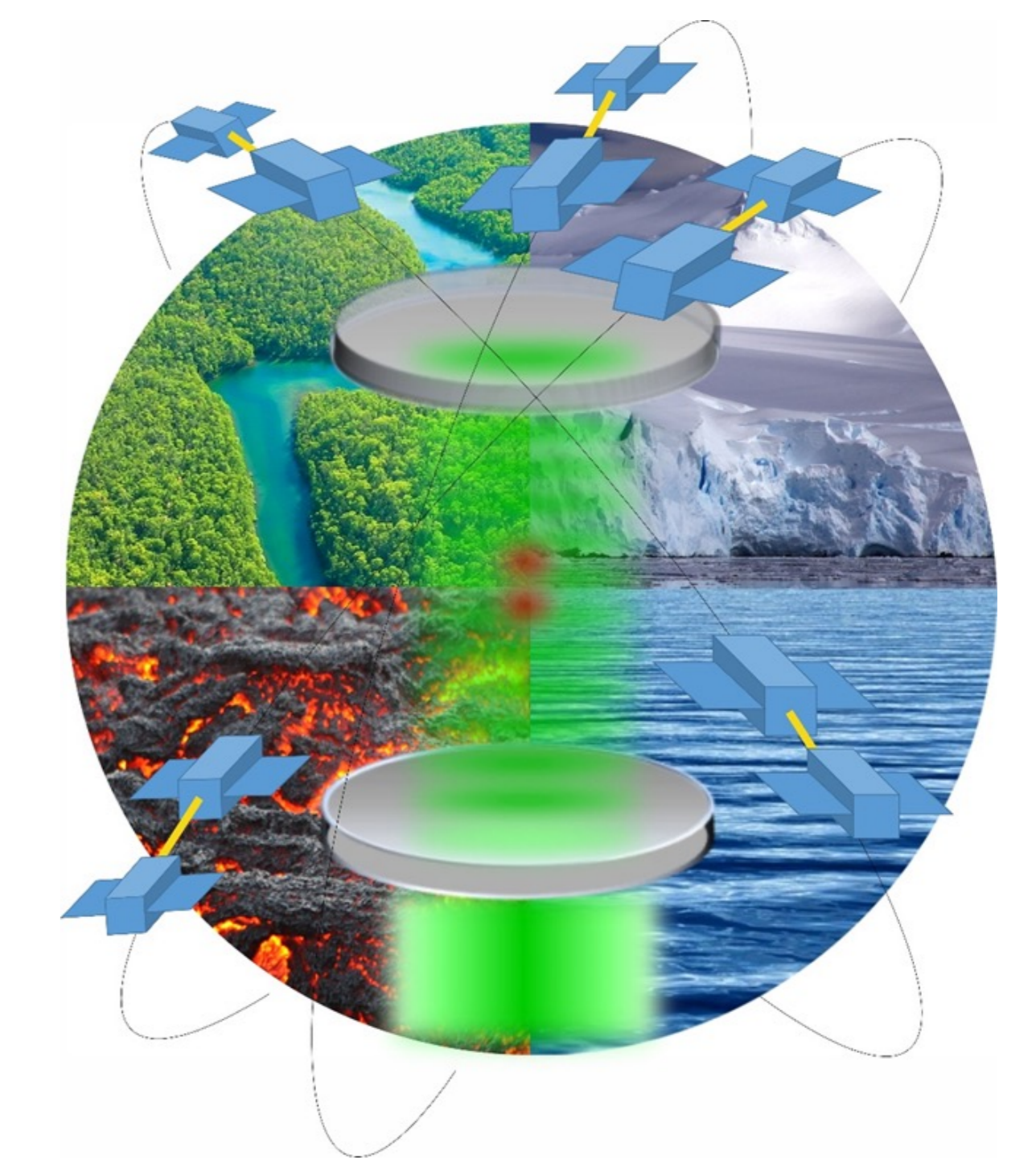


Community assessment on user requirements for future satellite gravity missions



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Scope

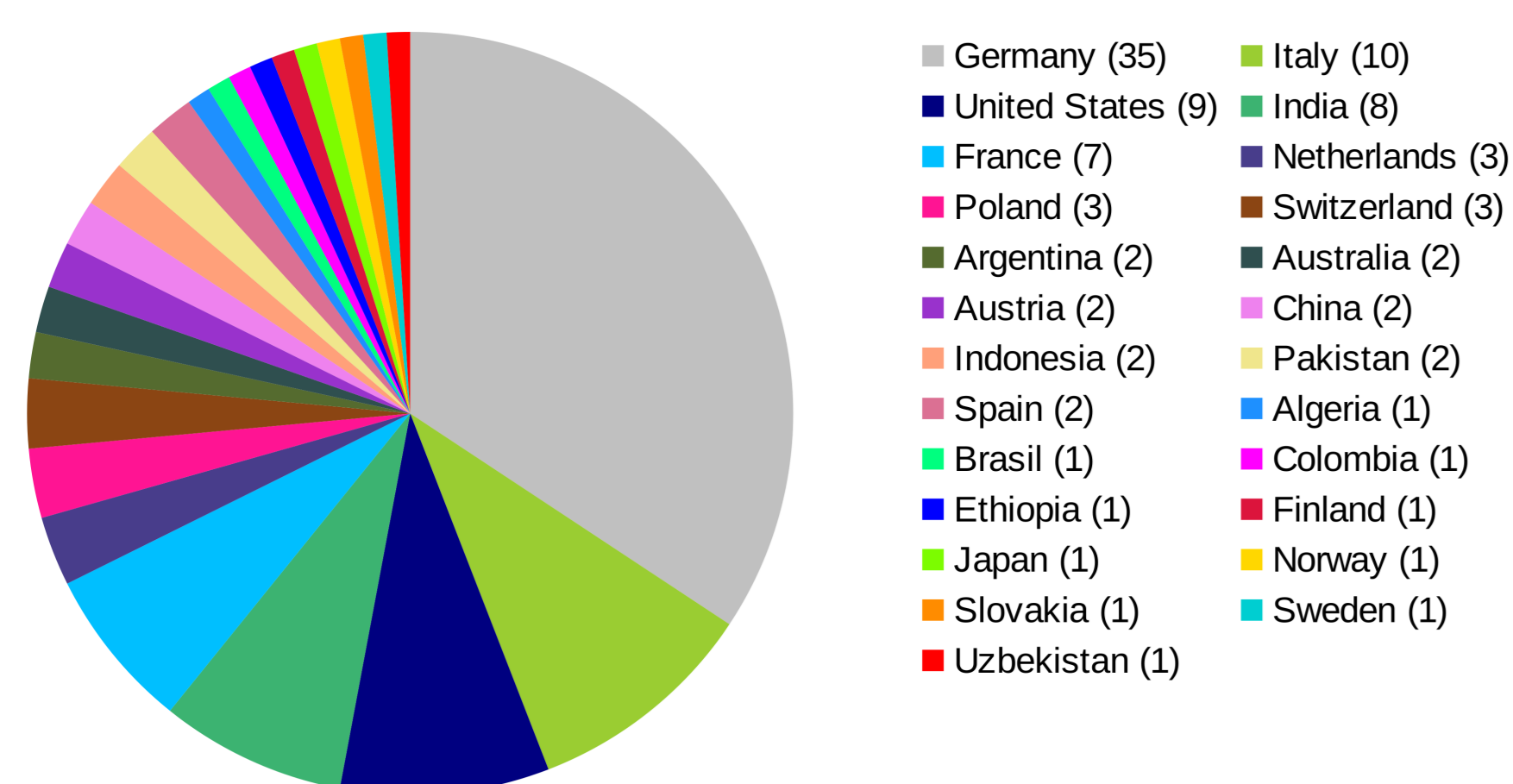
What do users expect from future satellite gravity missions?

- Assessment of user requirements based on community questionnaire
- Future missions:
 - post-MAGIC era (2040+ time frame)
 - possible multi-satellite constellations with quantum technology

