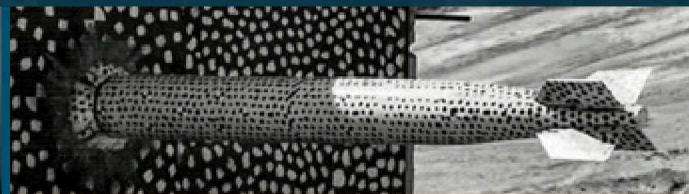


Geophysical Monitoring System (GMS) Using the NDC Forum to Track & Resolve Issues with the “IDC Processing of SHI Data” Document

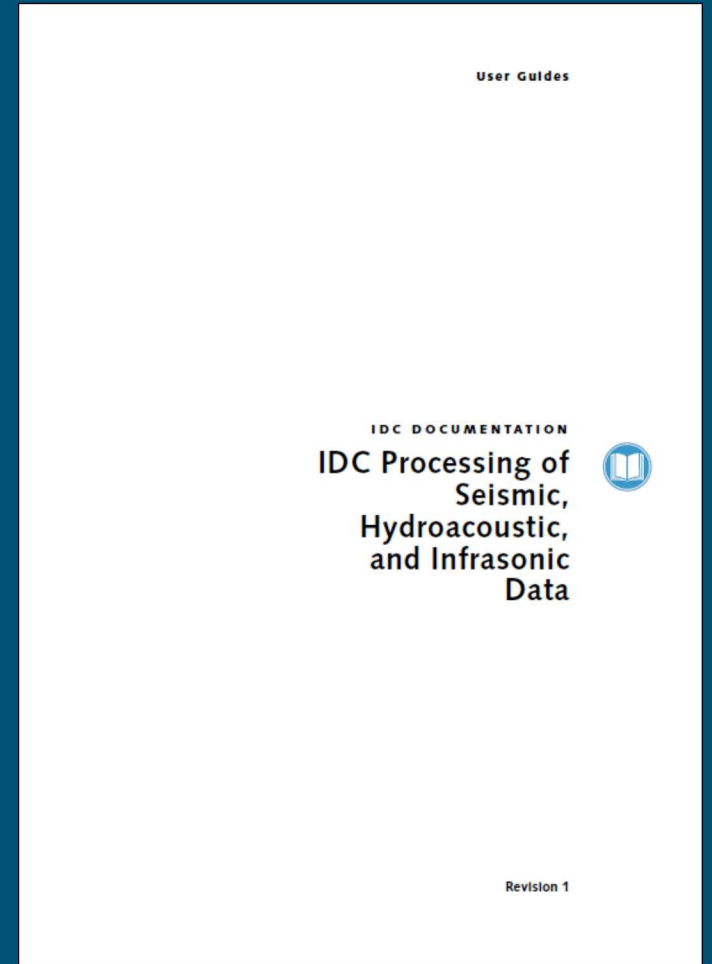


PRESENTED BY

Chris Young

What is This Document & Why Is It Important?

- *This document describes comprehensively and in detail the processing of SHI data by the IDC.*
- *Though the systems have diverged, there is still substantial algorithmic overlap between the USNDC and the IDC.*
- *This is usually our starting point for researching scientific algorithms that will be implemented in the GMS.*
- *The most recent version is from 2002, though most content is from the original version in 1999.*
- *Key assumption: document content = code content.*
- *When this is not true, significantly more SME effort may be required.*



Issues With The Document

Errors

- *Creating this document was a huge undertaking*
- *Many algorithms are complex and highly specialized; some mistakes were made in text and/or equations (only experts reading carefully would be likely to notice)*

Omissions

- *There had to be choices made about what level of detail to include*
- *Some things were left out, particularly specific details about processing (e.g., specific filters applied for a data processing task)*

New Algorithms

- *New calculations have been added to IDC system, some major (e.g., PMCC processing of infrasound)*
- *Few (any?) of these have been added to the document*

