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# Marine Mammals Tracking - MMT

## Processing and Delivery report

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## 1 Introduction

In January 2018, two Ross seals (*Ommatophoca rossii*) were equipped with ARGOS Platform Transmitter Terminals (PTTs) during the RV “Polarstern” cruise PS111 (ANT-XXXIII/2) in the southern Atlantic Ocean / Eastern Weddell Sea. Additionally, five Weddell seals (*Leptonychotes weddellii*) were equipped in February in the Weddell Sea. The ARGOS satellite system provides positioning information during transmission and enables the download of different processing-level products via their web-interface.

Two types of PTTs were used:

- SPLASH-PTTs were used for the two Ross seals. They are capable of measure various dive activities like duration and depths, the temperature at defined depth levels and the general immersion time of the sensors.
- SPOT-PTTs were used for the five Weddell seals. They deliver less detailed information on the dive activities like the time the sensors were immersed and the temperature of different time intervals.

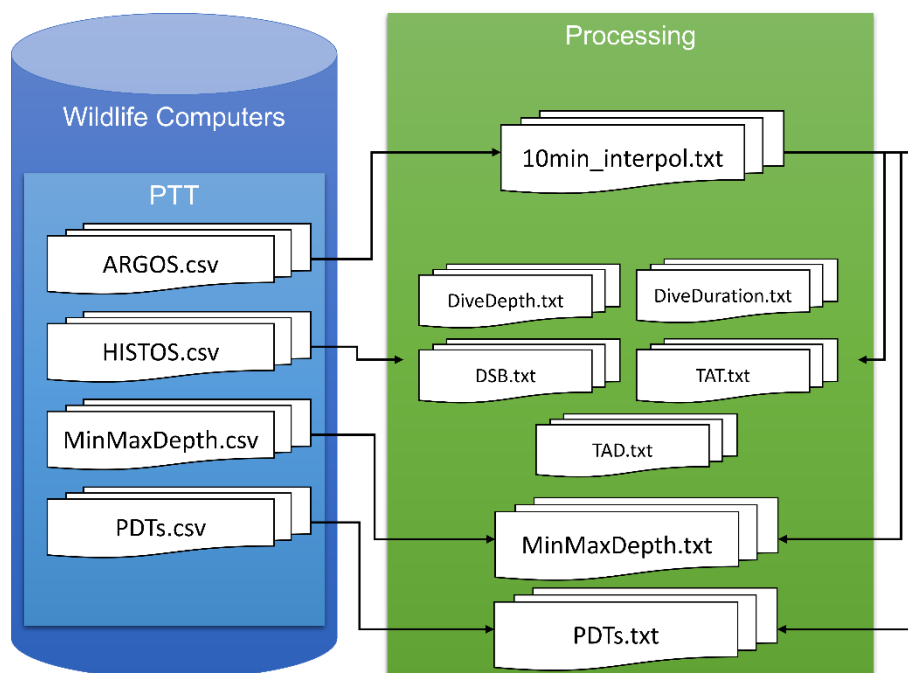
## 2 Workflow

### 2.1 Data retrieval

The data were downloaded from the website (<https://wildlifecomputers.com/>) as CSV-Files for each PTT separately. Due to a change of the program affiliation of the used transmitters on 30 June 2018 by the PI, there has been a break in the datasets. That made it necessary to merge the new incoming data together with the “old” datasets before further processing.

