International Arctic Buoy Programme Usability Study Report HCDE 517A | March 7th, 2023

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Background



International Arctic Buoy Programme (IABP)

20 research and operational institutions from 9 countries

Mission

to maintain a network of automatic data buoys that monitor synoptic-scale fields of sea level pressure, surface air temperature, and ice motion



Background | About the IABP



Background | Goals

Assess the International Arctic Buoy Programme (IABP) website to provide usability recommendations for their upcoming redesign.

Specifically, we investigated:

- The functionality of the *Data* page and the data download experience
- The navigability and discoverability of data sets
- The overall aesthetics and adherence to usability heuristics of the website
- The users of the IABP website and their goals



Figure: IABP Home Page

Background | Recruiting

Website User Breakdown



Research ScientistsMeteorologists

General Public

Ideal Experience Level	
Expert ¹	5
Novice ²	5
Total Participants	10

¹ Expert = has downloaded data from IABP website 3 or more times
 ² Novice = has downloaded data from the IABP website fewer than 3 times

Sent out a screener via email to 40+ research scientists from the following fields:

- Meteorologists
- Oceanographers
- Climatologists
- Geophysicists

We sought students and researchers with differing levels of experience with the IABP website.

7 total participants from a range of scientific fields and student levels



Participants' Scientific Field

- Climatology
- Oceanography
- Geophysics
- Electrical
 Engineering





3 novice users (have used IABP site 2 or fewer times) and

4 expert users (have used IABP site 3 or more times)



Background | Study Methodology

Study Flow

Moderator Introduction

Pre-Test Interview

Task 1

Post-Task 1 Questions

Task 2

Post-Task 2 Questions

Task 3

Post-Task 3 Questions

Post-Test Interview

Post-Test Questionnaire

Scenario

You are a climate scientist performing research where you are studying drift in the **Central Arctic region between 2019 and 2022**, and you heard that the International Arctic Buoy Programme might have some data that you might find useful in your research.

Tasks

Task 1: Find out what data is available for download that would support your research question.

Task 2: Find out if there are currently any buoys in the Central Arctic region and what hardware that buoy has.

Task 3: Select a buoy ID from the list of buoys currently in the Central Arctic and download the data for that buoy.

Findings



Findings | Successes

- Deploys and maintains arctic buoys
- Collects oceanic and meteorological data used for real-time operations and longterm research
- Provides users with highly impactful and invaluable resources
- IABP has been cited in 40 academic papers in the last year
- IABP provides data for weather and sea and ice forecasts used by scientists and meteorologists



Findings | Severity Ratings



Average SUS Score between all seven participants is 50.7 with a standard deviation of 21.6.

Question that most affected the score: I imagine most people would learn to use the IABP website very quickly.



Figures: Average SUS score for all participants in the IABP study plotted in context of percentile rankings of SUS scores (left); SUS score by participant with Sauro's benchmark line of 68 (right)

Findings | Overview

18 total findings within 8 areas

- Data Visualization
- Site Navigation
- Findability
- Limitations
- Discoverability
- Downloading
- Information Architecture
- Help Documentation

Findings highlighted a need to **improve information architecture, organization, communication,** and to add **critical features:**

- download buttons and search capabilities
- filtering on data pages and maps
- bounding on maps
- bulk download

Highlighted Findings

- 1. Lengthy workarounds needed to download and save data
- 2. Lack of **search bar or filtering** capabilities
- 3. Difficulty with map interactivity
- **4.** Participants get lost in the site navigation
- 5. Hardware information not discoverable

The button to download the raw data does not actually save the data, necessitating that users employ lengthy workarounds to get the data in a usable form.

