

ASTD DATA

INFORMATION DOCUMENT



PAME

Protection of the Arctic Marine Environment



ASTD DATA DOCUMENT

The *Cooperative Agreement among the Arctic States Regarding Arctic Ship Traffic Data Sharing* outlines access to the Arctic Ship Traffic Data (ASTD) System and the use of ASTD data.

This document outlines and explains the ASTD data.

The document is intended for all ASTD users.

Questions can be sent to the PAME Secretariat (pame@pame.is)

ASTD Data Document Version History

1.1: January 2019.

1.2: April 2020.

1.3: January 2021.

1.4: March 2021.

1.5: November 2022

1.6: January 2023

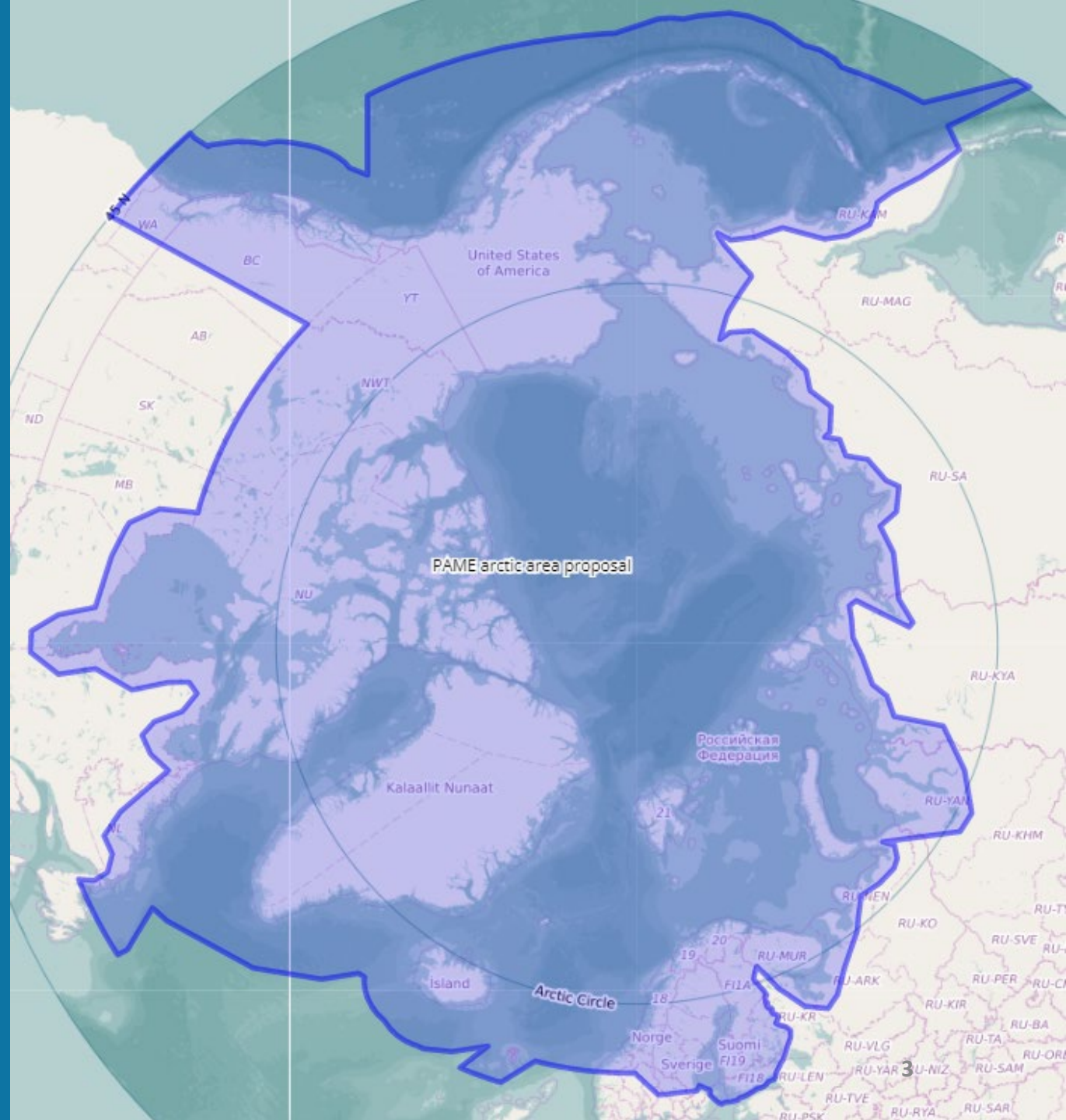
1.7: March 2023

1.8: September 2023

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Geographic Scope

Data in ASTD is collected from over 20 satellites and multiple base stations. Data is collected from a defined area, shown on the map to the right.



ASTD Data

The data from ASTD can be accessed by two means:

ASTD SYSTEM

- ✓ Easy access to data
- ✓ Quick analysis on pre-defined area
- ✓ Data is pre-calculated for each ship per month
- ✓ Simple to use

