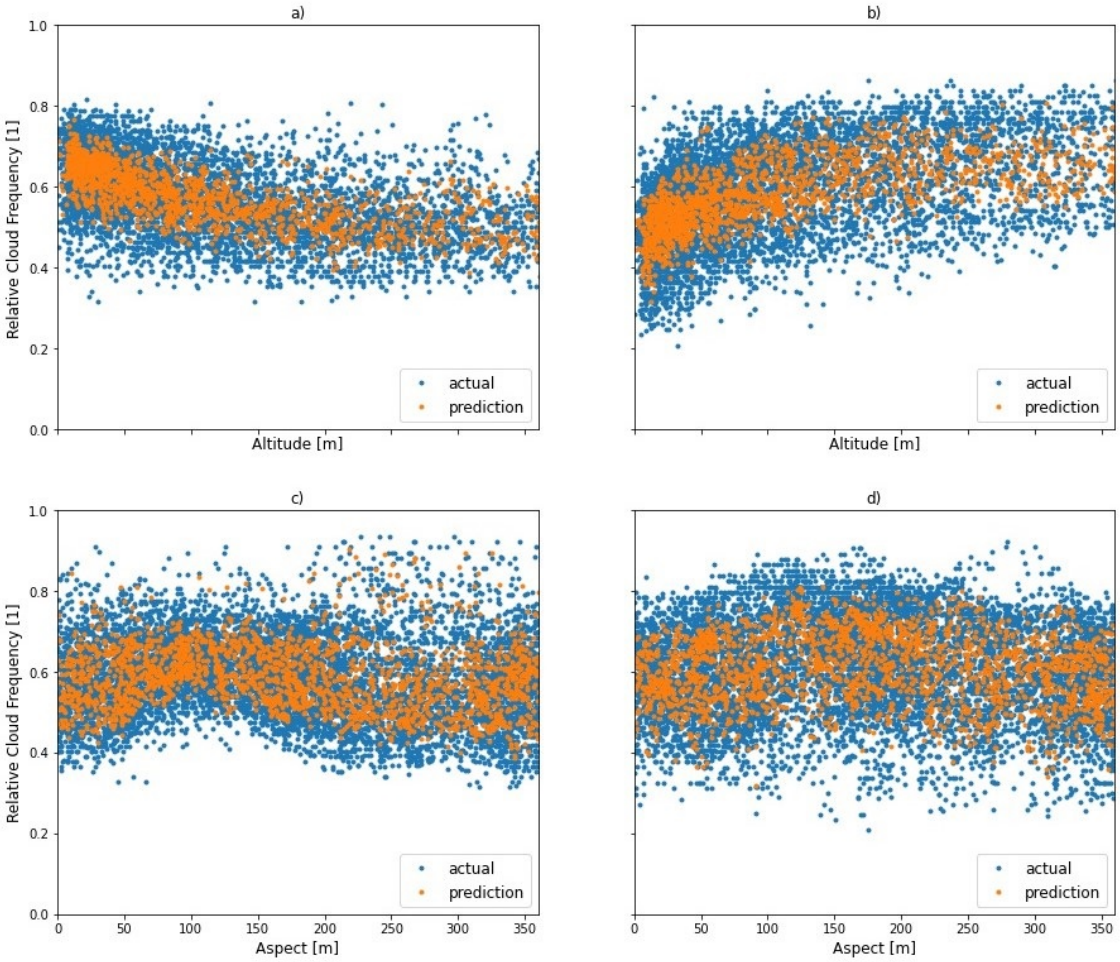

Figure S9: Results of the random forest regression of the hot season.

