Wehrtechnische Dienststelle 71

C r u i s e R e p o r t

r/v ELISABETH MANN BORGESE

Cruise- No. EMB 153

This report is based on preliminary data

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1. **Cruise No.:** EMB 153

2. **Dates of the cruise:** from 24th April 2017 to 05th May 2017

3. **Particulars of the research vessel:**
   Name: Elisabeth Mann Borgese
   Nationality: Germany
   Operating Authority: Baltic Sea Research Institute (BSRI) Warnemünde

4. **Geographical area in which ship has operated:**
   Sogne-Fjorden, see map.

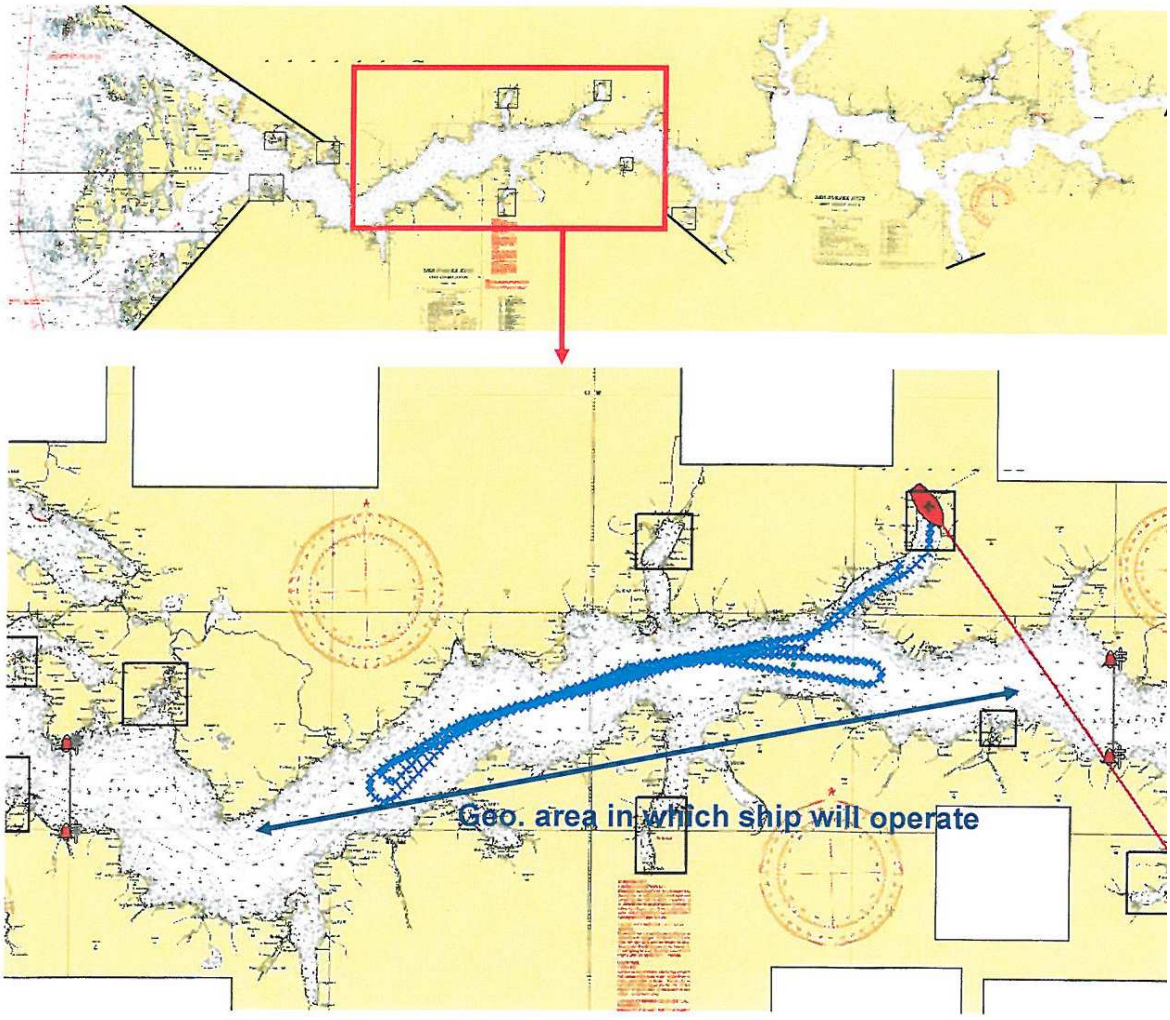

Figure 1: Typical towing course in Sogne-Forden.