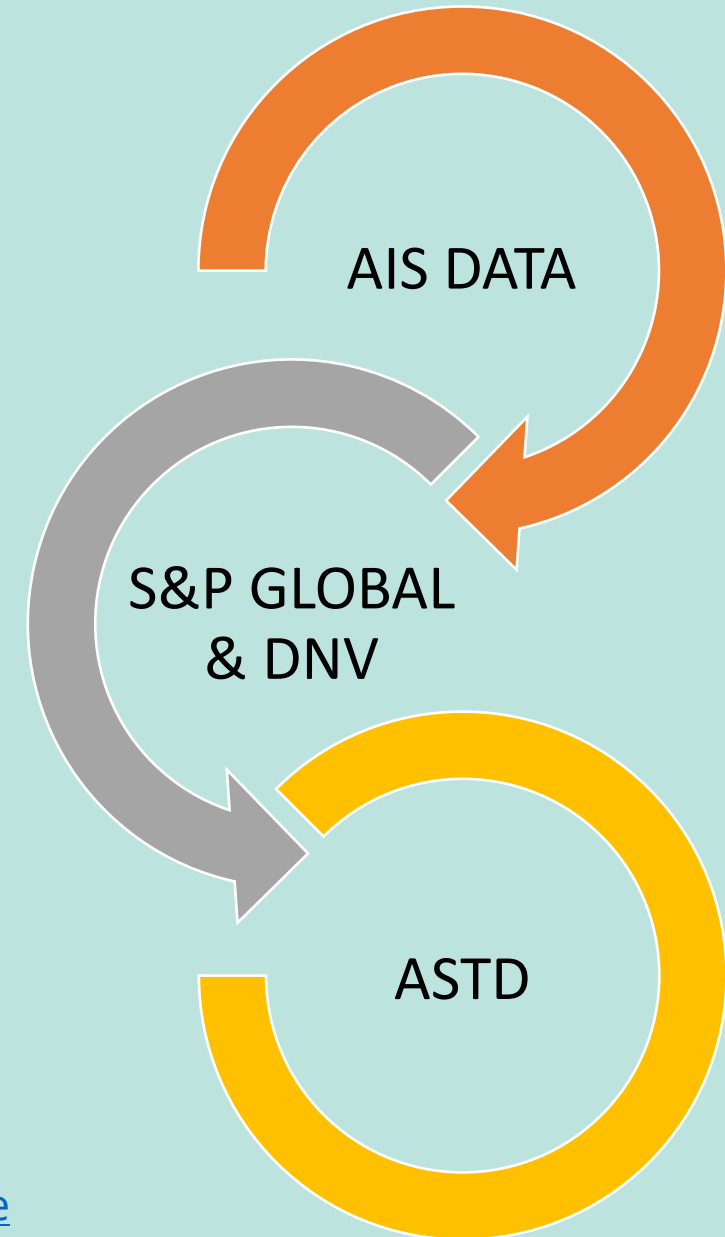
FTP SERVER

- ✓ Data in aggregated files for the whole of ASTD area
- ✓ Data needs to be filtered, cleaned
- ✓ Needs professional GIS experts
- ✓ Slightly more details in data
- ✓ Intended for specific analysis
- ✓ Contact PAME for access

ASTD DATA

The ASTD Database contains four types of information. These are:

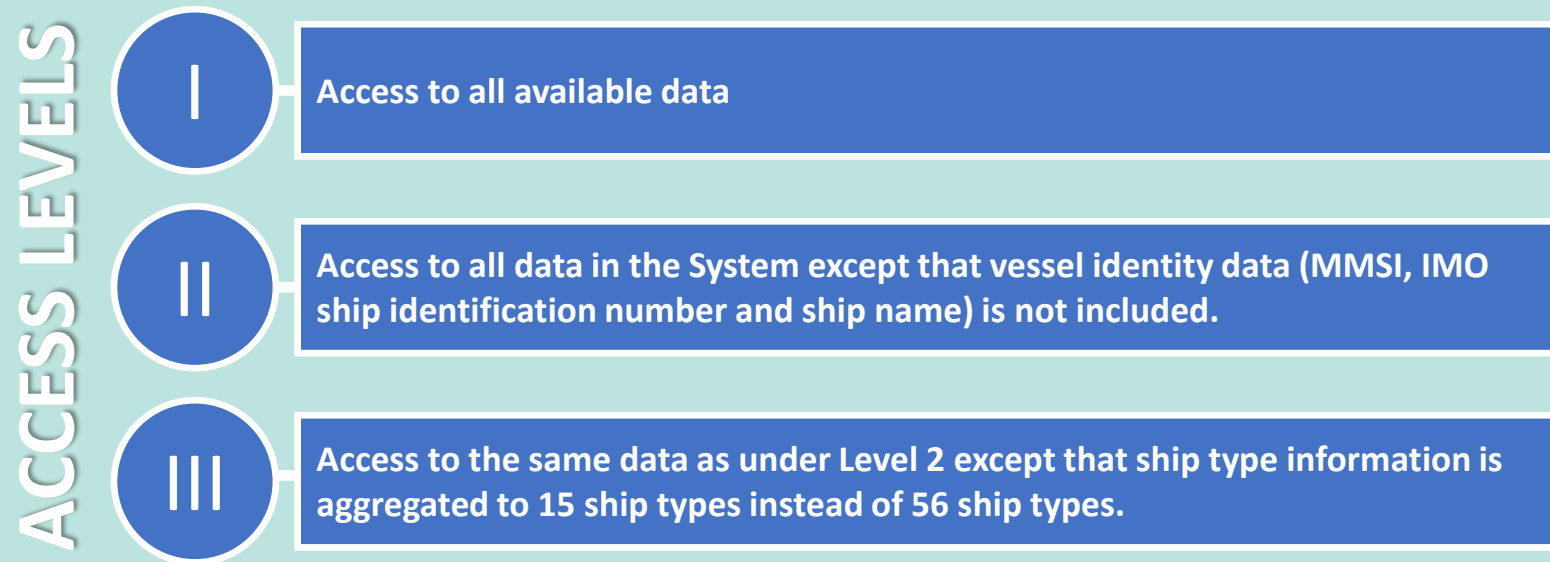
1. Automatic Identification System (AIS data) received from ships operating in the Arctic. This data is collected by satellites and is provided by USA and Norway.
2. Ship characteristic information (e.g., type, size, flag, gross tonnage) from S&P Global (formerly IHS Markit, which had acquired Lloyds Register in 2009). Lloyds Register had collected information on ships since 1790. On behalf of IMO, S&P Global hosts a ship information database and is the sole issuer of IMO numbers. An IMO number is a unique number assigned to each ship. The IMO ship identification number scheme was introduced in 1987 as a measure to enhance ship safety and security. It established a mechanism for assigning a permanent number to each ship for identification purposes. That number remains unchanged through the ship's life. From this, information in the table on page 7 is generated.
3. Information on the types of fuel ships are burning and calculated air emissions from such combustion are obtained from DNV. DNV makes these calculations based on IMO emission factors. DNV is the world's largest classification society and a recognized advisor to the maritime industry. See pages 18-19 & 21.
4. Sea ice data from the U.S. National Snow and Ice Data Center (NSIDC). ASTD contains monthly sea ice extent information obtained from the [NSIDC Sea Ice Index](#).



ASTD DATA – ACCESS LEVELS

Arctic State approved government agencies and ministries, Arctic Council Permanent Participants and Arctic Council Working Groups get free access to the database. Others, such as Arctic Council Observers, pay a small fee for access to ASTD. A document which outlines the access has been created and is available [here](#).

