Data on traffic collection and elaboration (automatic download from web)

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Summary

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Abstract

This report describes the use of AIS data as noise source in the QUONOPS model.

1 Introduction

The marine traffic is one of the most recognized and relevant source of underwater noise (see D3.1.1). The traffic route offers only a coarse information on real noise production by vessels, because it depends also from velocity and specific ship in action.

The AIS (Automatic Identification System) vessel tracking was developed for navigation safety and implies a frequent transmission by the vessel of identity, velocity, length and other information. The

data are collected by terrestrial and/or satellite station permitting to authorities and maritime safety bodies to manage the traffic and reduce the hazards of marine navigation.

In the past the system was working efficiently only along the coast, in case of open sea the data transmission suffers and data can be lost and the traffic can be underestimated.

Actually the Satellite AIS data integrates the terrestrial data and permits to estimate more accurately the vessel traffic and consequently also the underwater noise generation.

2 Why AIS data

The AIS is a vessel-tracking system that operates on VHF radio frequency bands. The transmission of VHF-AIS data is mandatory for all passenger ships, for cargo ships heavier than 500 tons and for every ship heavier than 300 tons and traveling in international waters, according to the International Convention for the Safety of Life at Sea (SOLAS) (IMO, 2004). The data transmitted carry all the information useful for the identification and location of the vessels. From this information, the position of the vessels, the MMSI (Maritime Mobile Service Identity), route, speed and heading can be derived. An AIS receiver allows the decoding of the input signal, decrypted through the standard NMEA 0183 Protocol (National Marine Electronics Association, www.nmea.org). Received data are then parsed and stored on a dedicated server for analysis.

The coastal AIS network cannot capture signals from vessels because not all vessels carries AIS on board, especially the smaller ones, resulting in offshore vessel movements being underrepresented, and the contribution from fishing vessels is likely to be underrepresented, as a (unknown) proportion may not operate AIS. The AIS based data set is therefore not totally exhaustive, but gives a reasonable description of large shipping.

2.1 AIS data description

AIS data files describing all vessel movements have a minimum time resolution of several seconds, which is sufficient for modelling the statistical acoustic field. The input format is csv with the following fields:

- √ Time in UTC of each vessel data;
- √ MMSI vessel number, unique identification of vessels;
- √ Latitude (in degrees);

- √ Longitude (in degrees);
- √ Course Over Ground (in degrees);
- √ Speed Over Ground (in knots);
- √ Classification Vessel Type (see details in Table 1);
- √ SizeA (meters);
- √ SizeB (meters).

The vessel length was obtained by adding SizeA and Size B.

Classification type proposed by QO	Type class Label	Classification type proposed by QO	Type class Label
0	undefined	51	search and rescue vessel
01 à 09	electronic system	52	tug
20 à 29	wing in ground	53	Port tender
30	fishing	54	anti pollution eq
31-32	towing	55	law enforcement
33	dredging	56-57	Spare-local vessel
34	ops diving	58	medical transport
35	ops military	59	Ship according RR resolution N°18
36	sailing	60 à 69	passenger
37	pleasure caft	70 à 79	cargo
38-39	reserved	80 à 89	tanker
40 à 49	high speed craft	90 à 99	others or unknow
50	pilot vessel	100 et +	Aids to navigation

Table 1 Vessel Type,proposed by QUONOPS, provided in the AIS data (numbers from 0 to 100+) and details of grouping of vessel Type into labels.

2.2 Noise model and AIS data

In order to represent the spatial and temporal distribution of shipping traffic for noise modeling purposes, including noise statistics which depend on seasonal variations, AIS data are used.
Vessels Information provided by the AIS and the VMS data are used to determine the source level of individual vessels at any time using, for instance, the RANDI3.1 model (Wagstaff, 1973; Breeding and Pfug, 1996; Wales and Heitmeyer, 2002).
Using the following formula, it is possible to estimate the source spectral density level (dB re 1 µPa/√Hz @ 1 m) from length (l) and speed (v) of ship:

$$L_s(f,v,l) = L_{s0}(f) + c_V \times 10\log_{10}(v/v_0) + c_L \times 10\log_{10}(l/l_0) + g(f,l)$$

Where

- → Ls is the sound pressure level in dB ref 1µPa/√Hz @1m;
- → Ls0 is a mean reference spectrum;
- → cV and cL are power law coefficients for speed (in knots) and length (in meters);
- → v0 et l0 are the reference speed and length;
- → g(f,l) is an additional length dependent correction from Ross model (Breedinget al., 1996);

Noise Measurements close to shipping lanes

Noise measurements at a relatively close distance to a shipping lane can be combined with AIS of individual vessels to provide information on vessel source levels. Estimates of these levels could be used to describe individual sound sources as input for models. For a well-defined shipping lane, measuring station should be placed about 100-500 m outside the lane and at the closest depth to the minimum of the sound speed.

3 QUONOPS AIS data elaboration

Quonops is able to manage several typology of noise sources. The maritime traffic represents the main source of continuous noise and Quonops Is able to manage the AIS data acquired by different data providers. Navigation data are used to identifier, temporal and spatial data in the form of near real-time data stream or data accumulated for a given period of time. Files are described in text based UTF8 encoded format. They are written in a list of columns as csv format.

The interface filename is:

<Corporation-Service/Entity>_<ProjectName>_<Area>_<t0>_<tf>.ais

where each term means:

<Corporation-Service/Entity>: Identification for file author or provider

<ProjectName>:	Name of project associated to the data
<Area>:	Label to identify the geographic area
<t0>:	Beginning of interval time. UTC date in the form:YYYYMMDD_HHMMSS
<tf>:	End of interval time. UTC date in the form: YYYYMMDD_HHMMSS

Here is the content of an example of navigation AIS data file.

date,mmsi,latitude,longitude,name,ship type index,length,draught,speed,heading

20161225_132130,123456789,1.12,25.2,Some ship,30,13,,4.7,121

20162525_132131,123455321,3.2,23.3,Another ship,70,80,5,7.0,16

20161225_132131,123456789,1.11,25.3,Some ship,30,13,,4.7,121

20162525_132135,123455321,3.3,23.3,Another ship,70,80,5,7.0,16

3.1 Project AISavailability

The AIS data of shipping units in the North Adriatic Sea investigation area will be available soon (purchasing process) and will be used to perform the noise model as mentioned above. This content will be described in the deliverable “Noise Model”.

Reference

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