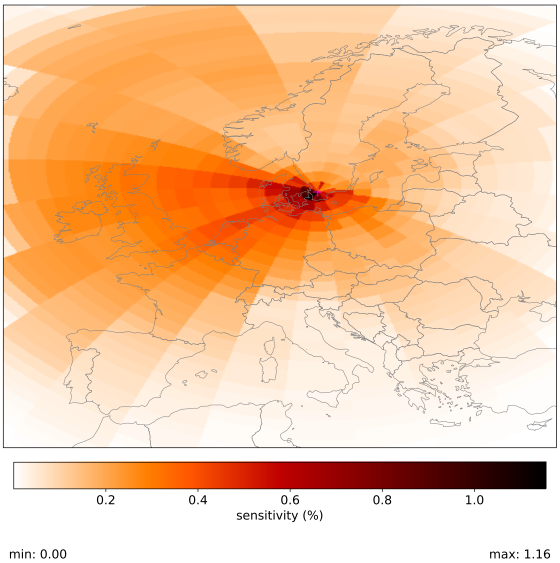
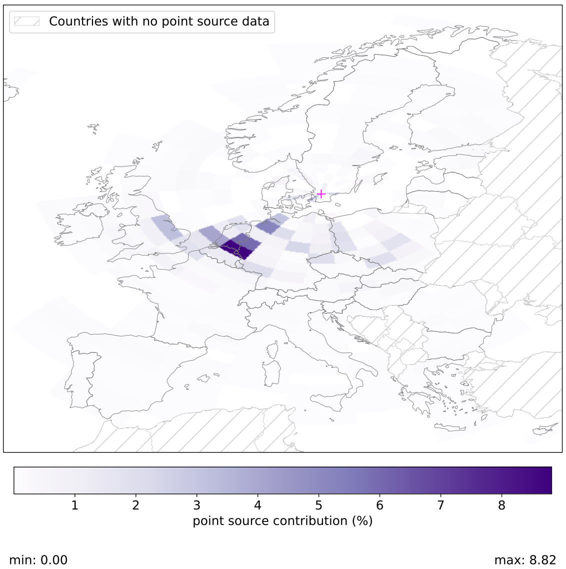
Hyltemossa station characterisation

The station characterisation is based on STILT model footprints, an anthropogenic emission inventory, a biogenic flux model and ancillary data layers. More detailed information on the data source and processing is provided at the end of this document. Hyltemossa is a class 1 ICOS atmospheric station of the type “tall tower” located in Sweden (latitude: 56.1°N, longitude: 13.42°E).

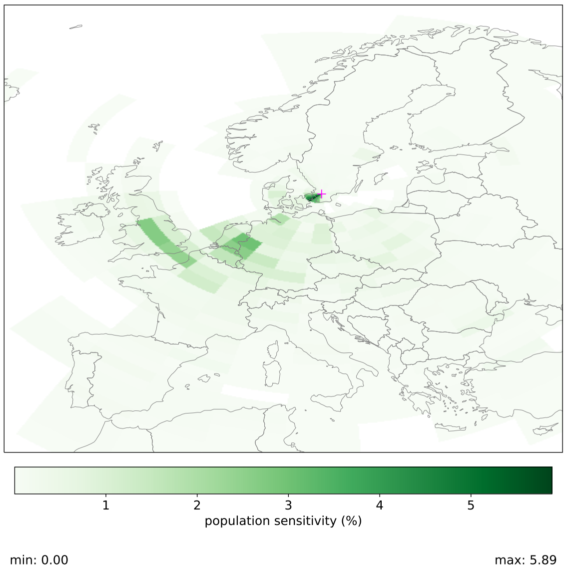


Model height: 150m above ground
Date range: 2020-01-01 to 2020-12-31
Hour(s): 0:00, 3:00, 6:00, 9:00, 12:00, 15:00, 18:00, 21:00
The map bins are 15 degrees at 100 km increments.