5. **Dates and names of ports of call**
   28th April 2017 until 02nd May 2017, Hoyanger

6. **Purpose of the cruise**

   FWG/WTD71 use drifting hydrophone systems and towed systems (FOCUS2) for its acoustical and geophysical experiments. The drifting hydrophone system has to be calibrated for future experiments, the towed system has to be equipped with sensors (optical and acoustical) and tested. This cruise is a replacement for the cruise EMB134 (18.-29.07.2016 in Sogne-Fjord, NO) that could not be conducted due to technical reasons.

7. **Crew:**

Name of master:	Uwe Scholz
Number of crew:	11

8. **Research staff:**

Chief scientist:	Dr. Edgar Schmidtke
Scientists:	----
Engineers:	Mr. Sven Osburg, Mrs. Jennifer Karstens
Technicians:	Mr. Rainer Kühl, Mr. Klaus Balzer

9. **Co-operating institutions:** none

10. **Scientific equipment**

The freely drifting buoy – a circular hydrophone array - is shown in figure 2. The buoy carrys a circular hydrophone array (2 m diameter, depth 100 m). After deploying the buoy the ship will stood close by or passed the buoy on a straight course. The buoy was always in sight, the distance was always closer than three nautical miles. A sound source ITC1007 was towed or the ship itself was used as broadband sound source. The frequency range for the towed sound source was 8 kHz 14 kHz with source levels less than 190 dB (re. 1 uPa @ 1 m distance). The sound source was deployed at a depth less than 200 m (depending on the sound velocity profile), connected via cable to the ship.

Figure 2: Drifting circular hydrophone array with 18 hydrofones.

The towed system shown in figure 3 is a carrier for many types of sensors, i.e. side scan sonar, optical, temperature, hydrofones etc. It is planned to equip this system with a forward looking sonar, hydrofones and magnetic sensors for this cruise and to test the hydrodamic behaviour of the fully equipped system between 10 m and 250 m depth and speeds from 4 knots up to 12 knots. For this purpose courses of 90° and 270° in the Sogne-Fjord were planned (see chart).

As an acoustical source the same drifting system was used for the cruise EMB082 (August 2014) in the same way. This sound source was used in the frequency range from 500 Hz to 5 kHz with source levels less than 190 dB (re. 1 uPa @ 1 m distance). The sound source was deployed to depths between 50 m and 200 m (depending on the sound velocity profile), connected via cable to the surface buoy that was equipped with VHF connection to the ship, a radar reflector and AIS transponder. The programmed acoustic signals werw used to calibrate the acoustic sensors attached to the towed system FOCUS2.