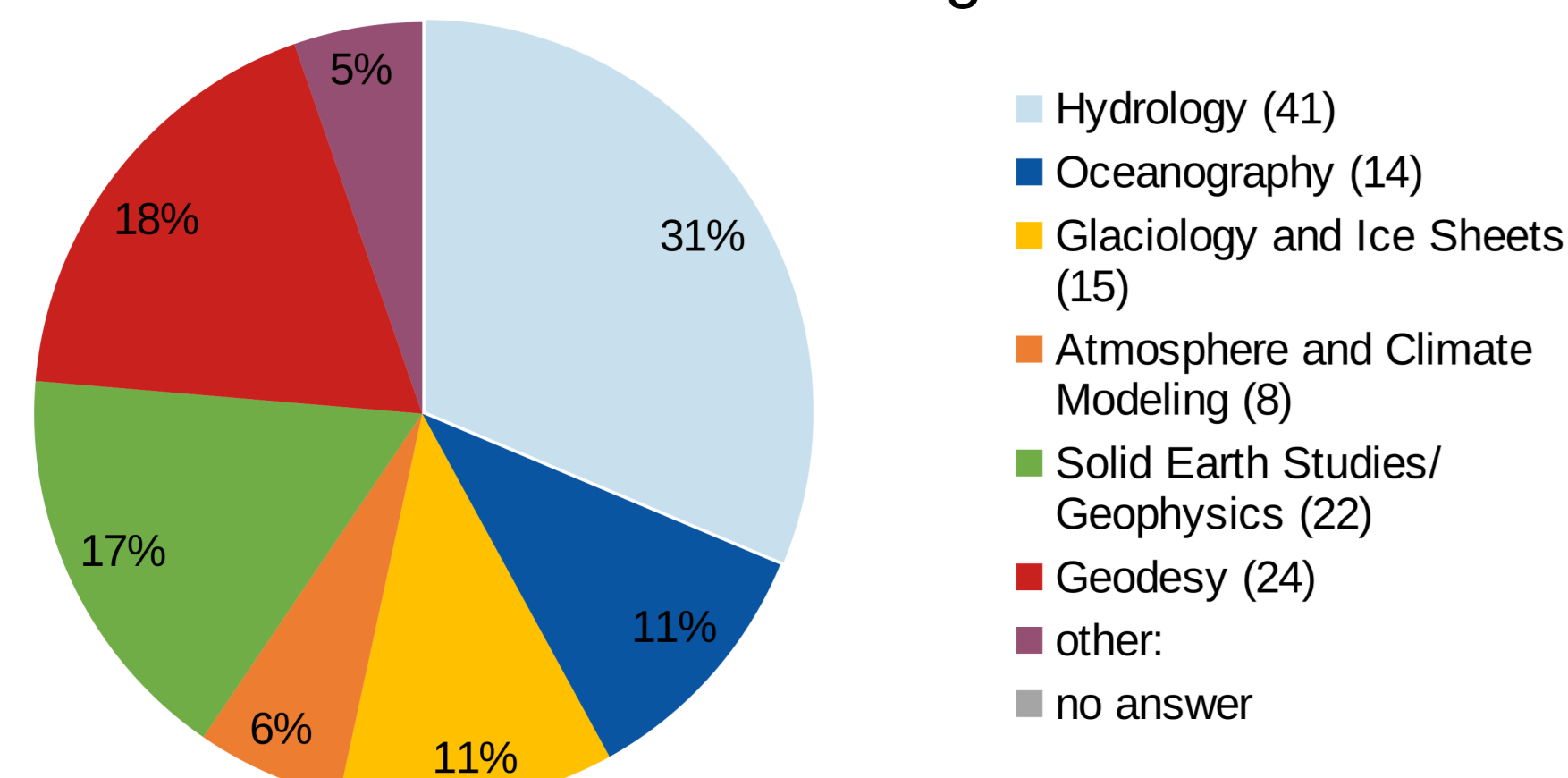
Questionnaire participation

- Duration: April 24 – July 31, 2023
- # surveys: 135
- 119 replies by individual scientists
- 16 replies from institutions