Severity Ranking: 2 (Serious) - creates significant delay and frustration

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			l] International	Arctic Buoy Prog	ramme			
BuoyID Year	Hour		Min	DOY	POS DOY	Lat Lo	on BP	Ts	
300234060321940	2022	02	00	269.0833	269.0833	82.96382	148.91619	1032.70	-0.07
300234060321940	2022	03	00	269.1250	269.1250	82.96293	148.96726	1032.60	-0.06
300234060321940	2022	04	00	269.1667	269.1667	82.96146	149.02660	1032.20	-0.04
300234060321940	2022	05	00	269.2083	269.2083	82.95984	149.09277	1032.10	-0.06
300234060321940	2022	06	00	269.2500	269.2500	82.95809	149.15925	1032.00	-0.07
300234060321940	2022	07	00	269.2917	269.2917	82.95665	149.22143	1031.50	-0.09
300234060321940	2022	08	00	269.3333	269.3333	82.95576	149.27055	1031.20	-0.12
300234060321940	2022	09	00	269.3750	269.3750	82.95675	149.31572	1030.60	-0.15
300234060321940	2022	10	00	269.4167	269.4167	82.95928	149.36109	1030.20	-0.18
300234060321940	2022	11	00	269.4583	269.4583	82.96311	149.41235	1029.60	-0.22
300234060321940	2022	12	00	269.5000	269.5000	82.96710	149.47890	1029.00	-0.26
300234060321940	2022	13	00	269.5417	269.5417	82.97043	149.56192	1028.30	-0.29
300234060321940	2022	14	00	269.5833	269.5833	82.97281	149.64930	1027.80	-0.32
300234060321940	2022	15	00	269.6250	269.6250	82.97394	149.73803	1027.10	-0.36
300234060321940	2022	16	00	269.6667	269.6667	82.97379	149.82756	1026.50	-0.40
300234060321940	2022	17	00	269.7083	269.7083	82.97270	149.91291	1025.80	-0.45
300234060321940	2022	18	00	269.7500	269.7500	82.97111	149.99008	1025.20	-0.49
300234060321940	2022	19	00	269.7917	269.7917	82.96930	150.05765	1024.40	-0.53
300234060321940	2022	20	00	269.8333	269.8333	82.96804	150.11788	1023.70	-0.57
300234060321940	2022	21	00	269.8750	269.8750	82.96782	150.17151	1023.00	-0.59

Figure: Result of user clicking 'LEVEL 1' button to access raw data - a .dat file opened in browser Four out of six participants would proceed from this point using a coded script to download the data. Two out of six participants would manually transfer the data into CSV format, **a process that took one participant approximately 2.5 minutes for a single data set.**

"The frustration I have is that **this [data set] isn't saveable.**" -P2

"I could copy paste this, but **that would be awful.**" -P7

Findings | Download Difficulties - Video Highlight



No search bar or filtering features present in the current website. Severity Ranking: 2 (Serious) - creates significant delay and frustration

Arctic Buoys Reporting Over the Last Week												
BuoyID	WMO	Year	Buoy Type	Owner	Logistics	Latest Report	Latitude	Longitude	BP	Ts	Та	DATA
300234060321940	2601516	2022	iceBTC2	AARI		03/04/2023	88.28974	141.50060	1030.10	-14.18	-999	LEVEL1
300234060324930	2601517	2022	iceBTC2	AARI		03/04/2023	86.95463	143.28886	1029.40	41.91	-999	LEVEL1
300234061160580	2601713	2022	iceSVPB	AARI		03/04/2023	89.37200	191.25740	1025.20	-999	-999	LEVEL1
300234061162580	2601714	2022	iceSVPB	AARI		03/04/2023	86.74560	136.97200	1021.50	-999	-999	LEVEL1
300234061164500	2601716	2022	iceSVPB	AARI		03/04/2023	88.54300	145.49200	1023.50	-999	-999	LEVEL1
300234065495020	4801636	2018	AXIB	USIABP	USIABP	03/04/2023	77.16840	-139.45580	1025.10	-10.00	28.80	LEVEL1
300234065495190	4801639	2018	AXIB	USIABP	USIABP	03/04/2023	70.26160	-127.93540	1034.50	-28.60	5.50	LEVEL1
300234065498190	4801658	2019	AXIB	USIABP	USIABP	03/04/2023	75.88600	-78.05220	1028.90	-17.30	-28.00	LEVEL1
300234067423940	4801663	2019	Ice Ball	USIABP	Healy	03/04/2023	83.91408	-78.30939	1035.30	-20.20	-999	LEVEL1
300234067527540	4801686	2020	Ice Ball	USIABP	Healy	03/04/2023	75.72831	-150.29531	1035.40	-17.55	-999	LEVEL1
300234068044050	2601510	2022	iceBTC2	AARI		03/04/2023	87.71379	161.79619	1024.40	-16.04	-999	LEVEL1
300234068287880	NA	2020	UIT	OSU	MOSAiC	03/04/2023	77.03560	33.80400	-999	-999	-999	LEVEL1
300434063448890	4802615	2022	SIMB3	CRREL		03/03/2023	71.86614	-7.74026	-999	0.00	-0.06	LEVEL1

Figure: Arctic Buoy data table; data shown is not in chronological order

Our site expert explained one missing feature - search capability - within the system that also doubles as a potential improvement.