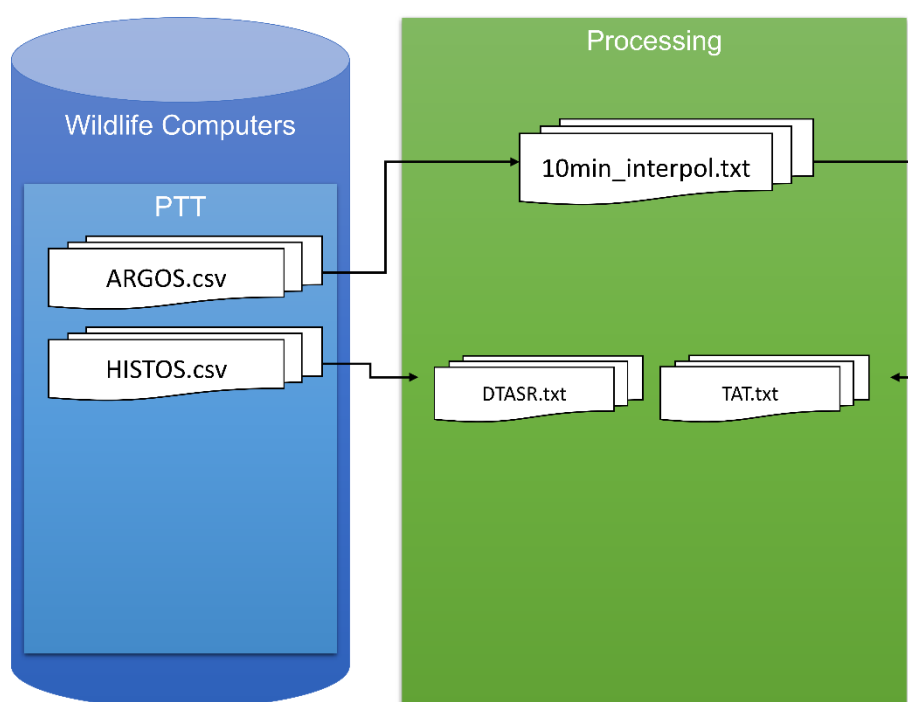
## 2.2 Data processing

For the processing of the SPLASH-PTTs, the information is extracted from the files *Argos.csv*, *Histos.csv*, *MinMaxDepth.csv* and *PDTs.csv*. The workflow is presented in Figure 1.



**Figure 1: Workflow of the SPLASH-PTT Processing**

For the processing of the SPOT-PTTs, only the files *Argos.csv* and *Histos.csv* are used. The workflow is presented in Figure 2.



**Figure 2: Workflow of the SPOT-PTT Processing**



The datasets of each PTT were excised according to provided starting date/time after the anesthesia of the animals and subsequent fitting of the instruments. The following dates/times provided by the PIs determined the start of valid data (Table 1).

**Table 1:** Start date/time for the used PTTs

<b>Event label</b>	<b>PTT</b>	<b>Start DateTime (ISO 8601)</b>
PS1112018_ros_a_f_01	35941	2018-01-28T17:52:27
PS1112018_ros_a_m_02	35940	2018-01-31T23:00:00
FIL2018_wed_a_f_01	164433	2018-02-13T16:45:00
FIL2018_wed_a_f_02	164431	2018-02-22T17:10:00
FIL2018_wed_a_f_03	164434	2018-02-21T18:10:00
FIL2018_wed_a_f_04	164432	2018-02-23T17:45:00
FIL2018_wed_a_m_05	164436	2018-02-24T11:50:00



## 3 Processing Report

### 3.1 File description

Table 2: Description of the delivered PANGAEA files

File	Description	columns
Argos.txt	Received positions and their quality	1. Event label 2. Date/Time 3. Latitude 4. Longitude 5. Pos type
DiveDepth.txt	Dive, differentiated by depth	1. Event label 2. Date/Time 3. Latitude 4. Longitude 5. Depth, water [m] 6. DDF [#] 7. Pos type
DiveDuration.txt	Dive, differentiated by duration	1. Event label 2. Date/Time 3. Latitude 4. Longitude 5. Depth, water [m] 6. DDF [#] 7. Pos type
DMD.txt	maximum diving depths	1. Event label 2. Date/Time 3. Latitude 4. Longitude 5. DMD [m] 6. Pos type
DSB.txt	Dives, at surface behavior	1. Event label 2. Date/Time 3. Latitude 4. Longitude 5. DSB 6. Pos type
DTASR.txt	Dives, time at surface, relative	1. Event label 2. Date/Time 3. Latitude 4. Longitude 5. DTASR [%] 1. Pos type
TAT.txt	Dive times, differentiated by temperature	2. Event label 3. Date/Time 4. Latitude 5. Longitude 6. DTR [°C] 7. DTT [min] 8. Pos type



File	Description	columns
TAD.txt	Dive times, differentiated by depth	1. Event label 2. Date/Time 3. Latitude 4. Longitude 5. Depth water [m] 6. TEMP [°C] MIN 7. TEMP [°C] MAX 8. Pos type
PDTs.txt	Minimum and maximum temperatures according to depth	1. Event label 2. Date/Time 3. Latitude 4. Longitude 5. Depth water [m] 6. TEMP [°C] MIN 7. TEMP [°C] MAX 8. Pos type

### 3.2 Received positions and their quality

A total number of 29211 messages was received and written to the file *Argos.txt*. The average lifetime of the seven PTTs was 230 days (ranging from 141 to 286 days). The average amount of messages per day was 20.87. Table 3 gives a summary of all processed data. Detailed maps and histograms of the location accuracies of the received messages are provided in the appendix (chapter 4.2 and 4.3 ).