Countries of affiliation



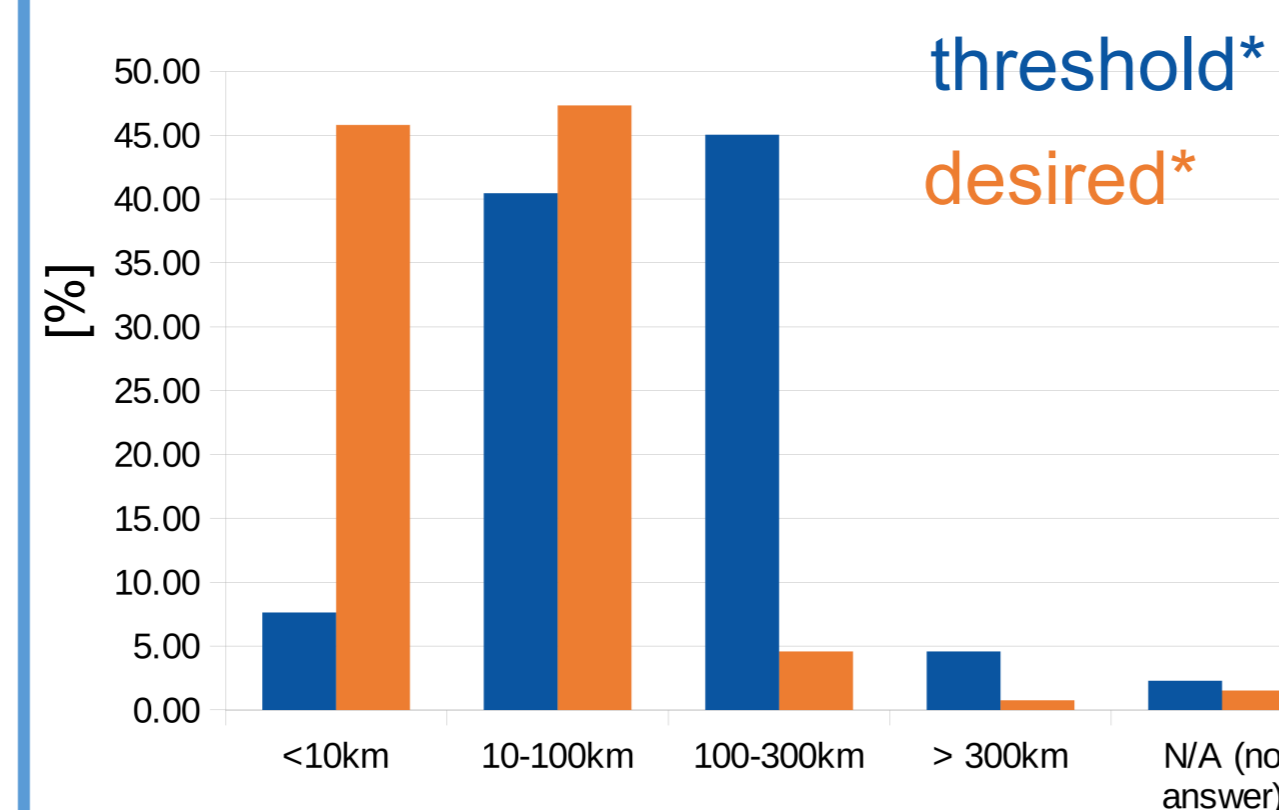
Scientific background



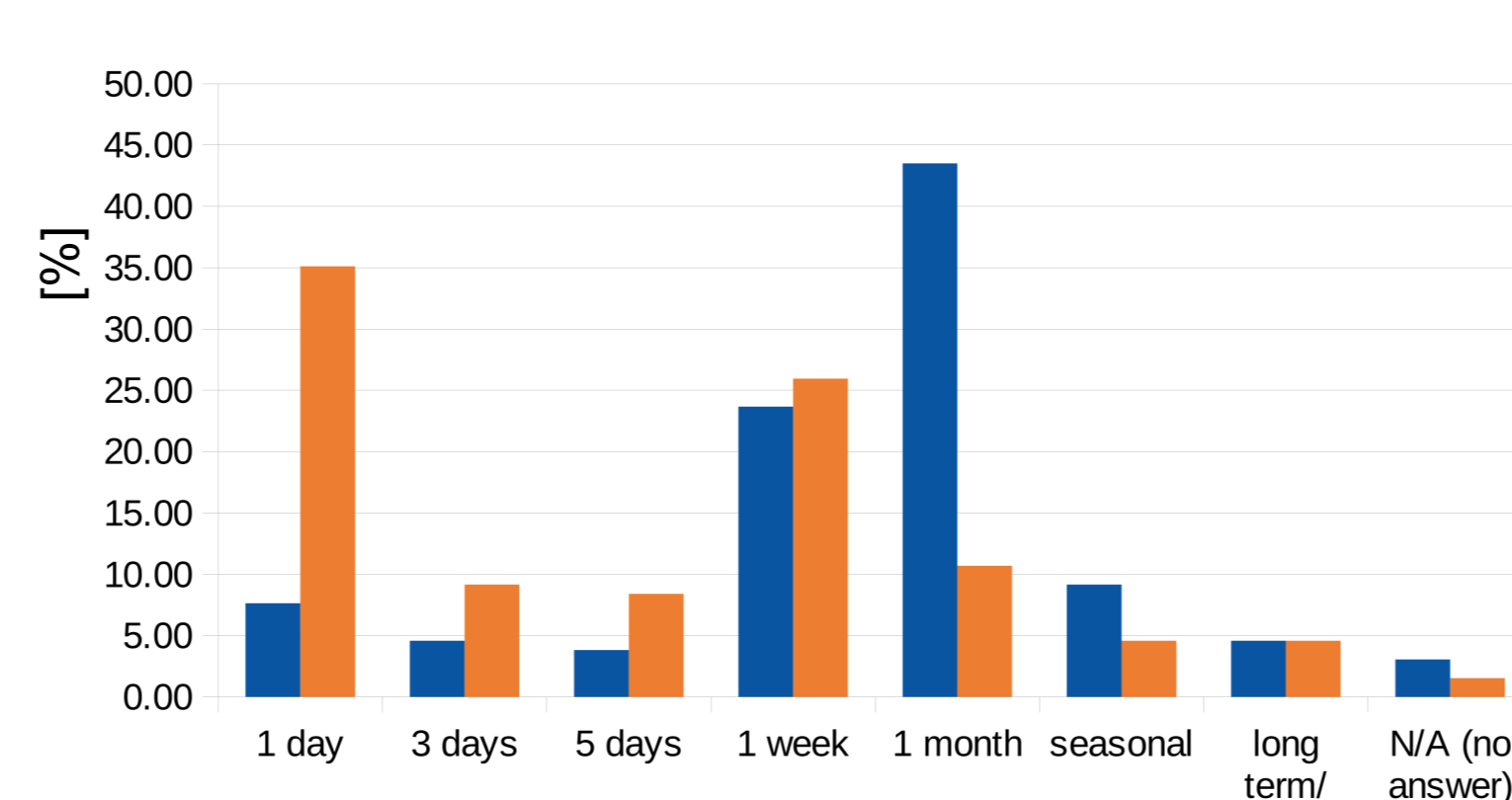
Application-driven demands

What do users want (“wishlist“)?