Access to ASTD data may be granted to eligible applicants at one of three access levels:
Level I, Level II and Level III



See table on page 7 what is included in the ASTD Data for each access level.

ASTD SYSTEM

The table shows data fields for each ship in the ASTD System and compares each access level. The fields are acquired by downloading data from the ASTD System.

See example of how the data looks when downloaded on page 8.

DATA FIELD IN ASTD DATA	LEVEL 1	LEVEL 2	LEVEL 3	EXPLANATION	PAGE
period	YES	YES	YES	Month and year chosen	-
area_type	YES	YES	YES	Type of area chosen (EEZ, LME etc.)	-
area_id	YES	YES	YES	Number if this area in the ASTD Database	-
Ship_id	NO	YES	YES	Ship identification number.	11
mmsi	YES	NO	NO	The identification number of the AIS-equipment on the vessel	11
imonumber	YES	NO	NO	IMO number of the ship	11
fishingvesselnumber	YES	NO	NO	Registration for fishing vessels	11
vesselname	YES	NO	NO	Name of ship	11
flagcode	YES	YES	YES	Flag Code for the ship	12
iceclass	YES	YES	YES	Ice Class for the ship, see page xx	13
norwegianshiptypeid	YES	YES	YES	Type of ship id (ASTD)	14-16
norwegianshiptypename	YES	YES	YES	Type of ship (ASTD)	14-16
lloydsshiptypeid	YES	YES	NO	Type of ship id (Lloyds)	14-16
lloydsshiptypename	YES	YES	NO	Type of ship (Lloyds)	14-16
lloyds5_cat	YES	NO	NO	Type of ship id (Lloyds)	14-16
yearofbuild	YES	YES	YES	Year which a vessel was delivered to its original owner by a shipbuilder.	-
deadweight	YES	YES	NO	DWT of the ship,	17
draught	YES	YES	NO	Draught of the ship	17
lengthregistered	YES	YES	NO	Length of the ship	17
passengercapacity	YES	YES	NO	Maximum passenger capacity	17
grosstonnage	YES	YES	NO	GT of the ship	17
vesselsizedescription	YES	YES	YES	Vessel size category	17
fuelquality	YES	YES	YES	Type of fuel used	18-19
distance_nm	YES	YES	YES	Distance sailed in nautical miles	20
consumption	YES	YES	YES	Fuel consumption in metric tons	18-19
co2emission	YES	YES	YES	Co2 emission of the ship in metric tons	21
coemission	YES	YES	YES	CoE emission of the ship in metric tons	21
noxemission	YES	YES	YES	NOX emission of the ship in metric tons	21
so2emission	YES	YES	YES	So2 emission of the ship in metric tons	21
operationhour	YES	YES	YES	Hours operated	22

ASTD FTP SERVER

The table shows data fields for each ship downloaded from the ASTD FTP Server and compares each access level. All downloads are for one month, for the whole ASTD Area.

See example of how the data looks when downloaded on page 10.

DATA FIELD	LEVEL 1	LEVEL 2	LEVEL 3	EXPLANATION	PAGE
mmsi	YES	NO	NO	The identification number of the AIS-equipment on the vessel	11
imonumber	YES	NO	NO	IMO number of the ship	11
ship_id	NO	YES	YES	Id of the ship – unique for each month.	11
date_time_utc	YES	YES	YES	Date/time of the AIS message reported by the vessel	-
vesselname	YES	NO	NO	Name of the ship	11
flagname	YES	YES	YES	Name of the ship flag	12
flagcode	YES	YES	YES	Code for the ship flag	12
iceclass	YES	YES	YES	Ice class of the ship	13
astd_cat	YES	YES	YES	Type of ship (ASTD aggregation)	14-16
lloyds3_	YES	YES	NO	Type of ship (Lloyds aggregation)	14-16
lloyds5_cat	YES	NO	NO	Type of ship (Lloyds aggregation)	14-16
sizegroup_gt	YES	YES	YES	Size of ship (ASTD aggregation)	17
fuelquality	YES	YES	YES	Type of fuel used	18-19
fuelcons	YES	YES	YES	Fuel consumption in metric tons from last signal	18-19
co	YES	YES	YES	Co emissions in metric tons from last signal	21
co2	YES	YES	YES	Co emissions in metric tons from last signal	21
so2	YES	YES	YES	So2 emissions in metric tons from last signal	21
nox	YES	YES	YES	Nox emissions in metric tons from last signal	21
dist_nextpoint	YES	YES	YES	Distance sailed since last point in meters	23
sec_nextpoint	YES	YES	YES	Seconds from last point	23
longitude	YES	YES	YES	Longitude position signal	-
latitude	YES	YES	YES	Latitude position signal	-