"So that would be one useful thing, to be able to go back and look up data, to be able to search. Basically, have some search bars. [...] This is all you got. **You** [have] to download the data and search through it yourself with your code right now to find what you want, basically." -Site Expert No search bar or filtering features present in the current website. Severity Ranking: 2 (Serious) - creates significant delay and frustration

	Arctic Buoys Reporting Over the Last Week												
Buoy	γID	WMO	Year	Buoy Type	Owner	Logistics	Latest Report	Latitude	Longitude	BP	Ts	Та	DATA
300234060	0321940	2601516	2022	iceBTC2	AARI		03/04/2023	88.28974	141.50060	1030.10	-14.18	-999	LEVEL1
300234060	0324930	2601517	2022	iceBTC2	AARI		03/04/2023	86.95463	143.28886	1029.40	41.91	-999	LEVEL1
300234061	160580	2601713	2022	iceSVPB	AARI		03/04/2023	89.37200	191.25740	1025.20	-999	-999	LEVEL1
300234061	162580	2601714	2022	iceSVPB	AARI		03/04/2023	86.74560	136.97200	1021.50	-999	-999	LEVEL1
300234061	164500	2601716	2022	iceSVPB	AARI		03/04/2023	88.54300	145.49200	1023.50	-999	-999	LEVEL1
300234065	5495020	4801636	2018	AXIB	USIABP	USIABP	03/04/2023	77.16840	-139.45580	1025.10	-10.00	28.80	LEVEL1
300234065	5495190	4801639	2018	AXIB	USIABP	USIABP	03/04/2023	70.26160	-127.93540	1034.50	-28.60	5.50	LEVEL1
300234065	5498190	4801658	2019	AXIB	USIABP	USIABP	03/04/2023	75.88600	-78.05220	1028.90	-17.30	-28.00	LEVEL1
300234067	7423940	4801663	2019	Ice Ball	USIABP	Healy	03/04/2023	83.91408	-78.30939	1035.30	-20.20	-999	LEVEL1
300234067	7527540	4801686	2020	Ice Ball	USIABP	Healy	03/04/2023	75.72831	-150.29531	1035.40	-17.55	-999	LEVEL1
300234068	<u>3044050</u>	2601510	2022	iceBTC2	AARI		03/04/2023	87.71379	161.79619	1024.40	-16.04	-999	LEVEL1
300234068	3287880	NA	2020	UIT	OSU	MOSAIC	03/04/2023	77.03560	33.80400	-999	-999	-999	LEVEL1
300434063	3448890	4802615	2022	SIMB3	CRREL		03/03/2023	71.86614	-7.74026	-999	0.00	-0.06	LEVEL1

Five out of seven participants explicitly suggested that filters that would subset the data for them would speed up their workflow and make it easier and quicker to find the data they need.

"I would like it if there was a better way of filtering the data according to your needs. I'd like to filter the data by the domain or region, hardware, geographic, and institution." -P1

Figure: Arctic Buoy data table; data shown is not in chronological order

No search bar or filtering features present in the current website. Severity Ranking: 2 (Serious) - creates significant delay and frustration



Figure: Arctic Buoy interactive map

Six out of seven participants used the map to locate a buoy within the specified region.

"It would be nice to have a **coordinate bounding tool (lat/lon)** - as many subsetting methods as possible." -P2

"If there was an ability to subset that would be pretty cool." -P3

"If there was simply a date column, that would be great for my work...that would be **a nice quality of life thing.**" -P2

Participants had difficulty interacting with buoys on the map, causing them to worry that they were missing data or using the tool incorrectly.

Severity Ranking: 2 (Serious) - creates significant delay and frustration



Participants initially expressed that they **liked the maps feature** for the visualization and interactivity elements, citing that this **visual data is helpful** when trying to find buoys in a particular area.

"This is a **really nice feature** they have to click on buoys." -P4

"I will look at maps and imagery - it's a **pretty cool** thing to see what information is available." -P3 Participants had difficulty interacting with buoys on the map, causing them to worry that they were missing data or using the tool incorrectly.

Severity Ranking: 2 (Serious) - creates significant delay and frustration



5 out of 6 participants indicated that the map did not behave as expected.

"I tried to click on one but it pulled up a cluster of five." -P7

"What's interesting to me is that I am clicking on these buoys but these red dots are showing up. **So I don't actually know if I'm getting the buoy I want.** There's some confusion there that I can only work out if I plot the data myself." -P3 Participants had difficulty interacting with buoys on the map, causing them to worry that they were missing data or using the tool incorrectly.

Severity Ranking: 2 (Serious) - creates significant delay and frustration



Figure: Arctic Buoy interactive map

Some participants expressed concern that they were missing buoys that would have critical data, and **one participant cited this as a reason they would click away from the website altogether due to a lack of trust in the data itself.**

"I would click away from this website because it seems like it's not working - like if the data access isn't working or looks a bit sketchy, I would have a lot of concerns about the data itself and not feel comfortable using it." -P2

Participants had significant difficulty finding what hardware a particular buoy has.