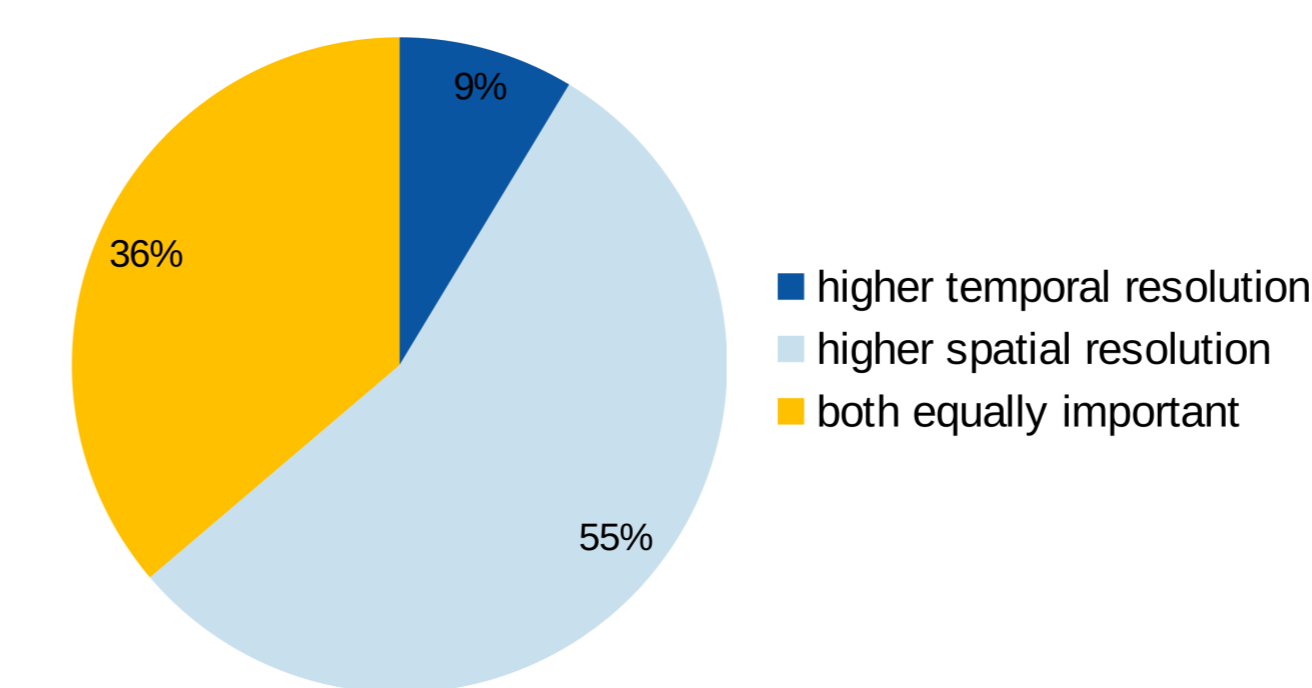
Spatial resolution



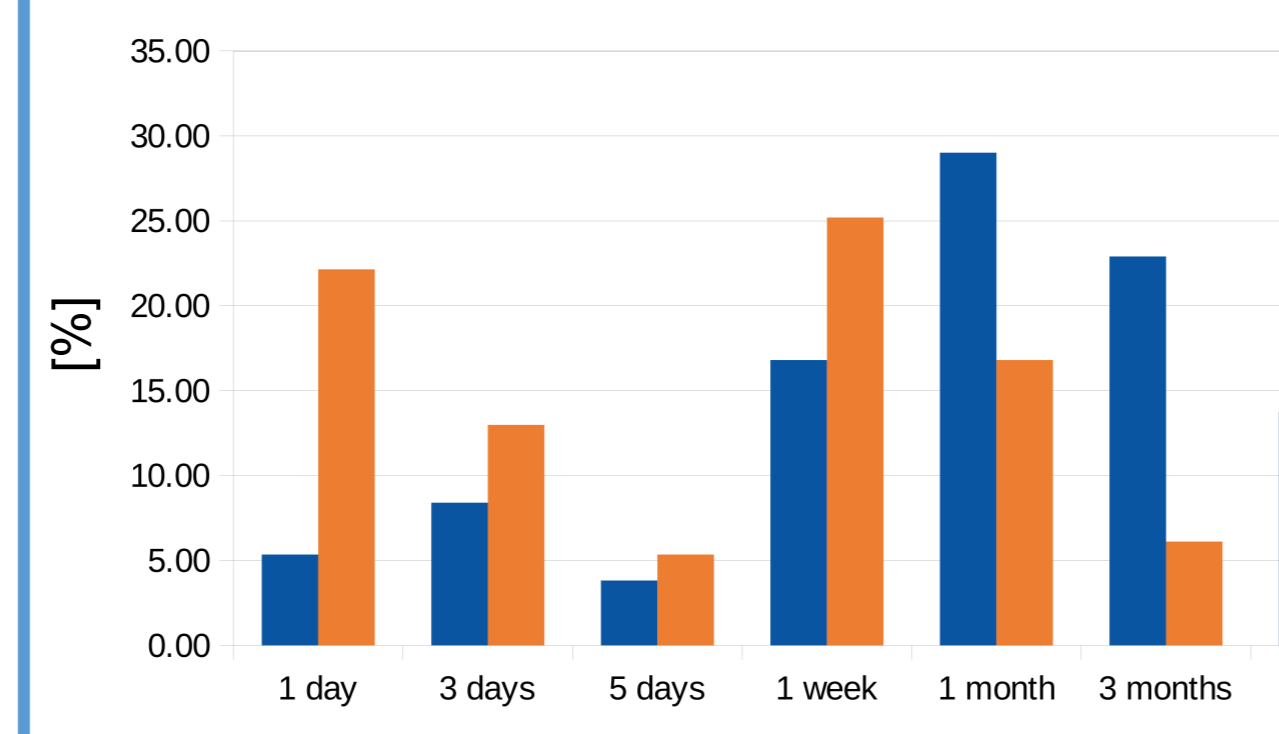
Temporal resolution