DATA EXAMPLE: FTP Server Data download – Level 1

Opened in Notepad++ - imported to Excel

	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	imonumber	date_time_utc	vesselname	flagname	flagcode	iceclass	sizegroup_gt	gross_tonnage	deadweight	draught	passenger_capacity	year_of_build	astd_cat	lloyds3_cat	lloyds5_cat	fuelquality	fuelcons	co2	co	nox	so2	dist_nextpoint	sec_nextpoint	longitude	latitude
2	9855173	1/15/2023 22:38	STANGVIKFIJORD	Norway	NOR		1000 - 4999 GT	2288	700	3.75	199	2020	Passenger ships	Passenger/Ro-Ro Cargo	Passenger/Ro-Ro Ship (Vehicles)	5	0.0066046	0.0210609	4.89E-05	0.0002938	1.19E-05	954.8	363	8.50687	62.88211
3	9855173	1/18/2023 5:28	STANGVIKFIJORD	Norway	NOR		1000 - 4999 GT	2288	700	3.75	199	2020	Passenger ships	Passenger/Ro-Ro Cargo	Passenger/Ro-Ro Ship (Vehicles)	5	0.0057944	0.0184922	4.29E-05	0.0002573	1.04E-05	284.543	362	8.487552	62.87901
4	8417651	1/19/2023 11:46	LAUTUS	Norway	NOR		< 1000 GT	267	250	3.35	0	1984	Other activities	Towing / Pushing	Tug	0	0.0004441	0.0014236	3.29E-06	1.95E-05	7.99E-07	0.085	362	8.277748	62.78408
5	8417651	1/19/2023 15:07	LAUTUS	Norway	NOR		< 1000 GT	267	250	3.35	0	1984	Other activities	Towing / Pushing	Tug	0	0.0004514	0.0014472	3.34E-06	1.99E-05	8.13E-07	0.851	368	8.278827	62.7844
6	8417651	1/21/2023 11:51	LAUTUS	Norway	NOR		< 1000 GT	267	250	3.35	0	1984	Other activities	Towing / Pushing	Tug	0	0.0006575	0.0021079	4.87E-06	2.89E-05	1.18E-06	0.564	536	8.281498	62.78348
7	0	1/21/2023 12:21	SOLVEIG										Unknown	Unspecified	Unspecified	0						1015.372	364	8.444415	62.74355
8	0	1/22/2023 13:49	SOLVEIG										Unknown	Unspecified	Unspecified	0						1201.862	360	8.159783	62.84905
9	0	1/24/2023 8:59	ALLJO										Unknown	Unspecified	Unspecified	0						1474.004	370	8.429887	62.87779
10	9855173	1/24/2023 19:08	STANGVIKFIJORD	Norway	NOR		1000 - 4999 GT	2288	700	3.75	199	2020	Passenger ships	Passenger/Ro-Ro Cargo	Passenger/Ro-Ro Ship (Vehicles)	5	0.0270459	0.0858598	0.0002001	0.0012136	4.87E-05	1953.313	363	8.491393	62.87919
11	9348948	1/24/2023 19:42	MISIDA	Finland	FIN	FS Ice Class 1A Super	10000 - 24999	15586	11407	7.25	12	2007	Ro-Ro cargo ships	Ro-Ro Cargo	Ro-Ro Cargo Ship	6	0.2034453	0.6505145	0.0015055	0.0157072	0.001974	3281.825	360	8.504026	62.72796
12	0	1/25/2023 10:13	DYKKERSERVICE 3										Unknown	Unspecified	Unspecified	0						1.486	370	7.877453	62.73758
13	0	1/25/2023 10:43	DYKKERSERVICE 3										Unknown	Unspecified	Unspecified	0						1.104	367	7.877449	62.73759
14	0	1/25/2023 14:55	SOLVEIG										Unknown	Unspecified	Unspecified	0						1212.459	360	8.15119	62.85867
15	9855173	1/26/2023 12:10	STANGVIKFIJORD	Norway	NOR		1000 - 4999 GT	2288	700	3.75	199	2020	Passenger ships	Passenger/Ro-Ro Cargo	Passenger/Ro-Ro Ship (Vehicles)	5	0.015788	0.0501712	0.0001168	0.000707	2.84E-05	1497.295	360	8.487763	62.87901
16	9150236	1/26/2023 12:26	WILSON GHENT	Barbados	BBD		1000 - 4999 GT	2446	3707	5.51	0	1996	General cargo ships	General Cargo	General Cargo Ship	6	0.0030235	0.0095271	2.24E-05	0.000133	1.27E-05	24.717	539	8.125611	62.84234
17	9150236	1/26/2023 13:53	WILSON GHENT	Barbados	BBD		1000 - 4999 GT	2446	3707	5.51	0	1996	General cargo ships	General Cargo	General Cargo Ship	6	0.0020194	0.0063632	1.49E-05	8.89E-05	8.48E-06	1.692	360	8.125525	62.84255
18	9150236	1/26/2023 16:35	WILSON GHENT	Barbados	BBD		1000 - 4999 GT	2446	3707	5.51	0	1996	General cargo ships	General Cargo	General Cargo Ship	6	0.0030235	0.0095271	2.24E-05	0.000133	1.27E-05	2.102	539	8.125544	62.84255
19	0	1/26/2023 17:13	SOLVEIG										Unknown	Unspecified	Unspecified	0						1378.599	368	8.33433	62.78145
20	8713653	1/26/2023 18:06	CARTEN ELINA	Norway (Nis)	NIS	FS Ice Class 1C	1000 - 4999 GT	4462	3727	5.85	0	1989	General cargo ships	General Cargo	Palletised Cargo Ship	6	0.0300748	0.0952698	0.0002226	0.0013498	0.0001263	2210.199	370	8.454342	62.74184
21	9150236	1/26/2023 18:53	WILSON GHENT	Barbados	BBD		1000 - 4999 GT	2446	3707	5.51	0	1996	General cargo ships	General Cargo	General Cargo Ship	6	0.002025	0.0063809	1.50E-05	8.91E-05	8.51E-06	2.952	361	8.125425	62.84252
22	9150236	1/26/2023 20:02	WILSON GHENT	Barbados	BBD		1000 - 4999 GT	2446	3707	5.51	0	1996	General cargo ships	General Cargo	General Cargo Ship	6	0.0030235	0.0095271	2.24E-05	0.000133	1.27E-05	4.88	539	8.125531	62.84254

SHIP IDENTIFICATION

ASTD Contains several ways to identify vessels:

SHIP ID

The *ship_id* field contains a number for each ship. The *ship_id* is consistent for each ship per month, but changes between months.

MMSI

The MMSI number (Maritime Mobile Service Identity) is a unique nine-digit number for identifying a ship's AIS-equipment. It provides an internationally standardized number for contacting the vessel.

IMO NUMBER

A unique reference number is assigned to each ship for identification purposes, assigned by S&P Global on behalf of the IMO. ASTD contains the latest known IMO number for given MMSI whenever IMO number is not reported.

FISHING VESSEL NUMBER

Identification information for fishing vessels.

VESSEL NAME

ASTD contains names of ships, but as names are not unique, using IMO or MMSI is better for ship identification. The name is taken from the latest AIS report of the ship.

FOR ASTD
LEVEL 2 AND
LEVEL 3



AVAILABLE ON LEVEL 1 ONLY

FLAG CODES

- ASTD data includes “*Flag Codes*” for each ship. A Flag Code represents the national ship registry where the ship is registered. Some countries have more than one national ship registry.
- Users should match the Flag Code to the National Ship Registry if it is unknown to them.
- A document with ASTD Flag Codes is available to download [here](#).

EXAMPLE

The first two columns show ASTD data when downloaded. The National Ship Registry Column is made using the [Flag Code document](#).