The **sensitivity area map** shows the average footprint/sensitivity area. The darker the colour, the more important the area is as a potential source influencing the measured concentrations. The total sensitivity to the surface varies between stations and Hyltemossa is in the second quartile compared to selected reference ICOS atmospheric stations (see multiple variables graph). The most important 50% sensitivity area is 864572 km^2.



The **point source contribution map** is the result of the average sensitivity map multiplied by the CO_2 emissions from industrial facilities within each footprint cell, translated into expected influence on the CO_2 concentration at the station. Relative to the reference atmospheric stations, Hyltemossa is in the second quartile regarding contribution from point sources.



The **population sensitivity map** is the result of the average sensitivity map multiplied by the number of people living within each footprint cell. Relative to the reference atmospheric stations, Hyltemossa is in the second quartile regarding sensitivity to population.

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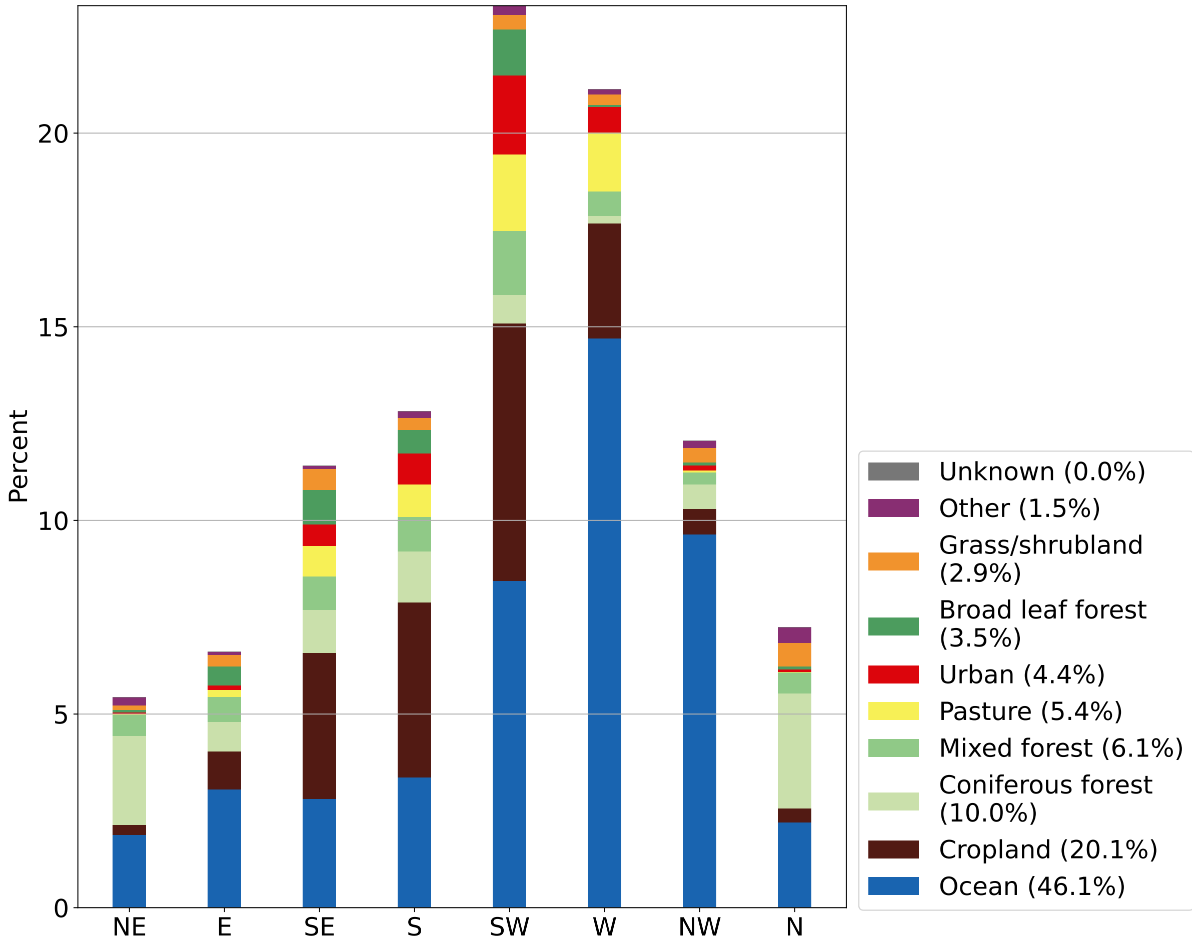
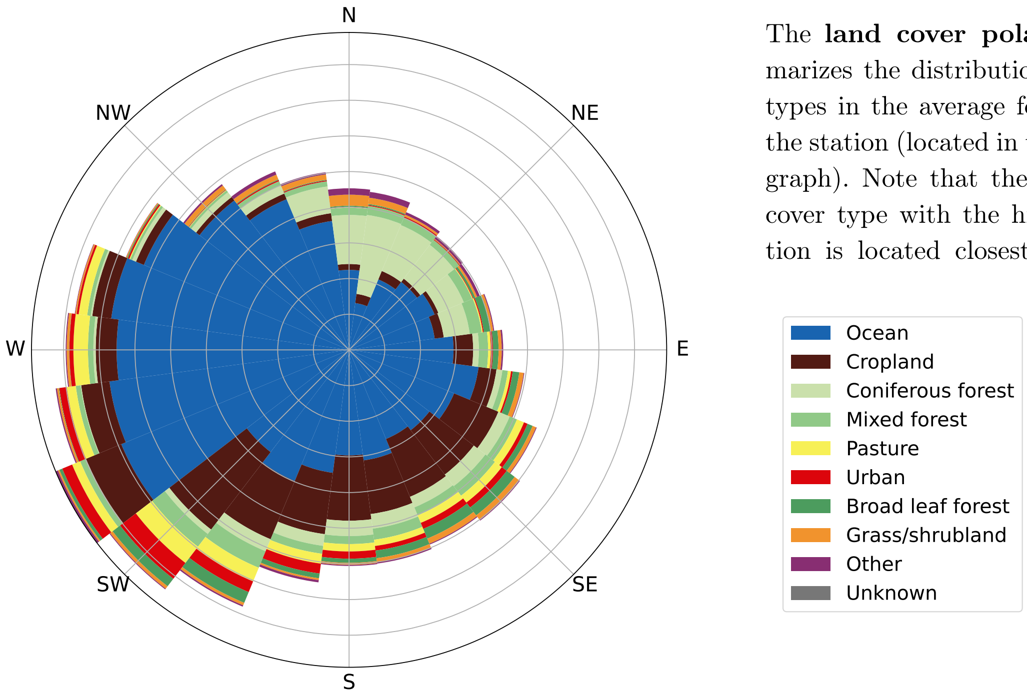
Variable	2020	Jan + Feb + Dec	Mar-May	Jun-Aug	Sep-Nov	Unit
Sensitivity	4.63	+10.63%	-17.70%	-2.34%	+9.64%	ppm given a uniform flux (1 µmol / (m^{2}s))
Population	26751	+49.94%	-44.18%	-36.87%	+32.01%	pop*sensitivity
Point source	0.78	+49.64%	-47.10%	-36.94%	+35.32%	ppm
GEE	-3.64	-92.42%	-51.73%	+164.46%	-21.55%	ppm (uptake)
Respiration	2.81	-18.50%	-51.06%	+42.30%	+27.36%	ppm
Anthropogenic	2.03	+62.60%	-42.88%	-46.27%	+27.53%	ppm

The **seasonal variations table** summarizes the results for the year 2020 and lists for each season the relative difference compared to the annual average. Gross ecosystem exchange (GEE), respiration and anthropogenic emission contributions to the CO_2 concentration are calculated online in the STILT model (see detailed specifications at the end of this document). A positive GEE value means that there is more CO_2 uptake from the vegetation compared to the average uptake from plants over the whole year, which is generally true for the growing seasons.