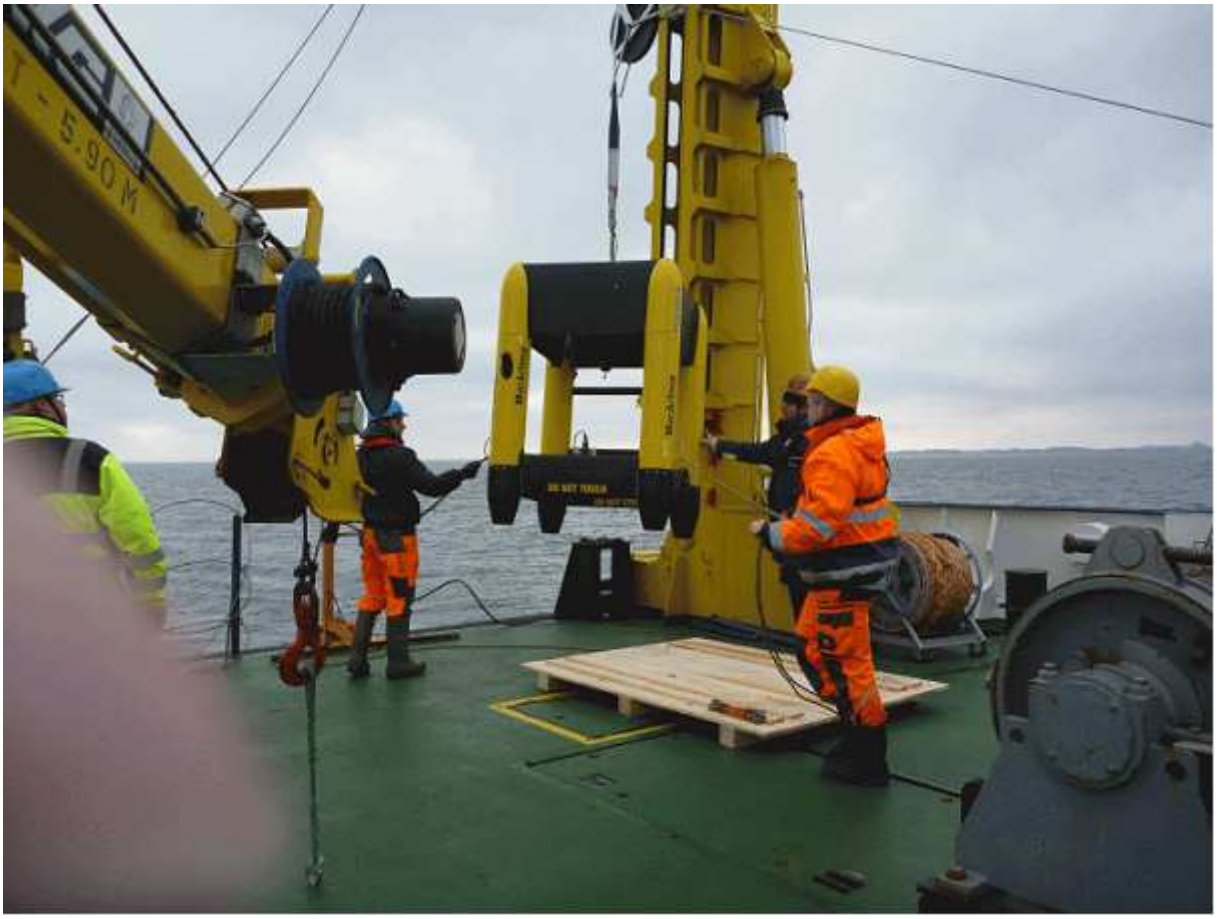

Figure 3: FOCUS2 Towed Body.

11. General remarks and preliminary result

The circular hydrophone array has been calibrated with respect to directivity and frequency using a towed sound ITC1007 between 8 kHz and 14 kHz. The directivity calibration uses cross correlation methods between 18 hydrophones and the compass module. The acoustic sound pressure level did not exceed 190 dB re. 1 uPa. The results are not intended to be published.

Calibration of circular hydrophone array was successfully performed on 01st May. This can be clearly seen in the course plot of this day, which is different to the other ones. The hydrophone array was deployed (drifting) and the vessel towed the sound source on passing courses, not exceeding distances that the sound source cannot be received by the hydrophone array.

The handling tests with the towed body were succesfully conducted the other four days. The four low light cameras (b/w) gave a clear view down to a depth of approximately 100 m at daylight without the use of extra under water lamps.

This was the case at clear daylight and no clouds. The brightness decreased rapidly in the afternoon. Neither fish nor mammals could be observed, only jelly fish in the approximately uppermost 30 m.

The FOCUS2 can be towed at a programmable fixed depth. For future experiments it is very important to know the “cable neutral point”, the depth at that the FOCUS2 “sails” only because of its negative buoyancy without using its flaps. This depth depends on the payload, the towing speed and the cable length. The payload could not be varied during this cruise, but the cable length and the towing speed were varied.

The dependency of the “cable neutral point” is shown in figure 4.