RF Regression - evening cool season

Average baseline error: 260.04
Mean Absolute Error of Cloud Freq.: 0.08
Accuracy: 86.43%
Variable: aspect Importance: 0.6
Variable: altitude Importance: 0.4

RF Regression - morning cool season

Average baseline error: 259.99
Mean Absolute Error of Cloud Freq.: 0.11
Accuracy: 81.98%
Variable: aspect Importance: 0.56
Variable: altitude Importance: 0.44

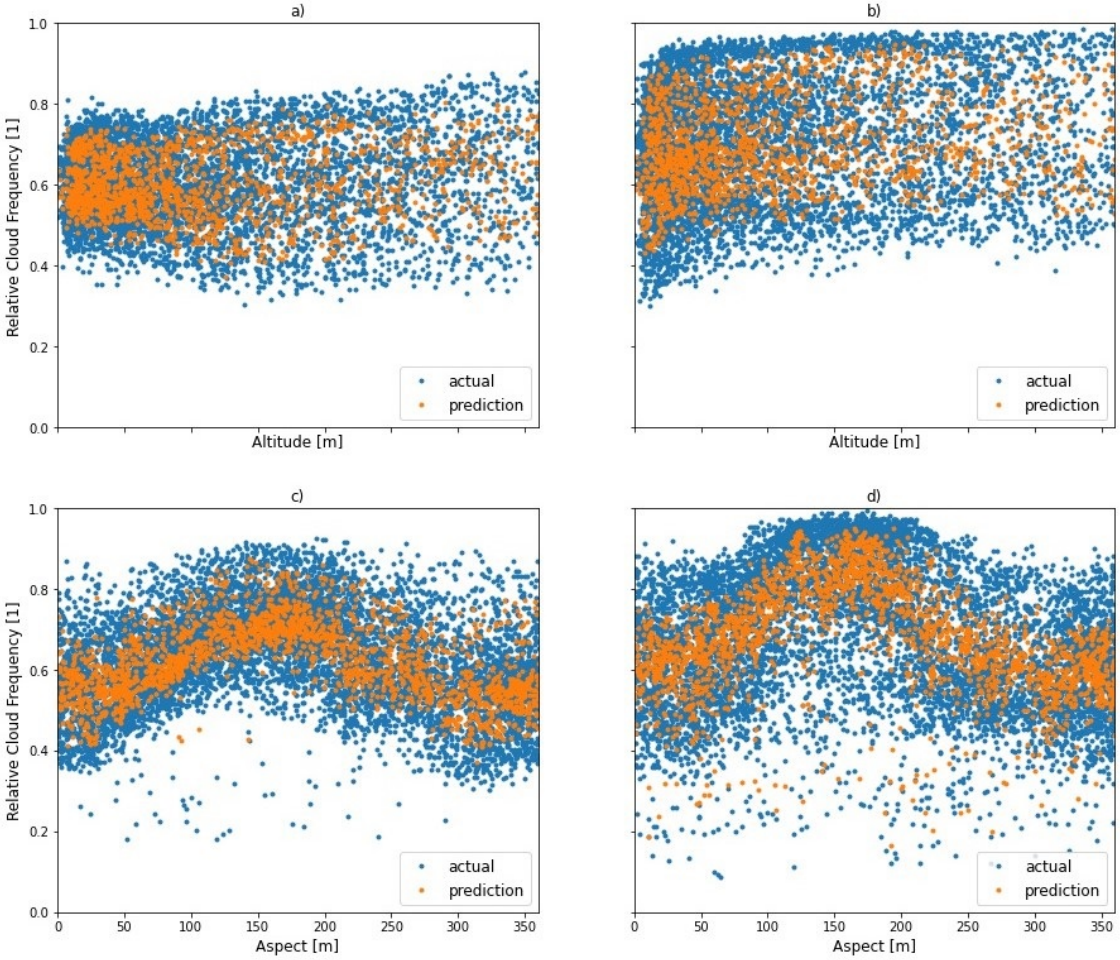

Figure S10: Results of the random forest regression of the cool season.