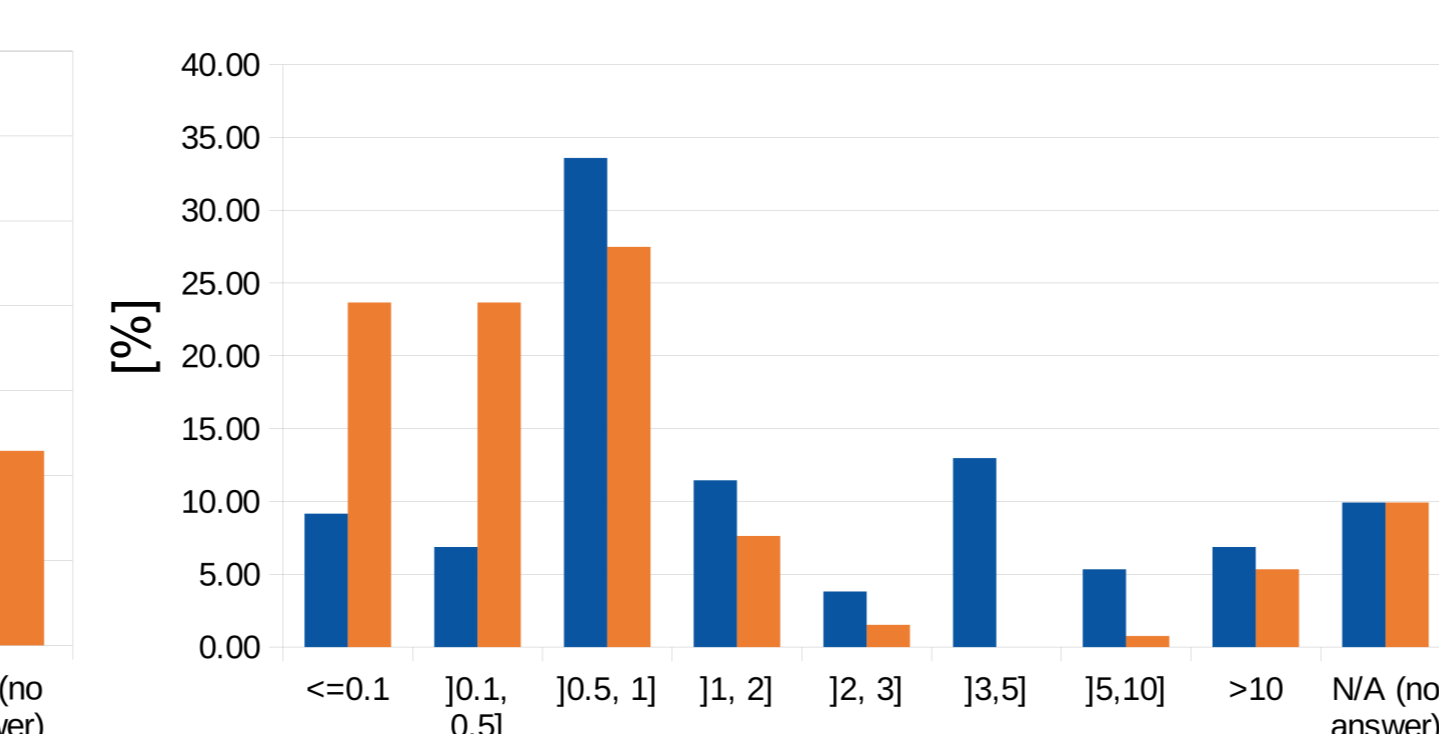
Would you prefer a higher temporal or higher spatial resolution?