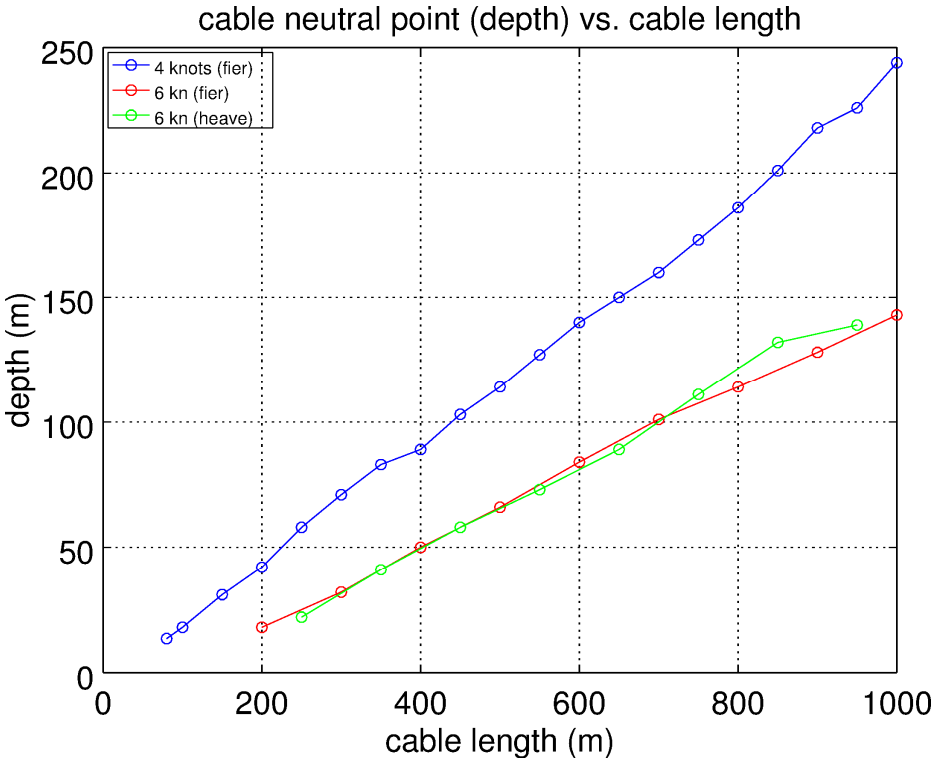

Figure 4: Towing depth as a function of towing speed and cable length.

Appendix: map and list of stations

Ten CTD measurements were contucted from 28th April to 02nd May, two measurements each day at nearly the same position. The nearly identical profiles are shown in figure 5. Exact times and places of the measurements are:

01 : UTC 07:10:22 28-APR-17 GPS: 61 08.8837N 5 57.1210E

02 : UTC 14:23:50 28-APR-17 GPS: 61 08.8905N 5 58.4429E

03 : UTC 05:45:59 29-APR-17 GPS: 61 09.0349N 5 57.9791E

04 : UTC 15:58:42 29-APR-17 GPS: 61 08.9352N 5 57.8540E

05 : UTC 06:21:42 30-APR-17 GPS: 61 09.0659N 5 59.1197E

06 : UTC 13:36:11 30-APR-17 GPS: 61 08.7702N 6 00.3171E

07 : UTC 06:22:26 01-MAI-17 GPS: 61 08.8287N 5 58.5604E

08 : UTC 13:54:15 01-MAI-17 GPS: 61 09.0521N 5 58.3968E

09 : UTC 06:30:14 02-MAI-17 GPS: 61 08.9249N 5 58.5106E

10 : UTC 12:38:32 02-MAI-17 GPS: 61 09.2825N 5 58.1802E

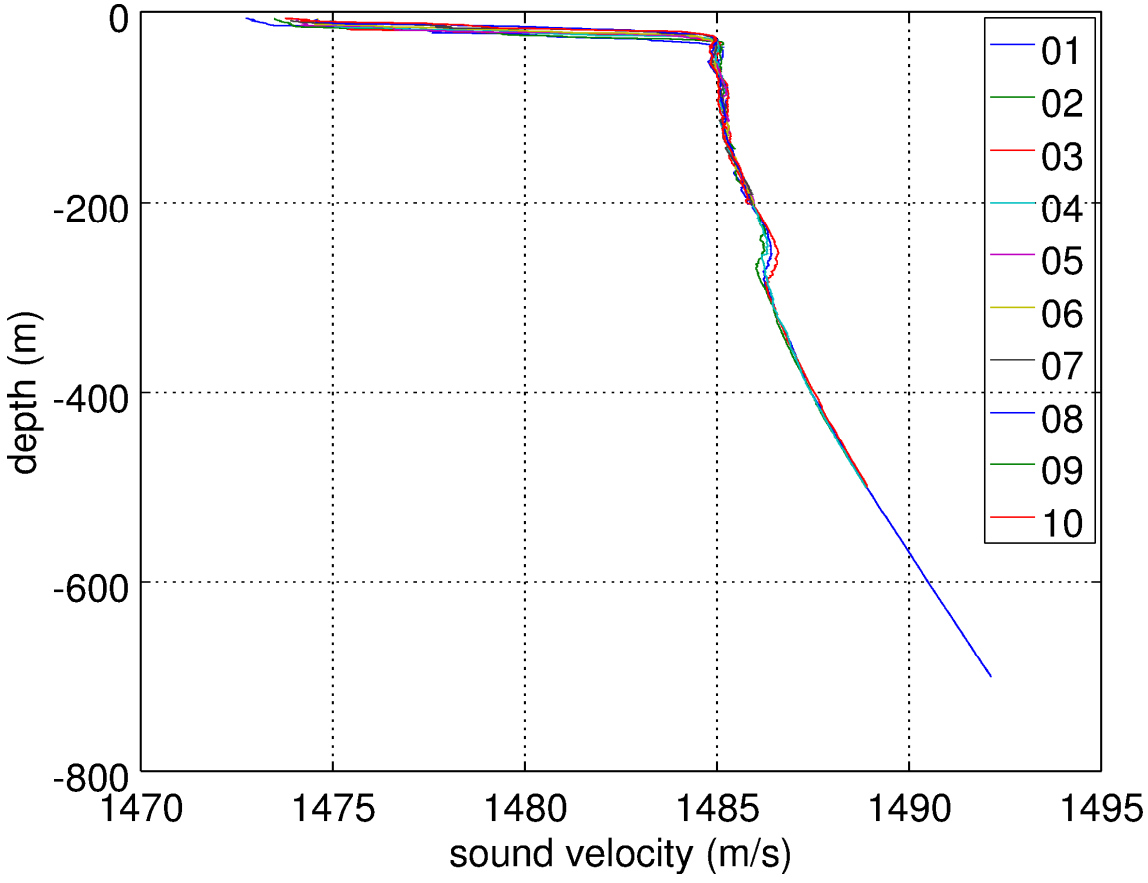

Figure 5: The 10 sound velocity profiles.

The course plots from 28th April until 02nd May are shown in figures 6a to 6e.

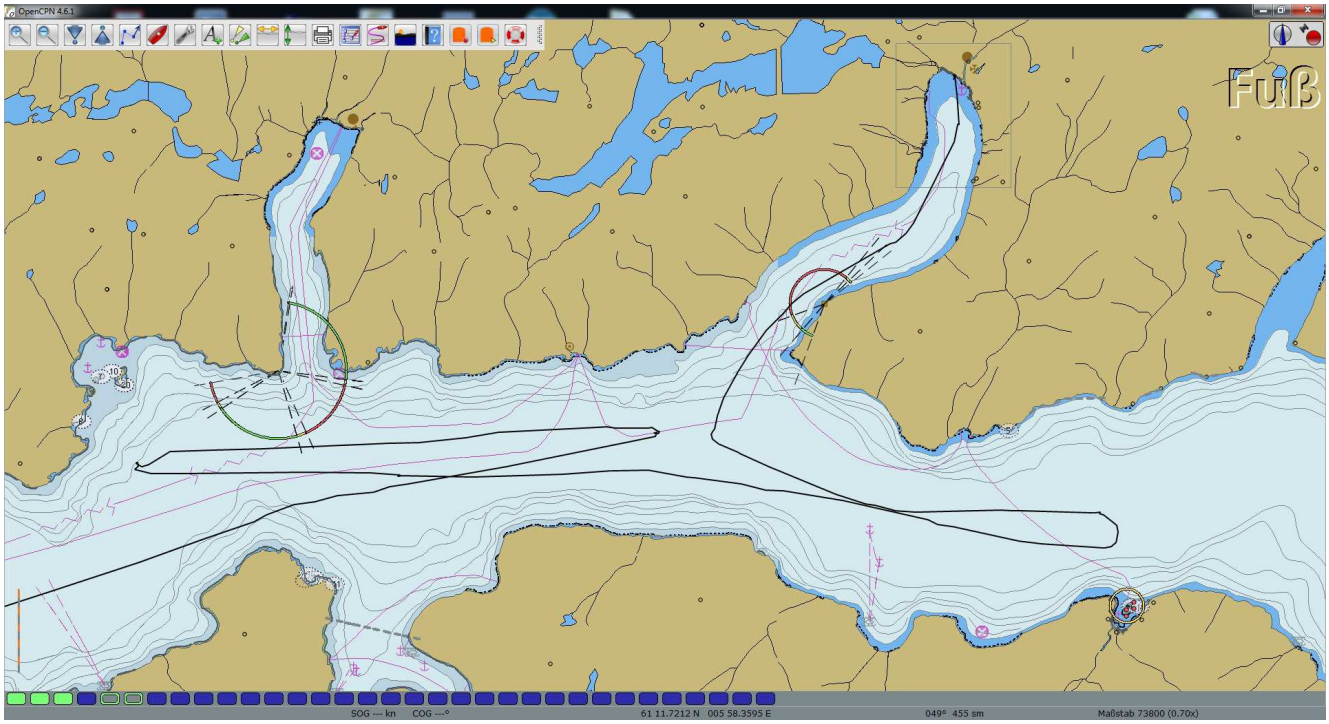

Figure 6a: Course plot of 28th April.