**Table 3:** Summary of the processed PTTs

Event label	First DateTime	Last DateTime	lifetime (days)	messages
PS1112018_ros_a_f_01	28.01.2018 17:52	07.07.2018 09:59	160	5724
PS1112018_ros_a_m_02	31.01.2018 23:13	21.06.2018 18:30	141	6446
FIL2018_wed_a_f_01	13.02.2018 16:50	22.11.2018 20:14	283	4737
FIL2018_wed_a_f_02	22.02.2018 18:40	23.10.2018 21:06	244	2785
FIL2018_wed_a_f_03	22.02.2018 19:43	05.12.2018 07:28	286	3185
FIL2018_wed_a_f_04	23.02.2018 19:30	25.11.2018 11:24	275	3724
FIL2018_wed_a_m_05	24.02.2018 12:42	03.10.2018 22:38	222	2610

Since there is not always a valid location for each time data are recorded within the sensor, the locations are linearly interpolated to a 10-Minute resolution. The assignment of the positions for the respective periods took place according to the following rules:

1. If there is a real position in the period, it will be used. Otherwise, the interpolated position of the middle of the time period is added (e.g. 00:00 to 01:00 AM – the interpolated position at 00:30 will be used)
2. If there is more than one valid position within the time period, the one with the better location accuracy will be used.



3. If there are more than one valid position within the time period with the same location accuracy, the one closer to the middle of the time period is used.

### 3.3 Dive, differentiated by depth

In the file *DiveDepth.txt*, the number of dives down to certain (predetermined) depth ranges (14 bins: 5 to >600 meters) is recorded. The Table 4 shows the number of entries per Ross seal.

**Table 4:** Entries of the file *DiveDepth.txt*

Event label	PTT	entries
PS1112018_ros_a_f_01	35941	3154
PS1112018_ros_a_m_02	35940	3965

### 3.4 Dive, differentiated by duration

In the file *DiveDuration.txt*, the number of dives for certain dive time ranges (14 bins: 0.5 to >30 Minutes) is counted.

**Table 5:** Entries of the file *DiveDuration.txt*

Event label	PTT	entries
PS1112018_ros_a_f_01	35941	3472
PS1112018_ros_a_m_02	35940	4312

### 3.5 maximum diving depths

From the file *MinMaxDepth.csv*, only the entry for the maximum depth in every 4-hour interval is used and written to the output file *DMD.txt*.

**Table 6:** Entries of the file *DMD.txt*

Event label	PTT	entries
PS1112018_ros_a_f_01	35941	930
PS1112018_ros_a_m_02	35940	818

### 3.6 Dives, at surface behavior

In the file *DSB.txt*, the information whether the tag was dry or wet (dry=0 / wet=1) is saved in a 1-hour interval.

**Table 7:** Entries of the file *DSB.txt*

Event label	PTT	entries
PS1112018_ros_a_f_01	35941	2693
PS1112018_ros_a_m_02	35940	3618





### 3.7 Dives, time at surface, relative

The file *DTASR.txt* includes only data from the SPOT tags. It records the percentage of time (of every hour of the day), the tag was dry (i.e. hauled out). This is done by a seawater conductivity sensor. The Table 8 shows the number of entries per animal.

**Table 8:** Entries of the file *DTASR.txt*

Event label	PTT	entries
FIL2018_wed_a_f_01	164433	4944
FIL2018_wed_a_f_02	164431	3576
FIL2018_wed_a_f_03	164434	4781
FIL2018_wed_a_f_04	164432	3984
FIL2018_wed_a_m_05	164436	3324

### 3.8 Dive times, differentiated by temperature

Both PTT types are capable of measuring the temperature. In the file *TAT.txt*, the time spent at certain temperature ranges (bin ranges) is recorded. The SPLASH tags distinguish 14 bins, the SPOT tags 12 bins. The percentage values given in the *Histos.csv* files are converted to minutes of the 4-hour time period. The Table 9 shows the number of entries per animal.

**Table 9:** Entries of the file *TAT.txt*

Event label	PTT	entries
PS1112018_ros_a_f_01	35941	3332
PS1112018_ros_a_m_02	35940	4172
FIL2018_wed_a_f_01	164433	15564
FIL2018_wed_a_f_02	164431	10284
FIL2018_wed_a_f_03	164434	13416
FIL2018_wed_a_f_04	164432	13164
FIL2018_wed_a_m_05	164436	10092

### 3.9 Dive times, differentiated by depth

In this file, the time of dives spent in certain depth ranges (12 bins: 5 to 500 meters) is recorded. The percentage values given in the *Histos.csv* files are converted to minutes of the 4-hour time period. The Table 10 shows the number of entries per Ross seal.