NAME OF SHIP	FLAG CODE	NATIONAL SHIP REGISTRY
SUNNANVIK	SWD	Sweden
SVYATOY PETR	RUS	Russia
ORASILA	DIS	Danish International Ship Registry
ISFJORD	NIS	Norway International Ship Registry
BRUARFOSS	FAS	Faroe Islands
BORIS SOKOLOV	CYP	Cyprus
SJOVEIEN	PAN	Panama
REMBRANDT VAN RIJN	VAN	Vanuatu
NATIONAL GEOGRAPHIC	BAH	Bahamas
ANTIGUA	NTH	Netherlands
OSTERFJORD	NOR	Norway
POLAR NATAARNAQ	DEN	Denmark
PISON	FAR	Faroe Islands
U. S. LIBERATOR	USA	United States
STEFFANO	ETN	Estonia
KIRKELLA	GBI	United Kingdom
CIDADE DE AMARANTE	PTG	Portugal
GERDA MARIA	GEU	Germany
TAURUS	LTH	Lithuania
SOLBERG	ICL	Iceland
MONTE MEIXUEIRO	SPN	Spain
NIKOLAY URVANTSEV	HKG	Hong Kong
DORADO 2	LAV	Latvia
POLARFRONT	FIS	French International Ship Registry

ICE CLASS OF SHIPS IN ASTD

- Ice class refers to a notation assigned by a classification society or a national maritime authority to denote the additional level of strengthening as well as other arrangements that enable a ship to navigate through sea ice. Some ice classes also have requirements for the ice-going performance of the vessel.
- ASTD ice classes are based on the Finnish-Swedish Ice Class Rules, which are cooperatively developed by the Finnish and Swedish maritime authorities.
- If ice class information is missing in the ASTD, the vessel does not have a registered ice class.

**ICE CLASSES OF
SHIPS:** *Finnish-
Swedish Ice Class
Rules explained*

SHIP TYPE AGGREGATION

- S&P Global assigns and validates IMO numbers on behalf of the IMO. IMO Numbers are issued from the global maritime databases maintained by S&P Global and consist of a unique seven-digit number. S&P Global manages this Scheme on behalf of the IMO.
- ASTD uses the AIS number to identify each ship, including its type and characteristics.
- S&P Global uses the *Statcode 5 Shiptype Coding System* to assign ship types to each ship. ASTD uses the same system to aggregate ship types. See an example on next page.
- A document showing how ASTD aggregates ship types is available to [download here](#).

[S&P Global website for IMO number scheme](#)

SHIP TYPE AGGREGATION: DATA FIELDS EXPLAINED

Data fields for ship types in ASTD are not the same in the ASTD System as in FTP Server. Here, all fields are explained.

ASTD SYSTEM

norwegianshiptypeid	Refers to an id in the ASTD Database to match with the column below. Each id represents the name of a ship type. Available to all users.
norwegianshiptypename	Refers to the ship type aggregated from <i>lloyds5_cat</i> to 16 ship types, referred to as the <i>Norwegian ship type</i> or the <i>ASTD Ship type</i> . Available to all users.
lloydsshiptypeid	Refers to an id in the ASTD Database to match with the column below. Each id represents the name of a ship type. Available for ASTD Level I and Level II users.
lloydsshiptypename	Refers to the ship types aggregated from <i>lloyds5_cat</i> to 56 ship types. Available for ASTD Level I and Level II users.
lloyds5_cat	Refers to an ID at the highest level available, the ID is used to match with a ship type in the ASTD Ship Type document . Available for ASTD Level I users.

FTP SERVER

astd_cat	Same as the <i>norwegianshiptypename</i> field. Refers to the ship type aggregated from <i>lloyds5_cat</i> to 16 ship types, referred to as the <i>Norwegian ship type</i> or the <i>ASTD Ship type</i> . Available to all users.
lloyds3_	Same as the <i>lloydsshiptypename</i> field. Refers to the ship types aggregated from <i>lloyds5_cat</i> to 56 ship types. Available for ASTD Level I and Level II users.
lloyds5_cat	Refers to an ID at the highest level available, the ID is used to match with a ship type in the ASTD Ship Type document . Available for ASTD Level I users.

SHIP TYPE AGGREGATION - EXAMPLE

	StatCode Level 5 (Iloyds5_cat)	Level 5 Ship Type	StatCode Level 3 (Iloydsship typename & Iloyds3_)	Level 3 Ship Type	ASTD Ship Type (norwegianshiptyp ename & astd_cat)	Description
	Available to ASTD Level 1 users		Available to ASTD Level 2 users		Available to ASTD Level 3 users	
CHEMICAL TANKERS	A12A2LP	Molten Sulphur Tanker	A12	Chemical	Chemical tankers	A tanker for the bulk carriage of molten sulphur in insulated tanks at a high temperature
	A12A2TC	Chemical Tanker	A12	Chemical	Chemical tankers	A tanker for the bulk carriage of chemical cargoes, lube oils, vegetable/animal oils and other chemicals as defined in the International Bulk Chemical Code. Tanks are coated with suitable materials which are inert to the cargo
	A12B2TR	Chemical/Products Tanker	A12	Chemical	Chemical tankers	A chemical tanker additionally capable of the carriage of clean petroleum products
	A12C2LW	Wine Tanker	A12	Chemical	Chemical tankers	A cargo ship designed for the bulk transport of wine in tanks. Tanks will be stainless steel or lined. New vessels will be classified as chemical carriers
	A12D2LV	Vegetable Oil Tanker	A12	Chemical	Chemical tankers	A cargo ship designed for the bulk transport of vegetable oils in tanks. Tanks will be stainless steel or lined. New vessels will be classified as chemical carriers
	A12E2LE	Edible Oil Tanker	A12	Chemical	Chemical tankers	A cargo ship designed for the bulk transport of edible oils in tanks. Tanks will be stainless steel or lined. New vessels will be classified as chemical carriers
	A12F2LB	Beer Tanker	A12	Chemical	Chemical tankers	A tanker for the bulk carriage of beer
	A12G2LT	Latex Tanker	A12	Chemical	Chemical tankers	A tanker for the bulk carriage of latex
	A14E2LJ	Fruit Juice Carrier, Refrigerated	A14	Other Liquids	Chemical tankers	A tanker for the bulk carriage of fruit juice concentrate in refrigerated tanks. May be arranged for the additional carriage of containers on deck
	A14F2LM	Molasses Tanker	A14	Other Liquids	Chemical tankers	A tanker for the bulk carriage of molasses
	A14G2LG	Glue Tanker	A14	Other Liquids	Chemical tankers	A tanker for the bulk carriage of glue
	A14H2LH	Alcohol Tanker	A14	Other Liquids	Chemical tankers	A tanker for the bulk carriage of alcohol
	A14N2LL	Caprolactam Tanker	A14	Other Liquids	Chemical tankers	A tanker for the bulk carriage of caprolactam, a chemical used in the plastics industry for the production of polyamides
	A22A2BN	Bulk/Caustic Soda Carrier (CABU)	A22	Bulk Dry / Oil	Chemical tankers	A bulk carrier with certain holds arranged with tanks for the alternative (but not simultaneous) carriage of caustic soda
	A22A2BX	Bulk/Sulphuric Acid Carrier	A22	Bulk Dry / Oil	Chemical tankers	A bulk carrier arranged for the alternative (but not simultaneous) carriage of sulphuric acid
	A22B2BQ	Bulk/Oil/Chemical Carrier (CLEANBU)	A22	Bulk Dry / Oil	Chemical tankers	A bulk carrier with arranged for the alternative (but not simultaneous) carriage of clean petroleum and chemical products.
	W11A5TC	Chemical Tanker, Inland Waterways	W11	Tanker	Chemical tankers	A tanker for the bulk carriage of chemical cargoes, lube oils, vegetable/animal oils and other chemicals as defined in the International Bulk Chemical Code which is not suitable for trading in open waters. Tanks are coated with suitable materials