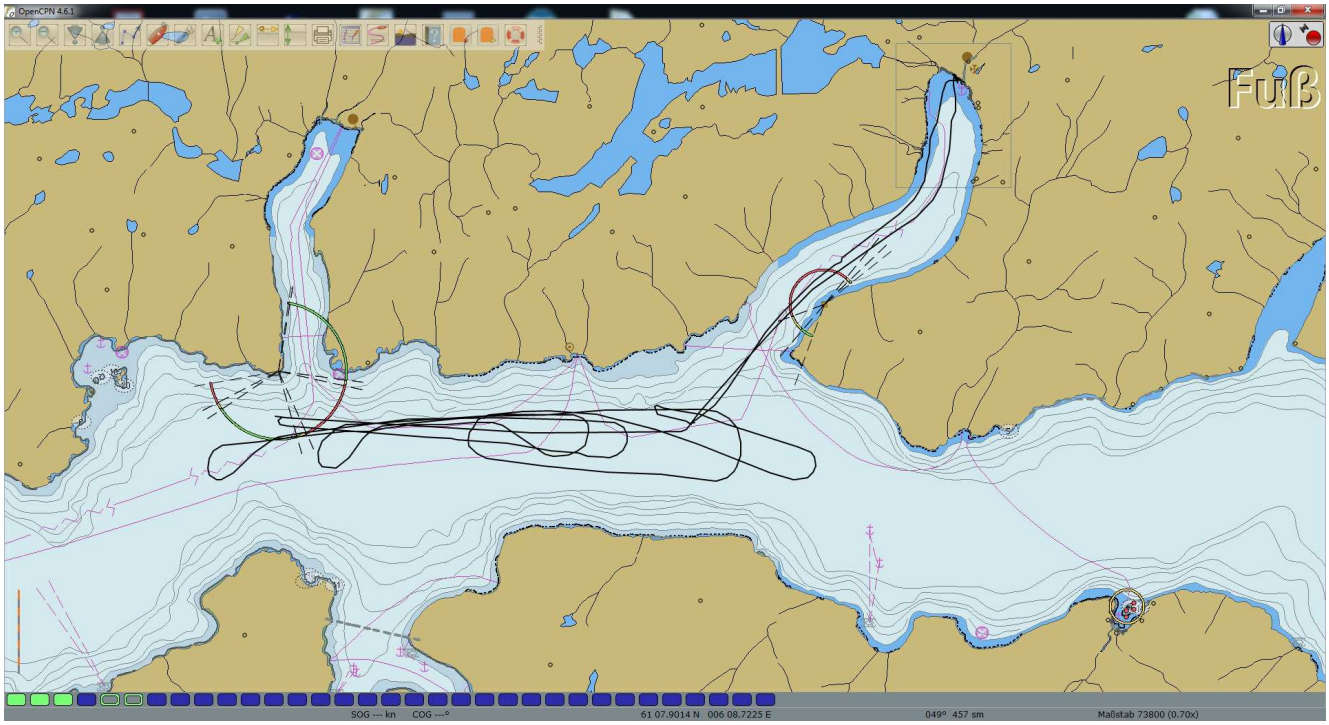

Figure 6b: Course plot of 29th April.

