

Decadal Survey for Earth Science and Applications from Space 2017-2027
Request for Information #2 - Frequently Asked Questions

Q1: Is it correct that RFI#2 is asking for proposals framed in terms of science objectives and measurements needed to retrieve geophysical variables rather than instruments and missions?

A1: Yes, this is a deliberate decision that was based on lessons learned from the previous decadal survey process.

Q2: Do responses need to be framed according to the value-based decision framework presented in the report [Continuity of NASA Earth Observations from Space: A Value Framework](#) (2015)?

A2: No. While encouraged, there is no requirement to submit ideas for science and application targets in the context of a potential contribution to a “Quantified Earth Science Objective” (QESO). Indeed, while the authors of the *Continuity* report note that the framework is broadly applicable, examples of its application focused on measurements related to climate continuity targets.

Q3: If adopting the QESO framework, is there a need to come up with a *single* number that represents the improvement that is sought in a *single* geophysical parameter?

A3: No. There are many examples of QESOs that involve more than one variable; examples are shown in the appendices of the report. We note, for example that a QESO to reduce the uncertainty in climate sensitivity would involve both radiative flux variable (top down observation) and multiple cloud properties (bottoms up observation of the process causing the feedback). This is discussed in Appendix C of the report. Similarly, a sea-level rise QESO would involve multiple geophysical variables including ice sheet mass and ocean heat storage. The relationship between the framework characteristics and a measurement/quantified objective pair is discussed in Chapter 3 of the report and illustrated in [Figure 3.1](#).

Q4: If adopting the QESO framework, are there guidelines for writing a good Earth science objective?

A4: No, there are no set guidelines. However, [Box 3.2](#) in the [Continuity](#) report provides example objectives that are worth examining. The particulars of these examples are found in [Chapter 4](#) and the [Appendices](#) of the report:

Examples of Quantified Earth Science Objectives:

- Narrow the Intergovernmental Panel on Climate Change Fifth Assessment (IPCC AR5) uncertainty in equilibrium climate sensitivity (ECS) (1.5° - 6°C at 90% confidence) by a factor of 2.
- Detect decadal change in the effective climate radiative forcing (ERF) to better than 0.05 W m^{-2} (1σ).
- Determine the rate of global mean sea level rise to $\pm 1 \text{ mm}$ per year per decade (1σ).
- Identify the land carbon sink and quantify this globally to $\pm 1.0 \text{ Pg C}$ per year aggregating from the $1^{\circ} \times 1^{\circ}$ scale.
- Determine the change in ocean heat storage within 0.1 W m^{-2} per decade (1σ).
- Determine changes in ice sheet mass balance within 15 Gt/yr per decade or 1.5 Gt/yr^{-2} (1σ).

In the context of the [Continuity](#) report, quantified science objectives are distinct from higher-level and more general science goals. The pursuit of the QESOs above will be associated with specific, measurable and tangible scientific action(s) that support the attainment of an associated Earth science goal. In most cases, actions associated with a science objective do not focus on “characterizing” the behavior (e.g. spatial or temporal) of a geophysical variable. A well-framed science objective would, for example, seek evidence for, or against, a stated hypothesis, or attempt to determine which of two factors plays a larger role in a given geophysical phenomenon.

Q5: If adopting the QESO framework, should I include a description, and rating, for each of the five measurement characteristics (I, U, Q, S, and A as described [here](#)) and, if so, how do I tailor my responses to fit within the four RFI-2 requests (page 4 of [RFI-2](#))?

A5: Responses that follow the QESO framework are encouraged, but not required. If responses are presented in the QESO framework, they should **not** include ratings of the I, U, Q, S, and A factors, but should provide sufficient evidence that would allow such a ranking. Note that the information requests in RFI-2 map directly to the framework factors:

- RFI-2, information request #1 → Importance (I);
 - RFI-2, information request #2 → Utility (U);
 - RFI-2, information request #3 → Quality (Q); and
 - RFI-2, information request #4 → Affordability (A) and Success Probability (S).
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Q6: Will the Decadal Survey rate submitted objectives and measurements using the approach described in the *Continuity* Report?

A6: It may, with the caveat that implementing the value-based decision framework of the *Continuity* report will not be easy and many of the details are TBD. Currently, we anticipate that a review by the survey study panels of the white paper inputs from RFI-1 and RFI-2. We expect the panels will first integrate white paper input within the panel research area(s) to be followed by cross-panel integration. There will likely be many more QESOs than can be accommodated within agency budgets or existing international observation plans. Nevertheless, the value-based decision framework suggested in the *Continuity* report should enable a clearer understanding of the benefit of any additional investments by NASA, NOAA, USGS, and the international community. This also provides a more open and explicit process to understand the value and cost of measurements that can fit within agency budgets versus those that cannot.

Q7: What happens in the case of a critical QESO with no current measurement to address it? Is there any reason to submit such a QESO?

A7: This type of submittal is still very important. It can assist the Decadal Survey in providing guidance on key areas for technology development efforts. An indication of the limiting technology or technologies would be appropriate in such a white paper. In some cases, demonstrated current technology may exist at lower levels of Utility or Quality, while new technology development has the potential to greatly increase Utility and/or Quality in support of the QESO. In this case a comparison of new versus existing capabilities would provide useful input.

Q8: Is there an online presentation that summarizes the *Continuity* report?

A8: Yes, please see:

http://sites.nationalacademies.org/cs/groups/ssbsite/documents/webpage/ssb_170359.pdf