Severity Ranking: 2 (Serous) - creates significant delay and frustration

Only **one out of seven** participants found the *Hardware* page detailing each piece of equipment, three out of seven participants confidently used workarounds, and **three out of seven participants** gave up and did not complete the task.

"I gave up because it wasn't worth my time to search through all the data." -P4

"I would ideally be able to find a specific piece of data I am looking for based on hardware." -P1

Arctic Buoys Reporting Over the Last Week												
BuoyID	WMO	Year	Buoy Type	Owner	Logistics	Latest Report	Latitude	Longitude	BP	Ts	Та	DATA
300234060321940	2601516	2022	iceBTC2	AARI		03/04/2023	88.28974	141.50060	1030.10	-14.18	-999	LEVEL1
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300234061160580	2601713	2022	iceSVPB	AARI		03/04/2023	89.37200	191.25740	1025.20	-999	-999	LEVEL1
300234061162580	2601714	2022	iceSVPB	AARI		03/04/2023	86.74560	136.97200	1021.50	-999	-999	LEVEL1
					-	-		-				



Figures: Arctic Table page with Buoy Type column with corresponding hardware (left); List of buoy IDs and hardware on Maps page (right)

Participants become lost in the navigation of the site and often find it difficult to find what they are looking for.

Severity Ranking: 1 (Severe) - prevents the completion of task

Users experienced **lostness** in multiple areas of the site including:

- the data products page
- while using sidebar navigation
- while trying to locate data download features

As a result, not all users were able to complete the assigned tasks and multiple users **expressed frustration** with the site and its navigation and lack of wayfinding.

"I can't even find where the data is in here."-P4

"I found a little difficult to navigate the website — it's **confusing how there is no clear 'mind map'**" -P7

"The data is there and visible, but it is a bit tedious to navigate to get the data. It is like there are three different ways to get the data on the site." -P1

Findings | Lostness



Figure: Average lostness score broken down by task, ranging from 0 to 1 with 1 meaning the user is most lost

Task 1

- 2 users failed to complete the task
- 100% of successful users exceeded the minimum number of steps needed to complete the task

Task 2

- 2 users failed to complete the task
- 80% of successful users exceeded the minimum number of steps needed to complete the task

Task 3

- 1 user failed to complete the task
- 60% of successful users exceeded to minimum number of steps needed to complete the task

Findings | Lostness

International Arctic Buoy Programme | Cognitive Map.

WHAT IS A COGNITIVE MAP? THE INTENT OF THIS MAP IS TO DISPLAY THE USER INTERACTION ON IABP AS THEY COMPLETE TASKS GIVEN TO

USABILITY TEST

SCENARIO: YOU ARE A CLIMATE SCIENTIST PERFORMING RESEARCH WHERE YOU ARE STUDYING DRIFT IN THE CENTRAL ARCTIC REGION BETWEEN 2019 AND 2022, AND YOU HEARD THAT THE INTERNATIONAL HAVE SOME DATA THAT YOU WOULD FIND USEFUL IN YOUR RESEARCH.

TASK 1: DISCOVER AVAILABLE DATA OPEN THE IABP WEBSITE LINK AND FIND OUT WHAT DATA IS AVAILABLE FOR DOWNLOAD THAT WOULD SUPPORT YOUR RESEARCH QUESTION.

ROUTES TAKEN TO COMPLETE THE TASK VS THE OPTIMAL ROUTE OPTIMAL ROUTE TASK 1 . . . P1 _____ 92 -----P3 -----



EXTERNAL TOOLS

THESE ARE TOOLS AND APPLICATIONS THAT PARTICIPANTS HAVE USED TO COMPLETE THEIR TASKS.

- P. NOTEPAD
- EXCEL (SPREADSHEET)
- <>> INTEGRATED DEV ENVIRONMENT (IDE)
- G GOOGLE SEARCH

LEGEND

FILE DIRECTORY

INFORMATION ARCHITECTURE ELEMENTS: TEXT/DATA FILE



THESE BLAMENTS ARE ACCESSIBLE IN - DATA - DATA - DATA PRODUCTS

International Arctic Buoy Programme | Cognitive Map

WHAT IS A COGNITIVE MAP? THE IS MAP IS TO DISPLA THE USER INTERACTION ON IABP AS THEY COMPLETE TASKS GIVEN TO

USABILITY TEST

SCENARIO: YOU ARE A CLIMATE SCIENTIST PERFORMING RESEARCH WHERE YOU ARE STUDYING DRIFT IN THE CENTRAL ARCTIC REGION BETWEEN 2019 AND 2022, AND YOU HEARD THAT THE INTERNATIONAL HAVE SOME DATA THAT YOU WOULD FIND USEFUL IN YOUR RESEARCH.