**Table 10:** Entries of the file *TAD.txt*

Event label	PTT	entries
PS1112018_ros_a_f_01	35941	3110
PS1112018_ros_a_m_02	35940	3796



### 3.10 Minimum and maximum temperatures according to depth

In the file *PDT.txt*, the information of the minimum and maximum temperature at different depth ranges is stored (comparable with a CTD without measuring conductivity).

**Table 11:** Entries of the file *PDTs.txt*

Event label	PTT	entries
PS1112018_ros_a_f_01	35941	1616
PS1112018_ros_a_m_02	35940	2345

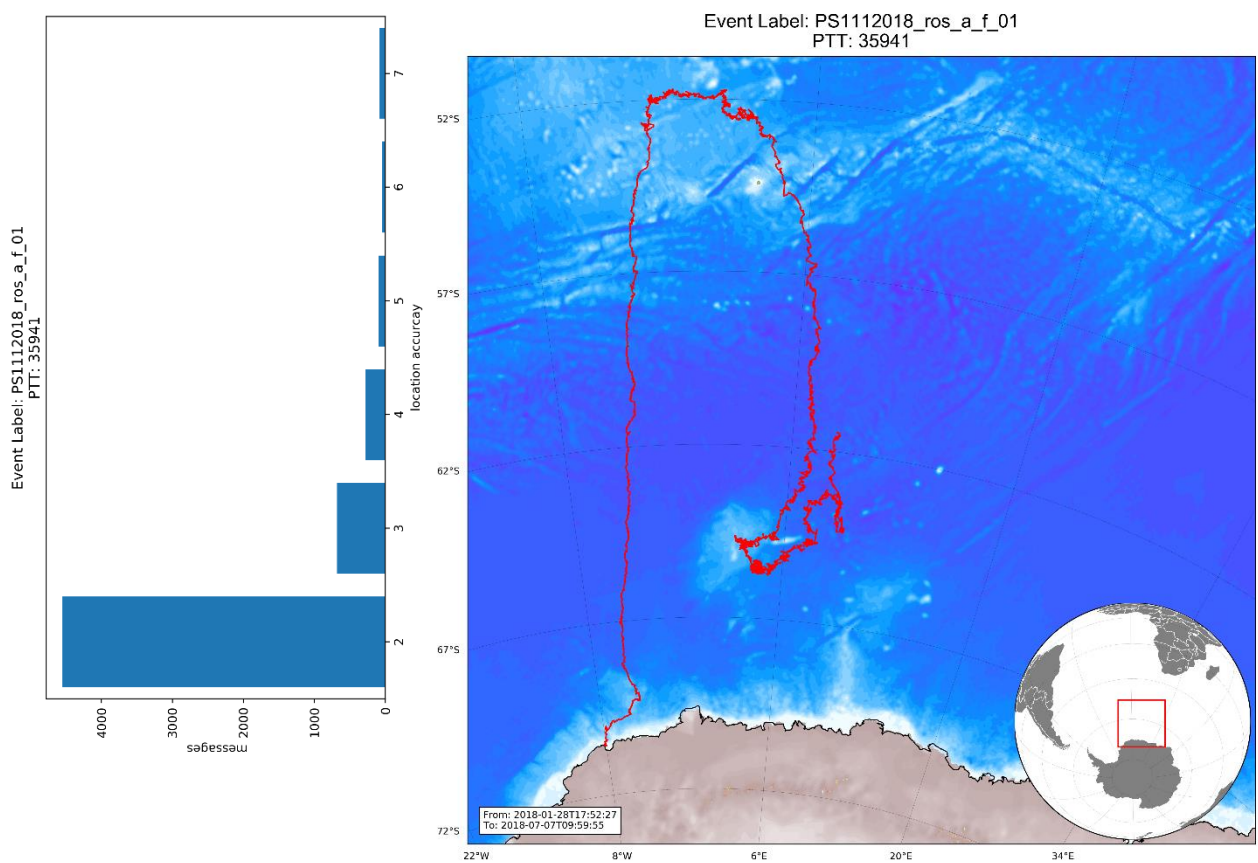
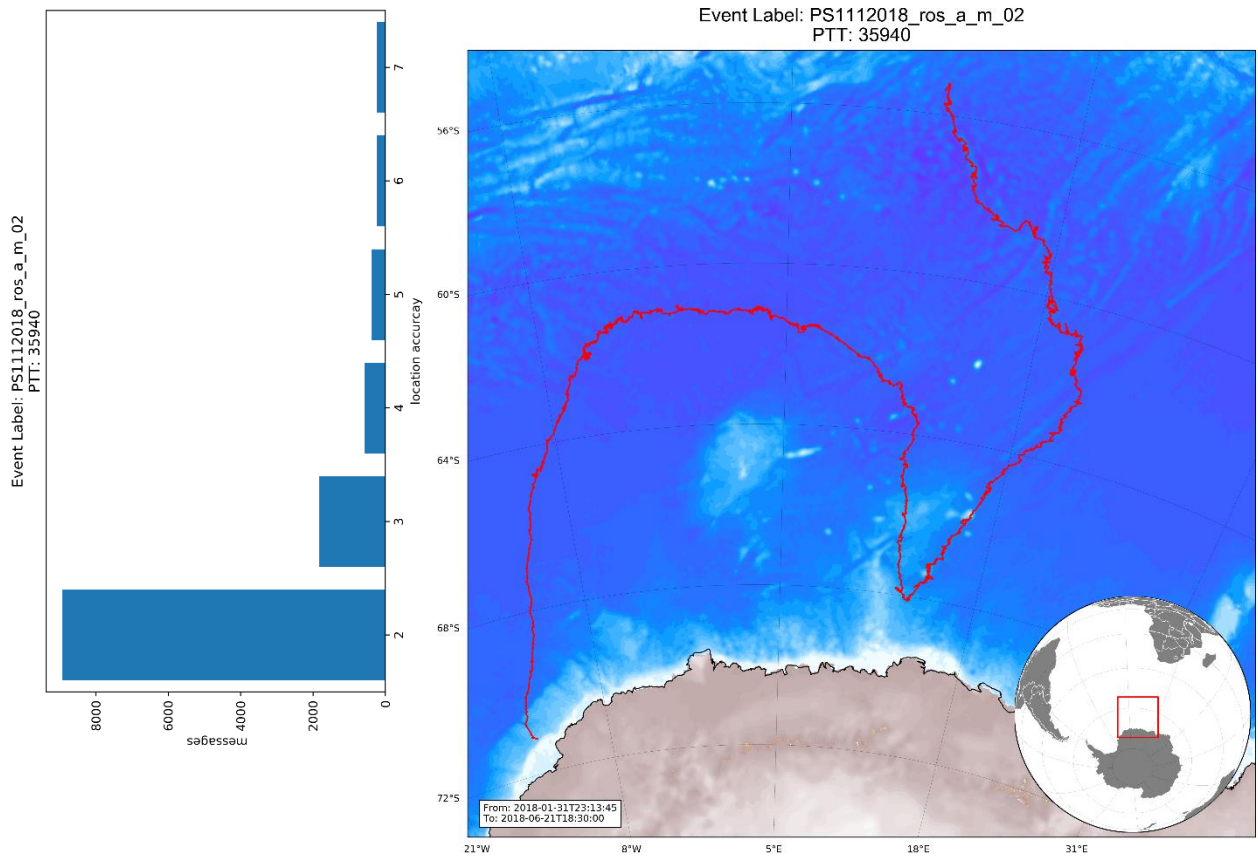
## 4 Appendix