SHIP CHARACTERISTICS: EXPLAINED

DEADWEIGHT	DRAUGHT	LENGTH REGISTERED	PASSENGER CAPACITY	GROSS TONNAGE	VESSEL SIZE DESCRIPTION
<p>Deadweight (dwt) - The weight in tonnes (1000 kg) of cargo, stores, fuel, passengers and crew carried by the ship when loaded to her maximum summer draught.</p>	<p>Maximum draught of vessel in Meters. Measured from the lowest point on the hull to the water level when at the maximum permissible summer load line.</p>	<p>Registered length in meters. The length of the vessel is measured from the furthest part of the bow and the centerline of the rudder stock. This is the value as displayed on the flag of registration certificate.</p>	<p>Total passenger capacity available (on deck and in berths).</p>	<p>Gross Tonnage is a function of the moulded volume of all enclosed spaces of the ship as per the 1969 International convention on tonnage measurement of ships.</p>	<p>ASTD also aggregates ships Gross Tonnage to seven categories:</p> <ul style="list-style-type: none">< 1000 GT1000 - 4999 GT5000 - 9999 GT10000 - 24999 GT25000 - 49999 GT50000 - 99999 GT>= 100000 GT

ASTD FUEL INFORMATION: TYPES

As IMO changed the regulations on sulphur content in fuel as of 1.1.2020, fuel information in ASTD is different before and after that date.

The ASTD fuel type information refers to the main engine fuel.

[READ MORE:](#)

[IMO 2020 sulphur limit implementation - carriage ban enters into force](#)

[IMO: March 2020](#)

BEFORE 1.1.2020

Fuel information is categorized by six types of fuel. The data field *fuelquality* contains a number which is matched to the table below.

0	Distillate marine fuel (MGO/MDO)
1	Residual marine fuel and heavy distillate (ISO-F-10 - 80)
2	Residual marine fuel (IFO-F-80 - 180) heavy fuel oil
3	Residual marine fuel (IFO-F-180 - 380 or above) heavy fuel oil
4	Liquid natural gas (LNG)
5	Battery power

AFTER 1.1.2020

Fuel information is categorized by four types of fuel. The data field *fuelquality* contains a number which is matched to the table below.

0	Distillate marine fuel (MGO/MDO)
4	Liquid natural gas (LNG)
5	Battery power
6	Residual marine fuel (replaced groups 1,2 and 3 into one from 2020).

ASTD FUEL INFORMATION: CALCULATION

- Fuel consumption in ASTD is measured in Metric Tons.
 - For the ASTD System, the data is aggregated for the ship for the given month
 - For the FTP Server, the data is between AIS messages, so users have to make their own calculations.
- To calculate fuel consumption, users can aggregate the *fuelcons* data field:

DATA EXTRACTED FROM ASTD FTP SERVER: LEVEL 1	date_time_utc	vesselname	fuelcons	dist_nextpoint	sec_nextpoint	longitude	latitude
	7/10/2018 0:00	ENNIBERG	0.085419096	2321.344	361	25.58781	71.24021
	7/10/2018 0:06	ENNIBERG	0.08438621	2339.384	369	25.65239	71.2412
	7/10/2018 0:12	ENNIBERG	0.08385511	2303.604	361	25.71747	71.2422
	7/10/2018 0:18	ENNIBERG	0.08198549	2314.87	370	25.78157	71.24303
RESULT: THE FISHING VESSEL ENNINBERG CONSUMED 12.83 METRIC TONS OF FUEL FROM 00:00 AND 23:57 ON OCTOBER 7 th 2018.	7/10/2018 0:24	ENNIBERG	0.0791576	2248.606	361	25.84601	71.24377
	<i>Points from rest of day excluded from this example</i>						
	7/10/2018 23:33	ENNIBERG	0.018696176	674.0636	370	32.37227	70.25326
	7/10/2018 23:39	ENNIBERG	0.081220426	2302.133	369	32.38686	70.24977
	7/10/2018 23:45	ENNIBERG	0.078736156	2243.539	361	32.44735	70.25248
	7/10/2018 23:51	ENNIBERG	0.08243172	2320.164	370	32.50608	70.25566
	7/10/2018 23:57	ENNIBERG	0.08749976	2378.666	370	32.56686	70.25887
	<i>Total fuel consumption:</i>		<i>12.82841752</i>				

DISTANCE SAILED

- Sailed distance calculates the distance a ship navigate
- ASTD System Download: Aggregated for a specific ship, per month, in nautical miles.
 - FTP Server: Not aggregated, only the distance to the next AIS point is show (in meters).
- To calculate sailed distance from the ASTD System Download, users can aggregate the *distance_nm* data field.