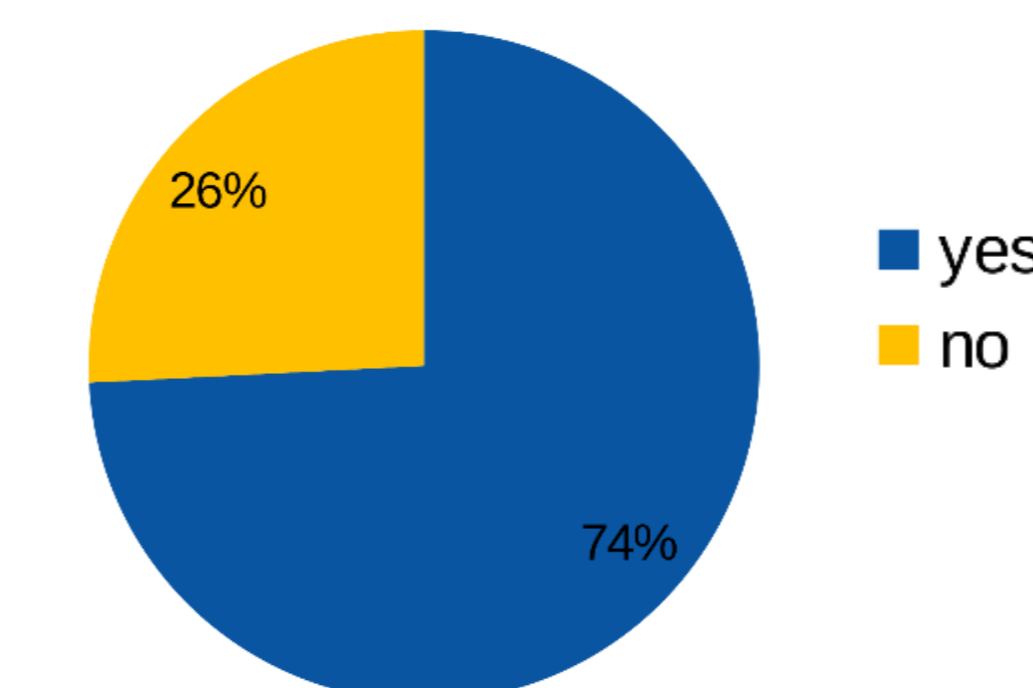
Latency



Accuracy



Is the accuracy of mass change data currently the limiting factor for combination with other data sets?



* Threshold = minimum requirement for data to be useful as a (new) observable

* Desired = data set would allow breakthrough new science

Spatial vs. Temporal: threshold

	<10 km	10-100 km	100-300 km	> 300 km
1 day	4	5	1	0
3 days	2	3	1	0
5 days	0	2	3	0
1 week	2	17	12	0
1 month	1	18	35	3
seasonal	1	7	4	0
long term/trends	0	1	2	3

Spatial vs. Temporal: desired

	<10 km	10-100 km	100-300 km	> 300 km
1 day	29	16	1	0
3 days	2	9	1	0
5 days	4	7	0	0
1 week	14	19	1	0
1 month	5	8	1	0
seasonal	4	0	2	0
long term/trends	2	3	0	1

Spatial vs. accuracy: threshold

	<10 km	10-100 km	100-300 km	> 300 km
<=0.1 cm	2	4	6	0
]0.1, 0.5] cm	1	5	2	1
]0.5, 1] cm	3	16	22	3
]1, 2] cm	1	9	4	1
]2, 3] cm	0	1	3	1
]3, 5] cm	0	8	8	0
]5, 10] cm	0	3	4	0
>10 cm	2	2	4	0

Spatial vs. accuracy: desired

	<10 km	10-100 km	100-300 km	> 300 km
<=0.1 cm	16	14	0	1
]0.1, 0.5] cm	12	18	1	0
]0.5, 1] cm	19	14	3	0
]1, 2] cm	3	7	0	0
]2, 3] cm	2	0	0	0
]3, 5] cm	0	0	0	0
]5, 10] cm	0	1	0	0
>10 cm	3	2	1	0