### 4.1 Location accuracy classes

ARGOS location class	PANGAEA location accuracy	Description
	1	Interpolated position
B	2	No estimate of location accuracy
A	3	No estimate of location accuracy
0	4	Estimated location accuracy > 1000 m
1	5	Estimated location accuracy 350 – 1000 m
2	6	Estimated location accuracy 150 – 350 m
3	7	Estimated location accuracy < 150 m

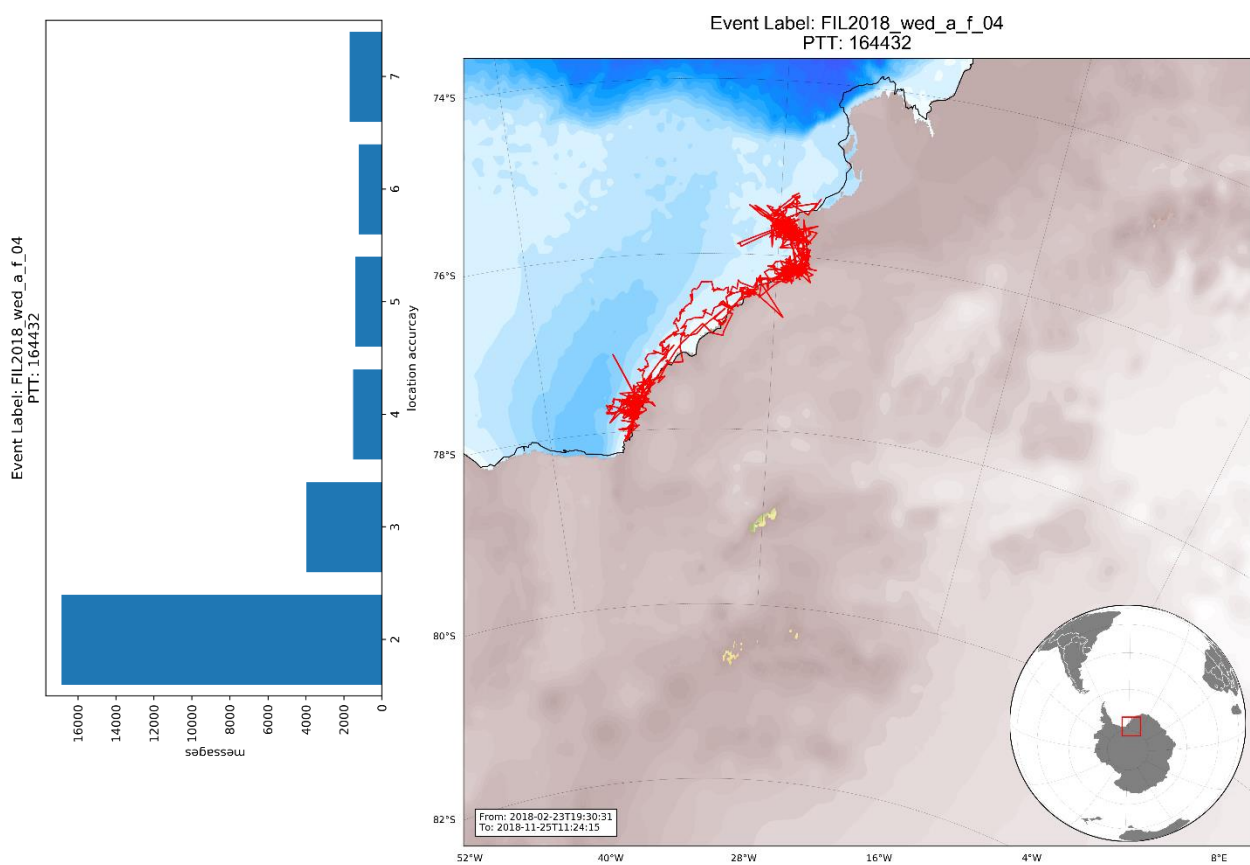
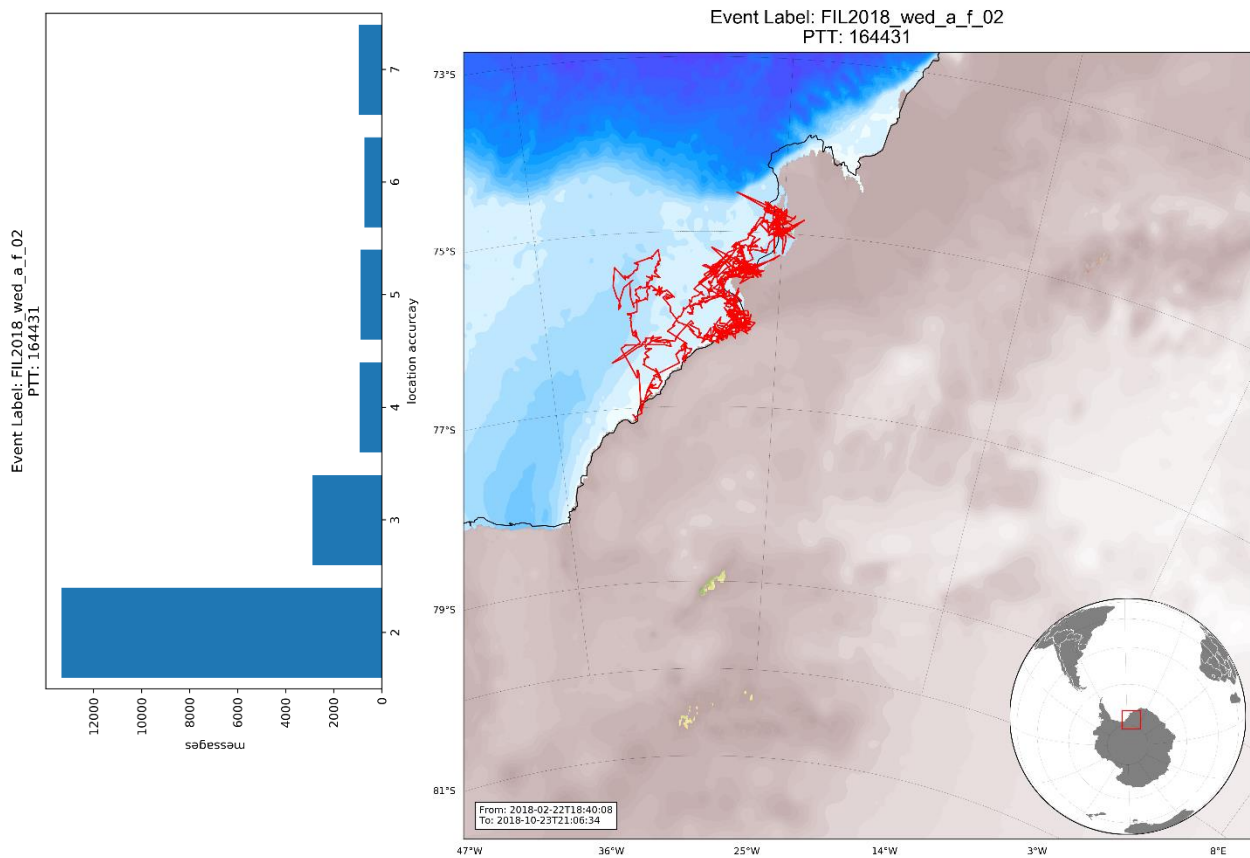