DATA DOWNLOADED FROM ASTD SYSTEM ON LEVEL 3: REFRIGIRATED CARGO SHIPS IN AUGUST 2023 IN THE POLAR CODE AREA

Result: All Refrigerated cargo ships which operated in the Arctic Polar Code Area in August 2023 sailed a total of **28.385 nautical miles**.

ship_id	distance_nm
678752641	447.4422192
1183955587	445.7237171
1214378204	389.3965853
205541528	1582.607832
2085431710	1513.316357
292651238	125.2485653
1177992752	89.7315324
1396719016	922.2421118
4318144	1258.947736
1218720291	509.6022576
1422359902	673.0680113
2059886045	244.2860778
898781001	277.363304
1700004637	301.7671874
1485251942	702.4789104
376172036	33.77325108
1253950234	732.6287462
1276410740	927.6464768
358526016	740.9039854
308721009	766.8940497
1160713059	413.2701388
1467375841	975.1508747
2027878929	3770.898587
1505855006	234.841567
1183617473	491.8889077
1904386502	678.8842883
201153845	187.3589428
1490585635	745.1513974
254501721	330.9877187
497699630	1464.604928
577931545	737.7206814
1767508517	590.4060821
1324293047	881.1826971
265411885	145.7432748
1138715978	495.7164811
1339556273	185.9946031
1375739116	92.66961393
1914139368	2679.687118
1198891381	597.7129195
Total	28384.93974

ASTD SHIP EMISSIONS

ASTD contains ship emission calculations for Co2, CoE, Nox and So2. All units are in metric tons.

- For the ASTD System Download: Calculations are for each ship for the chosen month/year
- For the FTP Server: Emissions for the distance between this and previous point/AIS message. Users conduct own calculations.

To calculate emissions from the ASTD System Download, users can aggregate the data fields between the desired period, as this example shows:

DATA DOWNLOADED FROM ASTD SYSTEM: LEVEL 1						
10 (OUT OF 65) BULK CARRIERS IN THE POLAR CODE AREA IN AUGUST 2023						
mmsi	imonumber	vesselname	co2emission	coemission	noxemission	so2emission
352001477	9838838	ADMIRAL SCHMIDT	210.8116043	0.449314514	4.12410675	0.526969641
273614220	9741724	ALARA	476.3633349	1.056313769	10.15401637	1.312188728
636015170	9593476	AM GHENT	587.4620307	1.355339542	14.13911671	1.767071576
538005067	9624122	AM KRAKOW	209.820003	0.485785507	5.012890065	0.626921281
354260000	9434515	AMSTEL TIGER	238.9055975	0.538181807	5.455265719	0.701509073
636022382	9407471	ANNA-ELISABETH	57.66534302	0.131440433	1.333915206	0.169133099
319147600	9514406	ANNA-META	177.9319175	0.358157133	3.148739562	0.455341601
316044196	9854698	ARVIK I	695.7069006	1.55948652	15.32886935	1.971832246
354437000	9839076	DREAM SKY	407.8454429	0.924950259	9.446625361	1.207477421
273212240	9079169	ENISEY	777.5341135	1.762230281	17.87787617	2.282459572
Total emissions:			3840	9	86	11

OPERATION HOURS

The ASTD System provides calculations for time spent in a given area. The units are in hours. To calculate operational hours, users can aggregate the data field *operationhour*.

mmsi	imonumber	vesselname	operationhour
219024883	7600287	NORTH VIKING	451.425
219027854	9854636	SIUANA ARCTICA	743.985
219027908	9854648	MALERAQ ARCTICA	743.9686111
219029632	9881421	TILIOQ ARCTICA	744.6719444
219029633	9881419	ARPAARTI ARCTICA	743.9797222
219364000	9618161	NANOQ ARCTICA	289.7886111
219663000	9618159	MINIK ARCTICA	745.5505556
219667000	9618147	IVALO ARCTICA	744.7972222
219668000	9618135	MALIK ARCTICA	408.4030556
228443600	9961659	PERSEVERANCE	213.4241667
244693000	9365659	AMERICABORG	18.07055556
244750715	9546473	TIBERBORG	77.17194444
245634000	9466374	ALASKABORG	86.24416667
246263000	9466336	AMURBORG	84.77666667
246519000	9466300	ALBANYBORG	33.74888889
246556000	9333539	ARNEBORG	51.00083333
366750000	9210309	MAJ RICHARD WINTERS	370.8005556
367535950	9437335	OCEAN GIANT	78.64777778
			6630

General Cargo Ships in the Greenlandic EEZ in August 2023, from ASTD System Download - Level 1 .



Result: General Cargo ships spent 6630 hours in the Greenlandic EEZ in August 2023. On average, the 18 ships spent 15 hours in the EEZ.



AIS

Automatic Identification System

AIS is a maritime navigation safety communications system standardized by the International Telecommunication Union (ITU) and adopted by the International Maritime Organization (IMO) to provide information about ship type, position (recorded every 6 minutes in ASTD), course, speed, navigational status, and other safety-related information.

SOLAS regulation 19 requires AIS to be fitted aboard all ships of 300 or more gross tonnage engaged on international voyages; cargo ships of 500 or more gross tonnage not engaged on international voyages; and all passenger ships irrespective of size. SOLAS regulation 19 became effective 31 December 2004.

[*IMO: Automatic identification systems \(AIS\)*](#)

AIS TRANSCEIVERS

Automatic identification system (AIS) transceivers automatically provide position, identification and static data (vessel details) to nearby ships, land based stations and satellites. There are two types of AIS transceivers: Class A and Class B.

Class A transceivers transmit with a power of 12.5W. Position is reported autonomously every 2-10 seconds dependent on the vessel's speed and/or course changes (every three minutes or less when at anchor or moored); and the vessel's static and voyage related information every 6 minutes. Class A transceivers are also capable of text messaging safety related information and AIS Application Specific Messages, such as meteorological and hydrological data, electronic Broadcast Notice to Mariners, and other marine safety data.

Class B transceivers do not meet the SOLAS 19 regulation requirements, but provide similar benefits to smaller vessels at a lower cost and with a simpler installation. Generally they report less frequently than Class A transceivers. Transmit power is 2W. They can receive safety related text and application specific messages but cannot transmit them. The vessel's static data is reported, however none of the voyage related information is.