TASK 2: FIND BUOY IN DESIRED REGION YOU ARE LOOKING FOR DATA IN THE CENTRAL ARCTIC REGION, USING THE SITE, FIND OUT IF THERE ARE CURRENTLY ANY BUDYS IN THAT REGION AND WHAT HARDWARE THAT BUOY HAS

ROUTES TAKEN TO COMPLETE THE TASK VS THE OPTIMAL POUTE OPTIMAL ROUTE TASK 1 . . . p2 _____

P3 PA FAILED P5 FAILED P6 _____

EXTERNAL TOOLS THESE ARE TOOLS AND DEPACATIONS

THAT PARTICIPANTS HAVE USED TO COMPLETE THEIR TAXAS NOTEPAD EXCEL (SPREADSHEET)

</>
INTEGRATED DEV G GOOGLE SEARCH

LEGEND

INFORMATION ARCHITECTURE ELEMENTS:

TEXT/DATA FILE

FILE DIRECTORY



International Arctic Buoy Programme | Cognitive Map

WHAT IS A COGNITIVE MAP? THE THE USER INTERACTION ON IABP AS THEY COMPLETE TASKS GIVEN TO ARA DEERVE **USABILITY TEST** ----SCENARIO: YOU ARE & CUMATE SCIENTIST PERFORMING RESEARCH WHERE YOU ARE STUDYING DRIFT IN THE CENTRAL ARCTIC REGION BETWEEN 2019 AND 2022, AND YOU HEARD THAT THE INTERNATIONAL HOME OF ONERVIEW PADE HAVE SOME DATA THAT YOU WOULD FIND USEFUL IN YOUR RESEARCH. TASK 3: DOWNLOAD BUOY DATA SELECT A BUOY ID FROM THE LIST OF BUOYS CURRENTLY IN THE CENTRAL ARCTIC AND DOWNLOAD THE DATA ROUTES TAKEN TO COMPLETE THE

TASK VS THE OPTIMAL ROUTE OPTIMAL ROUTE TASK 1 . . . P2 _____ P5 FAILED

FOR THAT BUOY.

EXTERNAL TOOLS THESE ARE TOOLS AND THAT PARTICIPANTS H P. NOTEPAD EXCEL (SPREADSHEET)

</> G GOOGLE SEARCH

LEGEND

INFORMATION ARCHITECTURE ELEMENTS: ORKING WEB PAG

TEXT/DATA FILE FILE DIRECTORY

1 have good MAPS > DAILY THESE FIVE PAGES ENGLISED SHOW SP UNDER MAPS - DAILY DOWNLOAD TIPS BUOY DATA (.DAT) ASCII TABLES ARCTIC AND ARCTIC TABLE CURRENT (.TXT) ANTARCTIC TABLES THESE ELEMENTS ARE ADDESSELE BOTH PADES. INDIVIDUAL BUDY DATA BUDY DATA LUAT) INFORMATION DEPI TRI SELECTOR BUDY ANTARCTIC TABLE CURRENT (.TXT) RAW FULL RESOLUTION DATA 3-HOURLY RESOLUTION DATA DAILY FULL RESOLUTION DATA

IABP WEBSITE

DATA / DATA PRODUCTS PAGE THESE ELEMENTS ARE ACCESSIBLE IN - DATA - DATA - DATA FRODUCTS

RESEARC

Reflections



If we were to run this study again, we would:

- Recruit more novice users, especially those who have never used the website
- Conduct a heuristic evaluation to start the process
- Further investigate information architecture for the website
- Add tasks to test other parts of the website, like the data directory or research pages

Suggestions for future testing:

- Dig deeper into information architecture through other techniques like card-sorting
- Upon adding additional features, test new features and their placement and prominence on website
 - O Click-and-drag functionality on maps
 - O Filtering on data table and search functionality
 - O Download process updates

What you do makes a difference, and you have to decide what kind of difference you want to make.

Dr. Jane Goodall



Q & A



Reference Slides



Reference | Lostness Score



Average Lostness Score by Task



Readiness to Proceed After Task 1

Readiness to Proceed Rating (1 = Very Ready, 5 = Not at all Ready)



Difficulty Rating (1 = Very Easy, 5 = Very Difficult)



Difficulty Rating (1 = Very Easy, 5 = Very Difficult)



Difficulty Rating (1 = Very Easy, 5 = Very Difficult)

Reference | Average Difficulty Rating