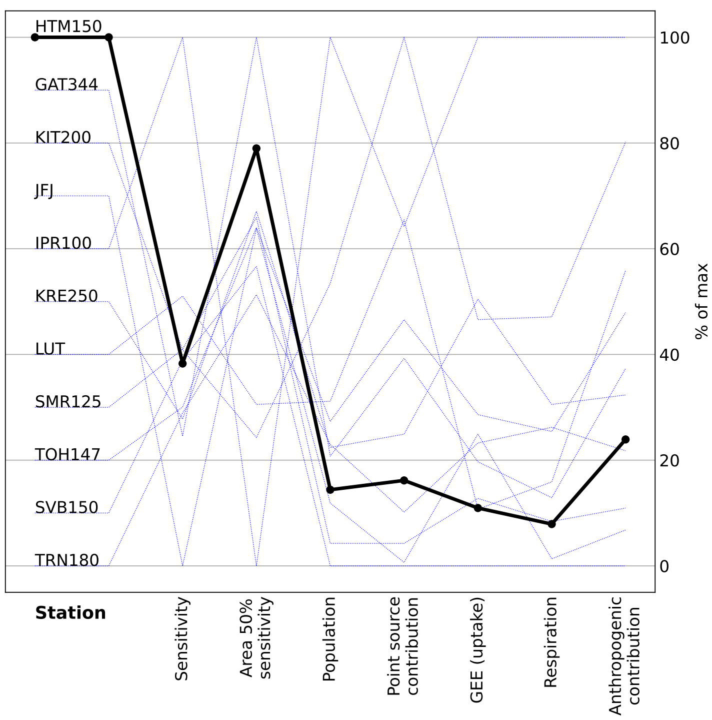


Contributions of different land cover types within Hyltemossa´s average footprint is shown in the **land cover bar graph**. The total contributions are listed in the legend and their relative occurrences in the different directions of the stations (North-East, East, South-East etc.) are indicated by the graph.

The following figures present more advanced syntheses. Please read the specification section at the end of this document for further information and explanations.



The **land cover polar graph** summarizes the distribution of land cover types in the average footprint around the station (located in the centre of the graph). Note that the area of a land cover type with the highest contribution is located closest to the centre.



Selected reference atmospheric stations (see below table) are compared in this **multiple variables graph**. Hyltemossa's values are shown with the black line and the points' placements on the y-axis are determined relative to the minimum (0%) and maximum (100%) of the reference stations. The same variables as in the seasonal variations table are shown above.

Code	Name	Country
TRN180	Trainou	France
TOH147	Torfhaus	Germany
SVB150	Svartberget	Sweden
SMR125	SMEAR/Hyytiälä	Finland
LUT	Lutjewad	Netherlands
KRE250	Kresin	Czech Republic
KIT200	Karlsruhe	Germany
JFJ	Jungfraujoch	Switzerland
IPR100	Ispra	Italy
GAT344	Gartow	Germany

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Specifications

All the visualizations and information in this document are based on footprints generated by STILT, a lagrangian atmospheric transport model, implemented as online tool at the ICOS Carbon Portal. Output footprints are presented on a grid with 1/12×1/8 degrees cells (approximately 10km x 10km) where the cell values represent the cell area's estimated surface influence ("sensitivity") in ppm / (µmol/ (m^2s)) on the atmospheric tracer concentration at the station. The footprints for a given station vary in time according to meteorological conditions, in this model represented by 3-hourly operational ECMWF-IFS analysis/forecasts. Modelled concentration can be calculated by combining individual footprints with an anthropogenic emission inventory (EDGAR) and a biogenic model (VPRM), which models the exchange of the tracer between the atmosphere and the natural surface vegetation.

