Zimbra **alana@mbari.org**

Re: cable density

From : Denis Klimov <klimov@mbari.org> Tue, Apr 02, 2024 05:47 PM
Subject : Re: cable density
To : Aaron Micallef <amicallef@mbari.org>
Cc : Aaron Schnittger <aschnittger@mbari.org>, Alana Sherman <alana@mbari.org>, Paul McGill <mcgill@mbari.org>
Reply To : Denis Klimov <klimov@mbari.org>

Hi Aaron M,
just a quick memo about the requirement for the desired cable density range **(2.2 - 3 g/cc)** in Alana's email. Following the call with Shawn, we had a quick meeting in Alana's office discussing this (Alana, Aaron S., and myself).

Here was the thinking:
- Lower side of density range **(2.2 g/cc)** was taken from the BEDs project, this was a **density value a number of spheres were made to, to ensure self-burial in the sediment flow on the bottom of the canyon, to at least several meters depth**.
- The higher side of density range **(3 g/cc)** was taken from the article below where the **"average density of the ocean bedrock"** was reported is **2.9 g/cm^3.**

The idea is, the density of the seafloor is inherently variable, since it could be composed from a range of materials and compositions anywhere from a loose silt/ sand / gravel, to their conglomerate, to the solid bedrock. The density of a solid bedrock is likely an upper limit of any natural material the DAS cable could be in contact with, that is why we chose it as an upper limit of the density range. Does this make sense, what do you think?

At any rate, **as Alana described, the density of the cable is not a hard requirement**, but we wanted, nevertheless, to specify the reasonable density range to qualify/ understand the quality of acoustic coupling.

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We analyze the density distribution of marine sediments using density samples taken from 716 drill sites of the Deep Sea Drilling Project (DSDP). The samples taken within the upper stratigraphic layer exhibit a prevailing trend of the decreasing density with the increasing ocean depth (at a rate of −0.05 g/cm^3 per 1 km). Our results confirm findings of published studies that the density nonlinearly increases with the increasing sediment depth due to compaction. We further establish a 3D density model of marine sediments and propose theoretical models of the ocean-sediment and sediment-bedrock density contrasts. The sediment density-depth equation approximates density samples with an average uncertainty of about 10% and better represents the density distribution especially at

deeper sections of basin sediments than a uniform density model. The analysis of DSDP density data also reveals that the average density of marine sediments is 1.70 g/cm^3 and the average density of the ocean bedrock is 2.9 g/cm^3.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3972868/
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This email is not addressed to Shawn, and Paul M. added instead.

cheers,

Denis Klimov

From: "Alana Sherman" <alana@mbari.org>
To: "Shawn Amirehsani" <s.amirehsani@winconn.com>
Cc: "Aaron Schnittger" <aschnittger@mbari.org>, "Aaron Micallef" <amicallef@mbari.org>, "Denis Klimov" <klimov@mbari.org>
Sent: Tuesday, April 2, 2024 3:13:19 PM
Subject: cable density

Hi Shawn
After some discussion, we decided that if we were just designing for an ideal mechanical coupling with marine sediment, the desired cable density would be between 2.2 - 3 gm/cc . However the existing design you showed us at 3.3 gm/cc is fine. At this point in the project, other design parameters such as bend radius and breaking strength are more critical. So please revise the design as we discussed in terms of increasing the breaking strength and depth rating and exterior jacket. We can assess the density at that point, I think it will probably not be a problem.
Thanks
Alana

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