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TIME SERIES

Time series data are a unique way to collect detailed readings of the depth, temperature, and/or activity experienced by the tag, and package those data into a form that can be transmitted via Argos. Each time series is defined by two parameters:

1. Sampling interval (75, 150, 300, 450, 600 seconds).
2. Summary period (1, 2, 4, 6, or 8 hours).

The summary period is automatically derived after you choose the sampling interval and is based on the amount of data that can fit into one Argos message. Within each summary period the data are split into the corresponding sampling intervals (e.g. 75-second intervals for a 1-hour summary period). For example, in a 1-hour summary period, the tag records the minimum and maximum values visited during that 1-hour period—this sets the “Series Range.” This range is then split into 16 steps, which define the resolution of the values being reported. The measured value (plus error) is reported every 75 seconds.

The sampling intervals and corresponding summary periods are used to reduce the bandwidth required to transmit these messages and allow us to use special encoding techniques in order to pack more information into each Argos message. The time series sampling interval is completely independent and unrelated to the archive sample rate.

Depth Time Series

For the Depth Time Series, the tag records depth (m) at the given sampling interval at a resolution determined by the min and max depths visited during the summary period. This resolution is derived by splitting the depth range visited during the summary period into 16 steps. Using the Depth Range for each summary period provides a higher resolution (steps that are closer together) when the range is small, while still accounting for variable behavior when the Depth Range is large (steps farther apart). The min/max values for each summary period are reported in the “Series Range.csv” file and the actual time series data (e.g. depth every 75 seconds) are reported in the “Series.csv” file.

Tags Containing This Data Product

SPLASH10
MiniPAT
sPAT (5 days only)

Temperature Time Series

Temperature Time Series is set up exactly the same as the Depth Time Series, but with temperatures (°C) being reported instead of depth.

Tags Containing This Data Product

SPLASH10
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TIME SERIES – CONTINUED

Activity Time Series

Activity Time Series (ATS) generates similar messages to the Depth and Temperature data described above. The summary periods and sampling intervals are the same as above, but the bins are populated with a count of “active events” instead of recorded depths or temperatures that were visited during the sampling interval.

This data product is designed to provide a transmittable metric of activity and is derived from a filtered proxy of ODBA using accelerometer data sampled at 10Hz. “Active Events” are counted if the movement of the animal is above the “normal” range as measured over the summary period (i.e. values that occur in the tail of the data distribution). Summary data (mean and Standard Deviation) of activity during each summary period are transmitted with each message. These summaries provide insight into the baseline activity level during each summary period so that activity may be compared over the entire deployment period.

Active events are counted if the movement of the tag/animal (mobility) is above the normal range as measured over the summary period (1 to 8 hours). After release from the animal, the tag will calculate the standard deviation of each accelerometer axis (X, Y, Z) over a 3 second sliding window. We then calculate “mobility,” which is the per second mean of all three axes:

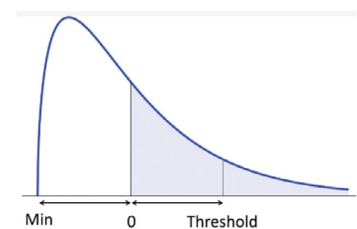
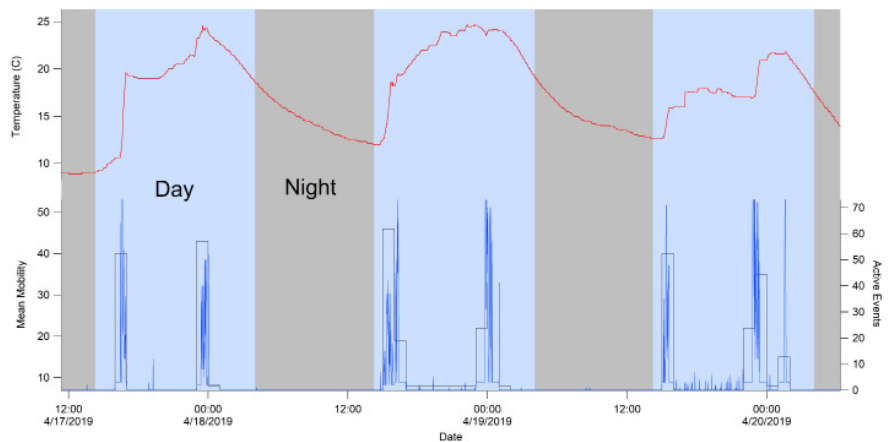
$$\frac{SD(Ax_i) + SD(Ay_i) + SD(Az_i)}{3}$$

The mobility vector is essentially a filtered proxy for ODBA. Next, we center the mobility vector on 0 by subtracting the mean. Mobility is a right skewed Gaussian distribution so by centering the mean at 0 we can identify outliers in the tail. We define outliers using the absolute value of the minimum mobility value in the 0-centered vector. Any mobility value greater than the threshold (found in the upper tail of the distribution) is counted as an active event. Thus, the threshold to determine an outlier and “high activity” is adaptable, very sensitive, and will adjust with each summary period. For more details see [Skubel et al 2020](#).

Depth Time Series must be turned on to enable ATS. When ATS is enabled, MiniPAT deployment duration is limited to 96 days.

Tags Containing This Data Product

MiniPAT



TIME SERIES – CONTINUED

Transmitted Data

Forty-eight records of time series data will fit into one Argos message. This means that the number of messages you generate increases dramatically based on the sampling interval and the number of time series you are collecting. For example, 12 time series messages are created per day if both Depth and Temperature data are sampled every five minutes (4-hr summary period). If you are collecting Depth, Temperature, and Activity time series data, this number increases rapidly. Shorter sampling intervals will require more Argos messages for transmission. This could result in an amazing, high-resolution time series dataset, but may also end up with gaps if not all messages are received.

Archived Data

Depth, Temperature, and Activity are archived at 1Hz. If you recover a MiniPAT with these time series enabled, you will also see the 1 Hz Mobility, along with the 1 Hz accelerometer data from the Z-axis only. Accelerometer data are NOT archived at 10 Hz so you cannot re-create ATS from a MiniPat archive.

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