[Types Of Automatic Identification Systems \(Per ITU-R M.1371 And IEC Standards\) | Navigation Center \(uscg.gov\)](#)

ASTD only includes signals transmitted by ships carrying AIS Class A transceivers. Thus, ASTD includes information on all ships that are required to carry AIS Class A transponders as well as any other ships not subject to SOLAS Regulation 19 that voluntarily opt to carry AIS Class A transceivers.

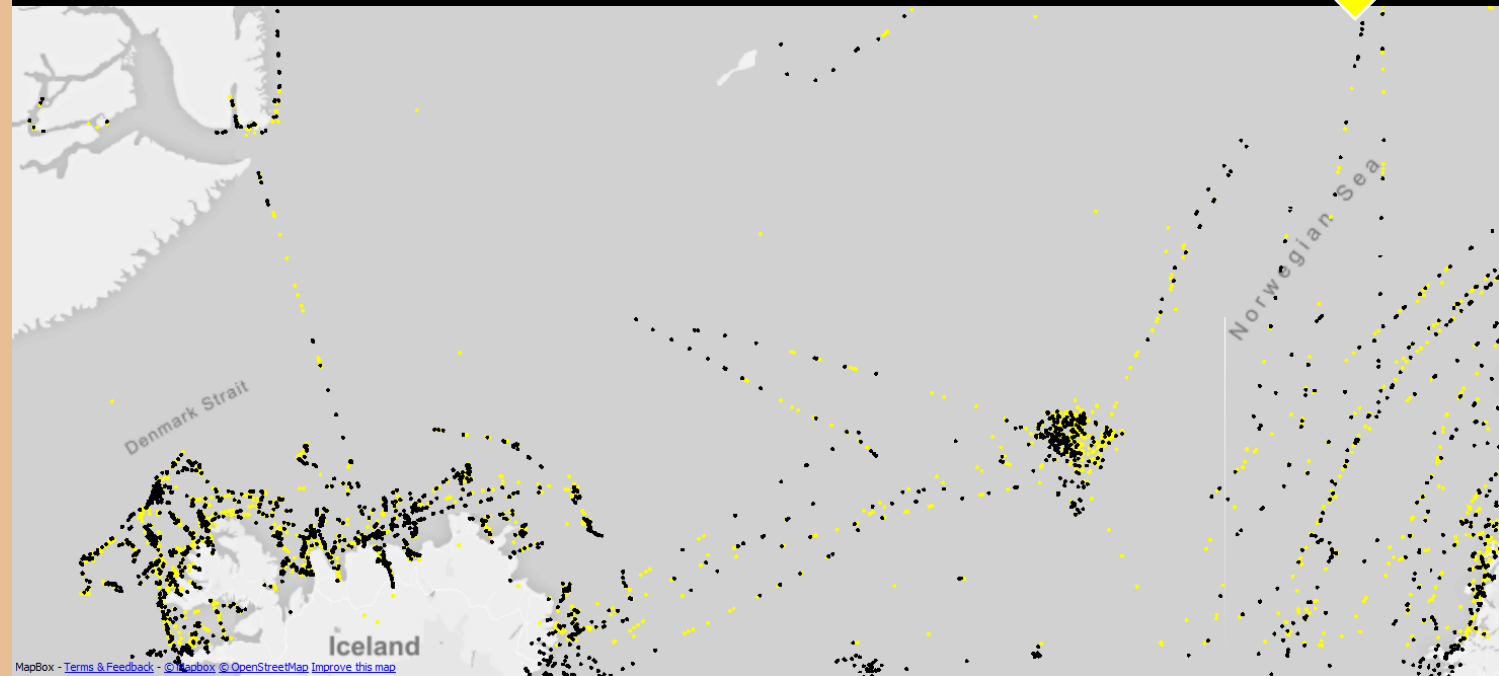
General AIS Limitations

AIS data in the ASTD System does not cover 100% of all ship traffic, but data quality is very high. This has been confirmed by comparing ASTD System data with data from other sources, including national collected information. Identifying pleasure craft and smaller fishing vessels can be challenging because these vessels are not required to carry AIS Class A transceivers.

In addition, numerous factors can affect the transmission and/or receipt of AIS signals, including:

- Technical failures due to faulty infrastructure (vessel and data flow)
- Erroneous onboard installation of AIS transceiver
- Problems with data links/networks
- Manipulation of AIS signals
- Data noise
- Satellite coverage limitations

The image below shows how AIS Class A transceiver data from the USA (yellow dots) supplements AIS Class A transceiver data from Norway (black dots) to give ASTD a more detailed and accurate picture of ship traffic.



ASTD Data Quality

The data in ASTD is very accurate. The data collected is vast, hundreds of gigabytes every year. Approximately 4 million records are added to the database every 24 hours. As outlined on page 18 of this document, AIS signals are not 100% accurate.

There are many variables which affect databases like ASTD. When comparing data between AIS databases, the information might not be 100% aligned. For example, there could be differences in the number, position and range in satellites which collect AIS signals. Data quality in ASTD is very high.

Working with ASTD Data

Data downloaded from the ASTD FTP requires sufficient computing capacity and the expertise of a GIS analyst.

Examples of software programs needed to work with ASTD data include CSV Explore, Python, or SQL databases like MySQL and PostgreSQL.

Keep this in mind when downloading large amounts of data.

However, smaller data samples can be downloaded by regular users, not specific GIS experts, and analyzed Excel. One has to download data and convert from CSV but from there analysis can be performed.

Please be careful with calculations to only use correct data.

Working with Data – “Data cleaning”

Please note that specific corrections are needed after downloading data to have as correct data as possible.

Satellites in orbit may pick up AIS signals from vessels located outside the geographic area covered by ASTD under certain atmospheric conditions.

In reports which the ASTD System can automatically generate, the ASTD System filters out all AIS Class A transceiver signals from ships for which satellites have picked up fewer than 10 positions in one month. ASTD users who download data from the FTP server for analysis must filter out this type of information themselves.

Please be aware when downloading data from the FTP server, data cleanup must be undertaken by the user to remove anomalies and other signals which could result in inaccurate analysis.



PAME

Protection of the Arctic Marine Environment



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