For all maps and the land cover polar graph, an average footprint for the specified date range has been used. In the **sensitivity area map** the 192 000 cells have been aggregated depending on their distance to, and direction of, the station. A uniform flux of 1 µmol/ (m^2s) is assumed. The most important 50% sensitivity is derived by including the sensitivity values of the footprint cells in descending order until 50% of the total sensitivity is reached. See the visualize average footprints notebook for more information. The same aggregation principles were used for the **population sensitivity map** and **point source contribution map**, where the average footprint cells were multiplied by underlying ancillary data layers. The unit of the maps is either percent or the absolute value of the aggregated cells. 100% in terms of the sensitivity map is the value of all aggregated cells summarized. 100% in terms of the population map is the value of all aggregated (total population count * sensitivity) cells summarized. The population data are from SEDAC (2020) and point source emissions data from E-PRTR (2017). The resulting values in the population map are mainly interesting for intercomparisons between areas, whereas the point source emissions were converted to estimated contribution to the CO_2 mole fraction at the station. The descriptions of the maps include what quartiles the station falls into in terms of absolute ranking among selected ICOS atmospheric stations. The first quartile includes the stations with the lowest total average values.

The **land cover polar graph** is like the maps in that the centre represents the location of the station and the direction bins have been used to aggregate data but do not represent the distance of the land cover type to the station. The area of a land cover type in the figure represents its presence in each direction of the station. The overall dominant land cover type is closest to the centre, with the less significant land cover types displayed in descending order. The **land cover bar graph** is a simpler way to visualize land cover type by direction. Eight 45 degrees bins around the station are represented by stacked bars. The land cover data is from HILDA (2018). The original land cover types are used except for the aggregation of classes to represent 'broad leaf forest' (HILDA codes 42 + 44), 'coniferous forest' (HILDA codes 41 + 43), 'mixed forest' (HILDA codes 40 + 45) and 'other' (HILDA codes 66 + 77).

The **seasonal variations table** shows the average anthropogenic and biogenic contributions during the different seasons of the year. The biogenic contributions include respiration (CO_2 input to the atmosphere) and Gross Ecosystem Exchange (GEE, CO_2 uptake by the biosphere). Individual footprints with associated estimates of CO_2 concentration components from respiration and GEE, as well as from anthropogenic emissions are displayed on the STILT result visualization page. The values for sensitivity, point source contribution and population are produced by summarizing the cells of maps where these layers have been multiplied by average footprints for the different parts of the year. The seasonal values are shown relative to the yearly averages. A positive relative difference of the seasonal GEE means more uptake of CO_2, which is usually true for the growing seasons.

The same type of values that are presented in the seasonal variations table, but for the average footprint of the selected date range, is used in the **multiple variables graph** to place the selected station relative to reference atmospheric stations in the ICOS network. The value on the y-axis is relative to the minimum and maximum values of these ICOS stations. 0% indicates the station with the lowest variable value, and 100% the highest.

Additional resources

More specifics about the processing of the ancillary data layers can be found in Storm (2020) (section 3.3). Further information about the station is available the station landing page.

An interactive Jupyter Notebook is available at ICOS explore data and can be used to output the figures and maps presented in this document, e.g. for a different time-period and/or specific hour(s) of the day. It is also possible to change the bin-sizes and intervals used in the maps and the land cover wind rose. Furthermore, it is possible to generate a characterisation for a hypothetical station. The only requirement is that footprints have been generated using the STILT on demand calculator.

To re-generate this PDF in the interactive Notebook, use the following settings. Copy and save the information as a JSON-file and use the option to "Load settings from file".


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{
 "stationCode": "HTM150",
 "startYear": 2020,
 "startMonth": 1,
 "startDay": 1,
 "endYear": 2020,
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 "binSize": 15,
 "binInterval": 100,
 "unit": "percent",
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 }
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The STILT model results for this report are availabe online here and other stations can be selected at the STILT viewer.