Statistics of Deviation of the resampled DEM

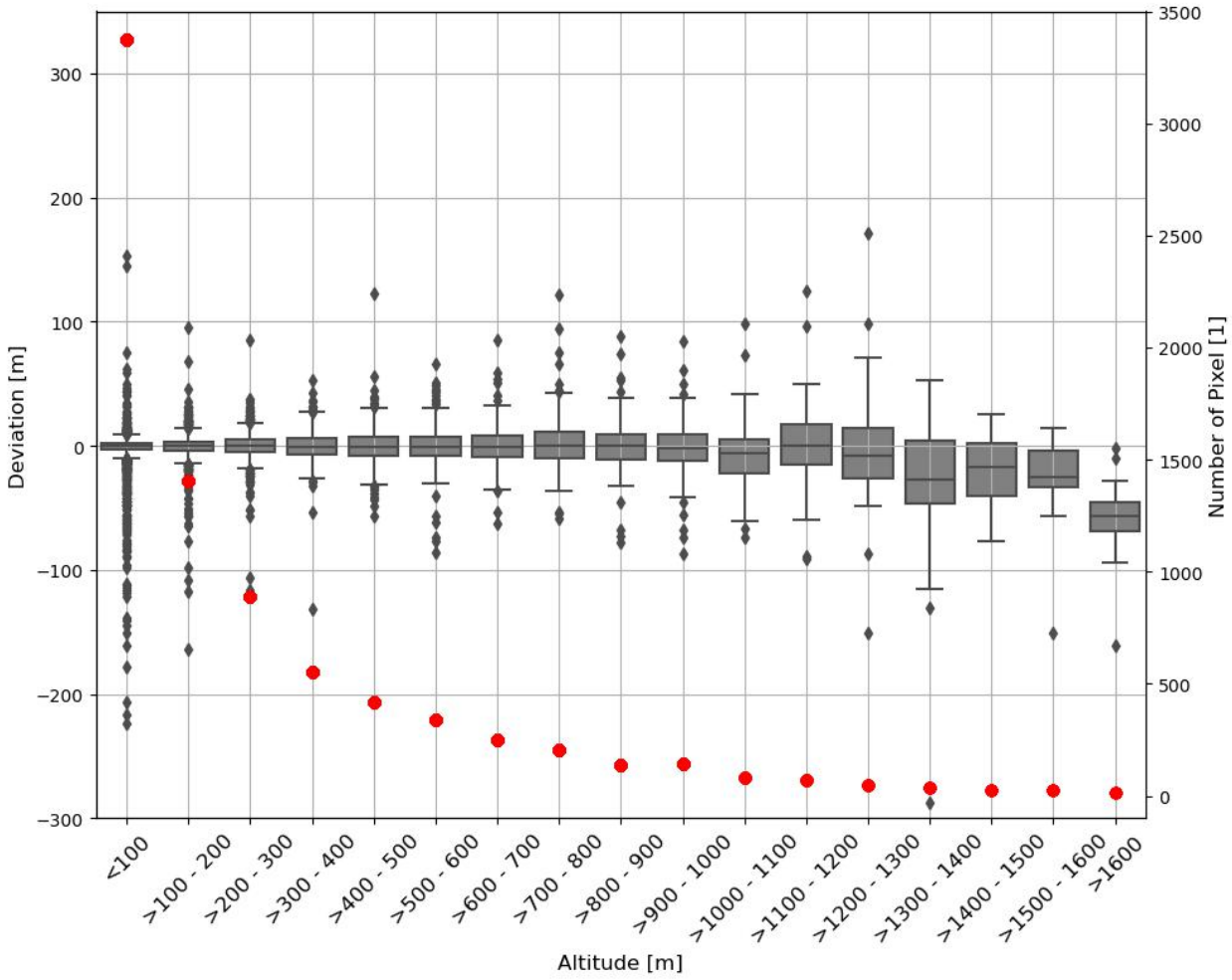

Figure S11: Statistics of deviations in terrain altitude of the 30 m pixels in a 1 km pixel. The classification of the x-axis is based on the 1 km data set. The red dots mark the number of pixels in each altitude class.