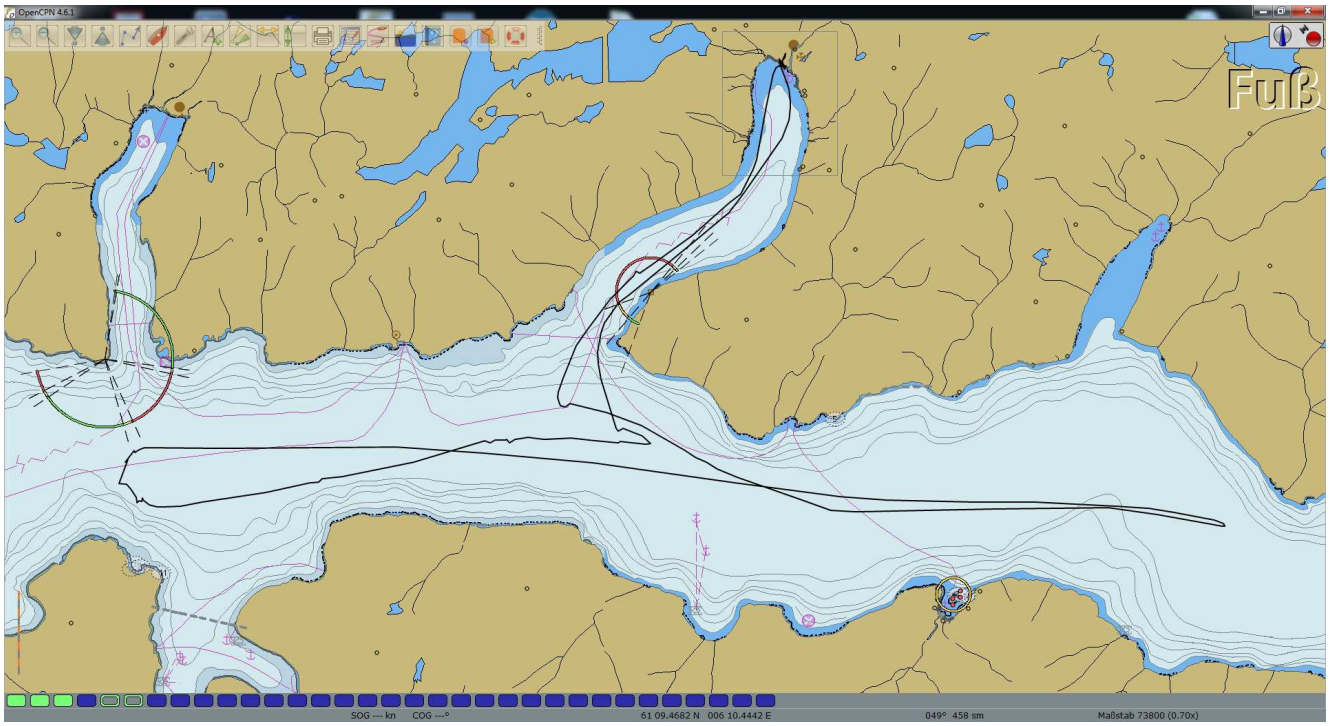

Figure 6c: Course plot of 30th April.