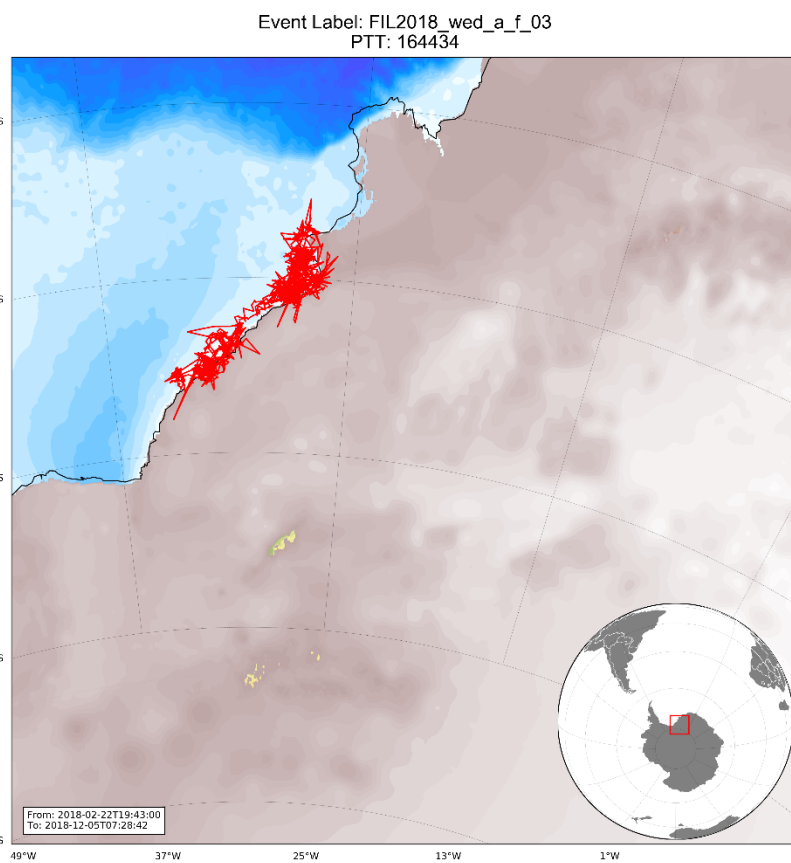
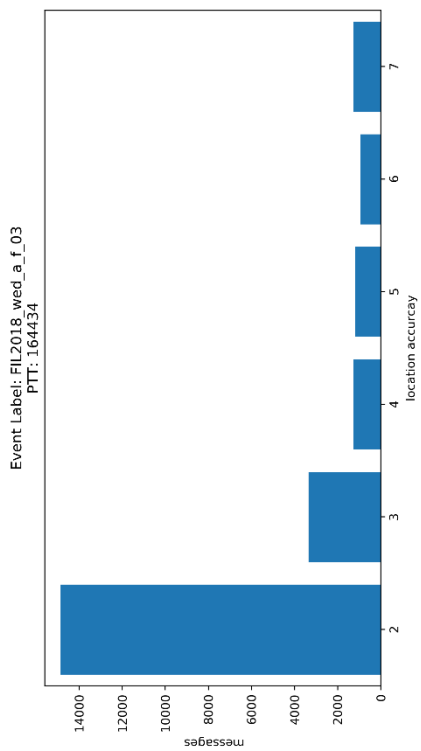
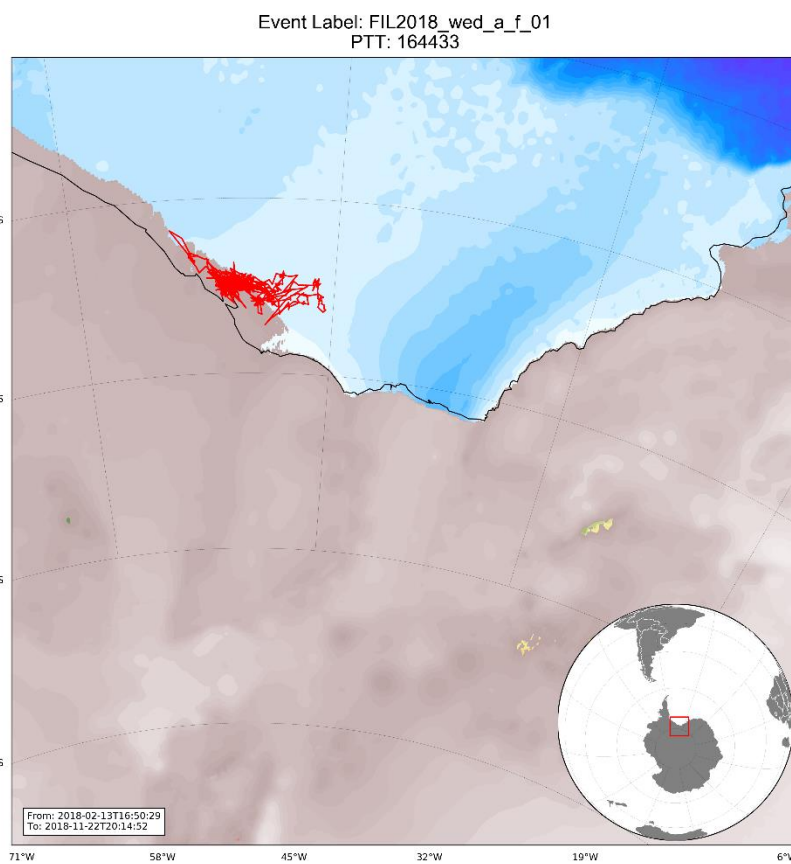
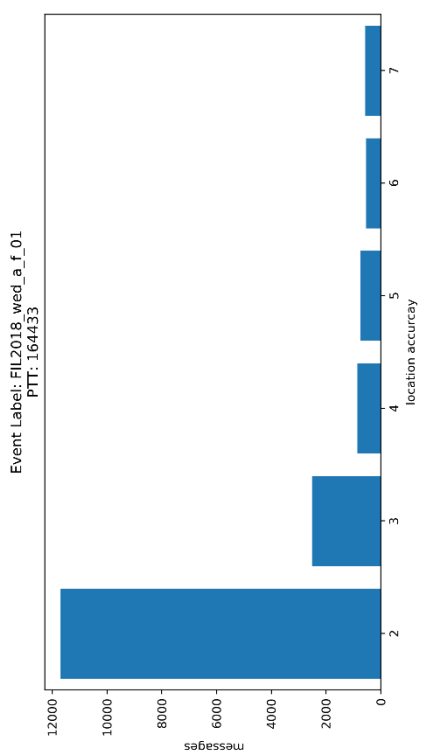
## 4.2 Maps and histograms of processed Ross seals





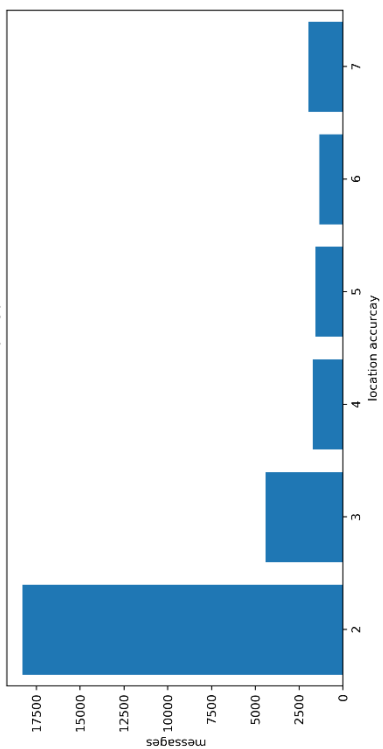
### 4.3 Maps and histograms of processed Weddell seals







Event Label: FIL2018\_wed\_a\_m\_05  
PTT: 164436



Event Label: FIL2018\_wed\_a\_m\_05  
PTT: 164436