Benefit of hypothetical mission scenarios

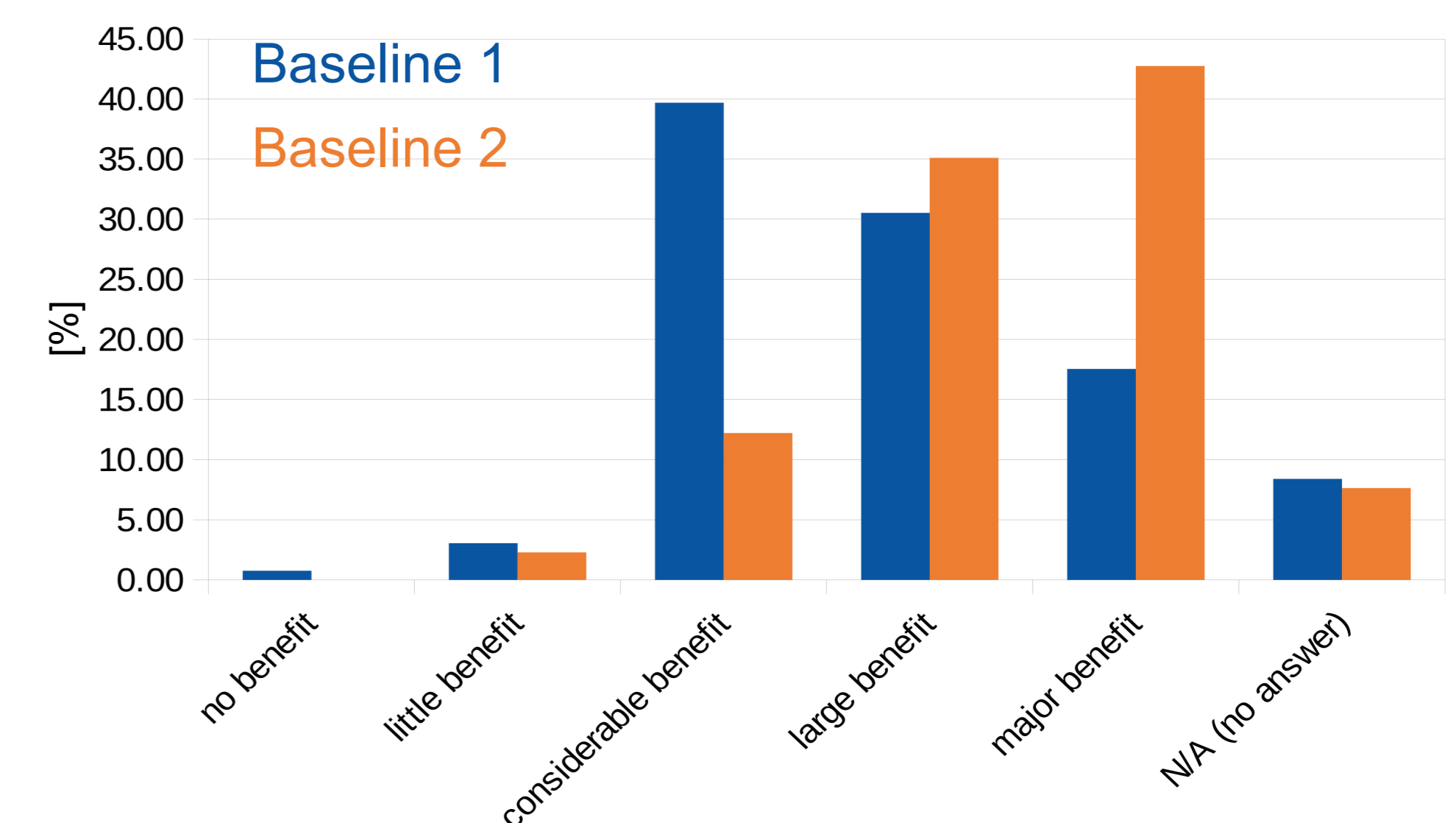
Scenarios*:

[accuracy of gridded mass change products in cm EWH]

	Daily		Weekly		Monthly		Trend
	[cm]		[cm]		[cm]		[cm/yr]
	600km	300km	300km	150km	300km	150km	150km
GRACE-FO	4.0	-	4.0	-	2.0	5.0	0.10
MAGIC	2.0	5.3	2.0	5.0	1.0	2.5	0.05
Baseline 1	1.0	2.7	1.0	2.5	0.5	1.3	0.03
Baseline 2	0.5	1.3	0.5	1.3	0.3	0.6	0.01

* Hypothetical scenarios, not actual performance numbers!

Expected benefit:



Main conclusions

- Evaluation of user needs for future satellite missions carried out based on community survey (135 participants).
- Many detailed responses - extended summary provided soon.
- **Threshold requirements:**
 - spatial resolution: 100-300 km
 - temporal resolution and latency: 1 week to 1 month
- **Desired requirements:**
 - spatial resolution: below 10-100 km
 - temporal resolution and latency: 1 day to 1 week
- Spatial resolution of higher interest for majority, but almost half of users considers temporal resolution at least as important.
- Considerable to large benefit expected from conservative **Baseline 1** scenario, large to major benefit expected from more optimistic **Baseline 2** scenario.