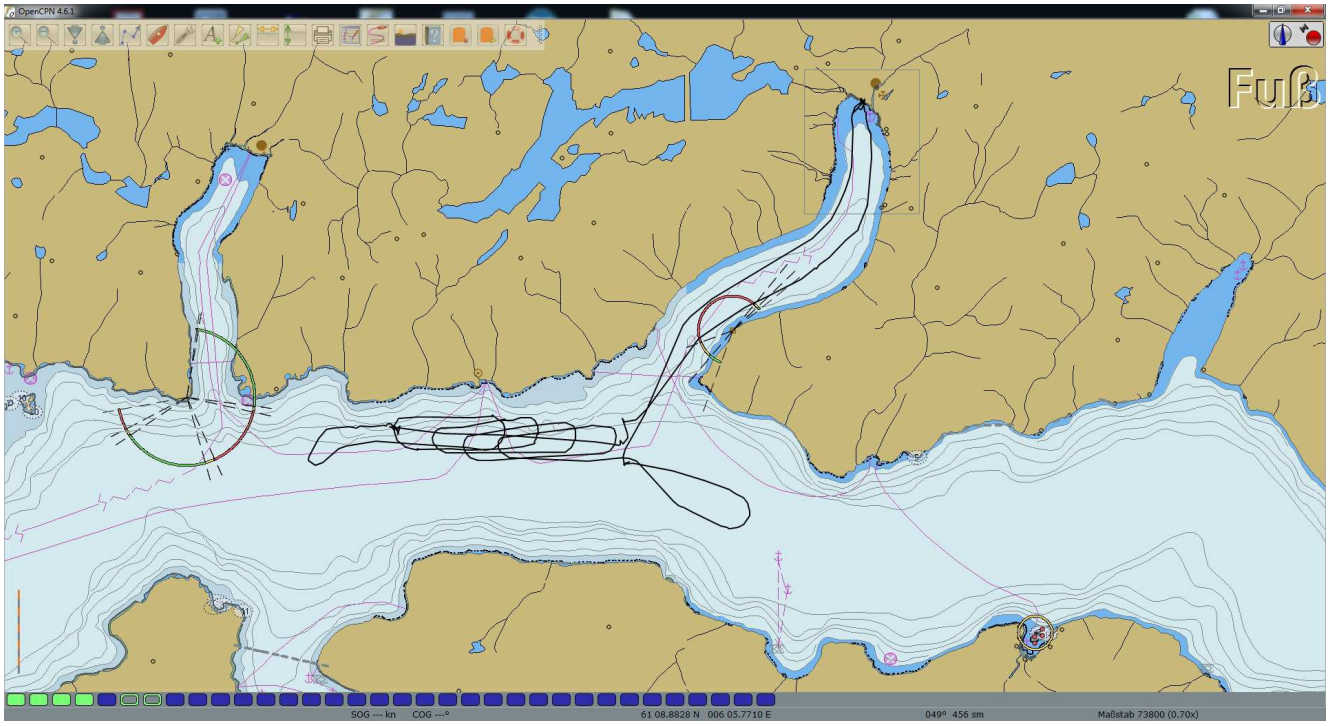

Figure 6d: Course plot of 01st May.

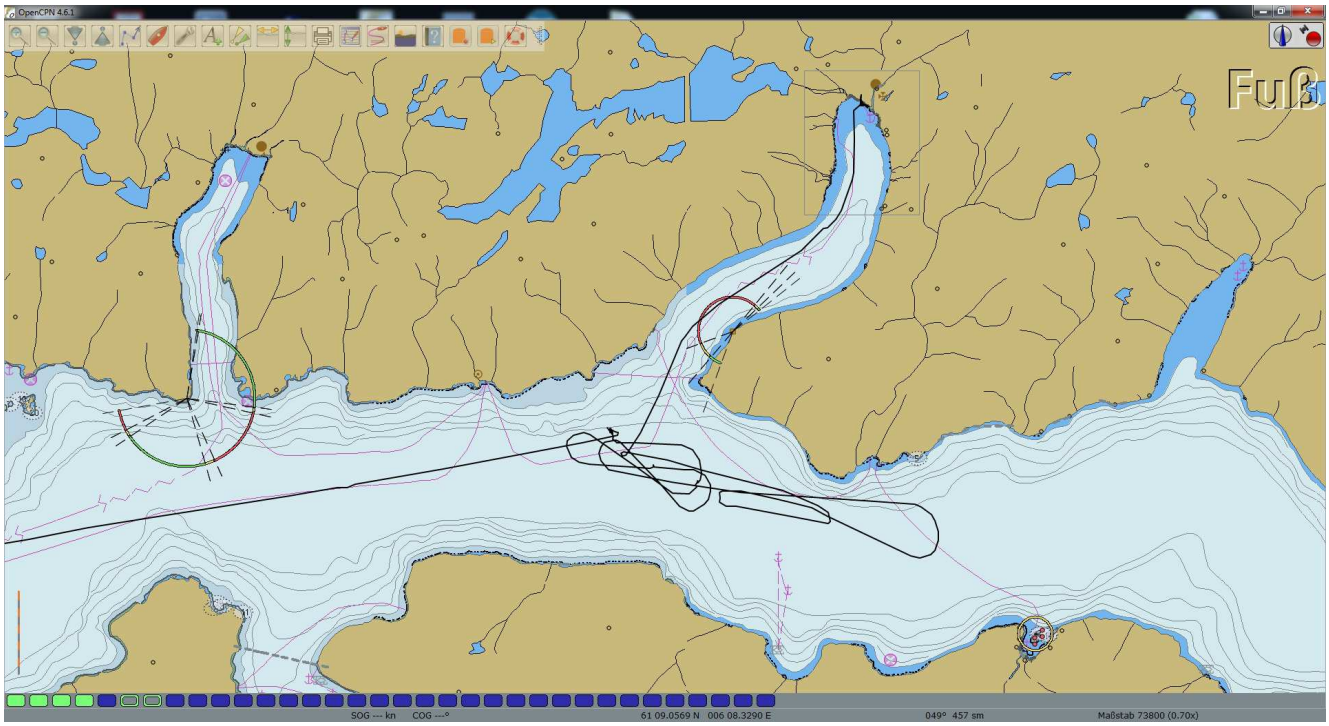

Figure 6e: Course plot of 02nd May.