Efforts To Track Issues With The Document

Geophysical Monitoring System (GMS) System Development

- *To modernize, minimize re-use of existing code → recode all the algorithms.*
- *Coding algorithms means understanding them completely (every equation) → if there are mistakes, we find them.*
- *Maybe the most comprehensive, detailed review of the document to date??*

WGB Waveform Experts Group (WEG)

- *Chairman has been collecting issues from users and PTS experts over many years.*
- *Many of these seem to be about omissions related to details of processing.*

Collaboration Opportunity

Goals

- *Note issues with the document (all)*
- *Fix document (IDC staff?)*


GMS can benefit from NDC member states knowledge, and IDC can benefit from GMS development




- *How do we facilitate this?*
- *Need a means to make sharing of information easy*
- *Needs to be a good fit for a global set of users (domain experts)*
- *Should be self-guided (i.e. automated, requiring little if any supervision)*
- *Very limited resources available to set up (people, time, \$)*



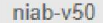



















Solution: Use NDC Forum

- *Document is a “Topic”*
- *Chapters are “Sub-Topics”*

NDC Forum Topic









Uncategorized	8	 released	1 8d
Topics that don't need a category, or don't fit into any other existing category.		 SHI NDC-in-a-Box	 niab-v50
Alpha Tester Groups (ATG)	20	 Authorized Users 2019 Survey	0 16d
Under this category all Alpha Test Groups are available. Usually, Alpha Tests are performed in closed groups and you will only have access to those groups where you are a member.		 Video tutorials on Infrasound Data Processing	8 17d
		 DTK-(G)PMCC	 tutorial
IDC SHI Data Processing Document	13	 Scdfx problem	1 29d
This category is used to track known issues with the IDC SHI Data Processing document IDC_Processing.pdf (9.8 MB) , i.e errors, missing information, unclear descriptions. Forum participants can view the known issues with each Chapter by selecting the appropriate Chapter subcategory. Forum participan...		 "mbsnr" as measure of quality of P-wave amplitude and period measurements	1 Dec '19
 Chapter 2: Seismic Station Processing		 Deltim - estimated measurement error	3 Dec '19
 Chapter 8: Post-Location Processing		 What is mb_tmp?	0 Dec '19
 Chapter 9: Algorithms			
 Chapter 1: Overview			
 Chapter 3: Hydroacoustic Station Processing			
 Chapter 4: Infrasonic Station Processing			
 Chapter 5: Network Processing			
 Chapter 6: Event Location			
 Chapter 7: Analyst Review			
Workshops	39		
 Regional Workshops			
 Infrasound Workshops			

An Example Issue Entry & Discussion


Original issue entry
(author noted),
follows templated
format.

CTBTO





Error in FK calculation equation


■ IDC SHI Data Processing Document ■ Chapter 9: Algorithms

C.YOUNG Nov '19


- Brief Description:** Error in FK calculation equation
- Section/Page:** Frequency-Wavenumber Analysis, page 225, Equation 141.
- Status:** Submitted
- Longer Description:** The $F_l(f)$ term in the numerator should be $X_l(f)$; i.e. the full complex Fourier transform of the l th element, not just the amplitude. It is necessary to include the phase information to combine with the phase information from the wavenumber transforms to get the proper interference of the signal from the different elements.
NOTE: the error is in the equation in the document, not in the implemented code. The IDC software is coded correctly.
- Proposed Solution:** In the numerator, replace $F_l(f)$ with $X_l(f)$.

...  Reply

created

 Nov '19



last reply


 Nov '19


3 replies

14 views

2 users









SARAGIOTIS Nov '19

I agree that the $F_l(f)$ in the numerator should be changed in equation 141 to $X_l(f)$.

The numerator in this equation is the energy of the beam (within a scaling constant) in the frequency domain (due to Parseval's theorem), therefore the summands of the inner sum should be the Fourier transforms of the shifted waveforms (channels of the array). The FT of each of the shifted signals is the FT of the non-shifted signal (that is $X_l(f)$) multiplied by the exponential (that makes for the shift).

☒ Solution     Reply

Reply by another user
(identity noted),
discussing issue.