ANNEX XI. PRIORITIZATION CONCEPT IN THE RRR PROCESS

1. Background

The WMO's RRR process captures the observational requirements ranges for a variety of application areas. These requirements are currently expressed in terms of 6 criteria (or attributes): uncertainty, horizontal resolution, vertical resolution, observing cycle, timeliness, and stability (where appropriate). For each of these criteria, the requirements are captured in a table containing three values determined by experts: these are (1) "threshold" the minimum requirement to be met to ensure that data are useful, (2) "goal" is an ideal requirement above which further improvements are not necessary, (3) "breakthrough" is an intermediate level between "threshold" and "goal" which, if achieved, would result in a significant improvement for the targeted application.

These requirements defining which geophysical observations are needed for a certain application, and their associated attributes, are meant to provide information from experts (as compiled by the Points of Contact, PoCs, in each Application Area) to provide guidance to observing systems designers and networks architects to optimize their designs and networks. However, these requirements are currently not prioritized. In the absence of prioritization of requirements, the relative importance of the requirements and their attributes is not known to sensors' designers and network planners, leaving an important gap in the guidance to those architects and designers to really know how to optimize their concepts and networks.

2. Suggesting a Mechanism to Prioritize the Requirements

We propose including the notion of prioritization in the RRR process as this could be useful to those designing and deploying observing systems (both space and surface-based). For example, in situations where budget constraints are such that not everything is affordable at the breakthrough level, it is informative to know whether one observation should be prioritized over another in terms of meeting users' requirements at the breakthrough or threshold or goal levels. Or, for a specific observation required, it is also useful to know the relative importance of the particular attributes. In case of technology constraints (in terms of mass, volume, power and cost), during the design of a specific sensor, engineers would appreciate knowing whether spatial resolution for example (requiring bigger antennas) is more or less important than the precision of the measurement (usually driving designs with additional spectral channels). It is important to note that implicitly, if no priority is given, all requirements (and their attributes like resolution, temporal refresh, etc.) are considered to be of equal importance.

It should be highlighted that the priorities proposed in this document are against observations requirements and their attributes. They should be archived in the OSCAR database along with the requirements and are specific to individual application areas. The priorities are defined for:

(a) The Requirement in total e.g., does an application value more the near-surface temp. than moisture for instance?

(b) The attributes of the Requirement e.g., for a given Requirement, does the application area value one attribute more than another, e.g. does it value more the spatial resolution than vertical resolution or/and than the uncertainty?

These priorities are called the Application-dependent Technical Priorities (ATP) and should be defined to convey, for a given application area, the relative importance between the

requirements and, for a given requirement, the relative importance between the attributes. These priorities (or weights) should be a numerical value between 0 and 1, that can be used for optimizing network design purposes. They should be defined with a minimum level of granularity i.e., enough to be useful but not too complex to assign. The table below contains the suggested definition of the different priorities.

Table XI. 1 Definition of priorities

Priority Value (weight)	**Description**
1.0	**Core (1):** The requirement (or criteria) is **absolutely critical** for the application, so meeting at least the breakthrough requirements where technical solutions exist, must be the highest priority. Where breakthrough requirements are not already being met by existing capability, research and development plans should be actively seeking to address the gap as a high priority
0.8	**Recommended (0.8):** The requirement (or criteria) is **essential** for the application so should meet at least the breakthrough requirements where technical solutions exist. Where breakthrough requirements are not already being met by existing capability, research and development plans should be actively seeking to address the gap, but with a lower priority than those requirement identified as Core
0.6	**Useful (0.6):** The requirement (or criteria) is **useful** for the application, but not absolutely essential. Meeting the breakthrough requirements where technical solutions exist, should be a medium priority, but meeting the threshold requirement should be a high priority. Where threshold requirements are not already being met by existing capability, research and development plans should be actively seeking to address the gap, but with a lower priority than requirements identified as Recommended or Core
0.4	**Marginally useful (0.4):** The requirement (or criteria) is **not essential** for the application. Meeting the threshold requirements where technical solutions exist, should be a low priority. Where threshold requirements are not already being met by existing capability, research and development plans should not be actively seeking to address the gap, but opportunities arising should be considered
0.2	**Not currently useful (0.2):** There is no current identified use of the requirement (or criteria), but some use may be identified in the future.
0.0	**Not useful (0):** There is no current or future identified use of this requirement (or criteria).

Note: priorities for requirements and their attributes are sometimes scientifically inter-connected. In other words, the specific requirement (and associated priority) for the attributes (of vertical resolution, uncertainty, horizontal resolution, timeliness, observing cycle, etc.) sometimes vary depending on the ranges of the other attributes. It is important to note that this inter dependency applies to both priorities and requirements ranges. Despite this caveat, it is believed however that the requirements' ranges (and priorities) are very important and informative to the observing systems and networks owners. They should be considered as *first degree assessment* of ranges of requirements and their priorities, with the caveat that there are nuances related to the fact that there are spatial, temporal and situational variations of the requirements and priorities.

3. Two Additional attributes:

Currently, in OSCAR, a Requirement defines the sought-after observational data stream in terms of the variable and the domain (vertical layer/s and horizontal coverage) to be sampled. However, an observing system (network/fleet/constellation/programme/mission) designer may seek to optimize the trade-off between the sampling of the specified domain and the quality characteristics of the measurements, and the User (Application Area) may wish to convey the extent to which this is acceptable. To enable this, two additional attributes are proposed and these are (1) vertical Layer(s) extent and (2) Horizontal Coverage extent.

4. How to Implement the Prioritization into the RRR Process and OSCAR system

The priorities, for each Application area, should be handled in a fashion similar to how the requirements are currently collected, vetted, and maintained. The entity/person(s) responsible for gathering the priorities should be the same PoC in charge of collecting the requirements. Similarly, the same entity/person(s) responsible for coordinating the requirements within an application area category should also be coordinating the priorities within the same category.

In OSCAR, it is recommended that (1) a priority value be associated with each recorded requirement (to be interpreted vertically, i.e. between requirements), and (2) a priority value be associated with each of the attributes of each requirement (to be interpreted horizontally, i.e. between the attributes). By default, a priority value of 1.0 will be assigned to each requirement and associated attributes. The person(s) in charge of updating/maintaining the requirements ranges should therefore be able to update the priorities and modify the default values.

It is recommended that all documentation related to the (1) RRR, (2) SoG, (3) WIGOS manuals, (4) PoC guide, etc. be updated to reflect the notion of the Prioritization described in this document.

For illustration purposes of this prioritization concept, the Figure 1 is introduced in the appendix, showing the proposed two additional attributes, and illustrating how the priorities (for the requirements and the attributes) should be handled. The particular cases of application areas related to the global NWP, Space weather and aeronautical meteorology were used for illustration.

ID	Requirement definition				Requirement attributes							
	User	Observational data stream			Priority=red. Performance level: blue=goal; green=breakthrough; orange=threshold							
No. Pr.	Application Area	Variable	Vertical Layer/s	Horizontal Coverage	Vertical Layer(s) Extent	Horizontal Coverage Extent	Uncertainty	Stability	Horizontal Resolution	Vertical Resolution	Obs. Cycle	Timeliness
255 1.0	GNWP	T	FT	Global	100% 70% 30% 1.0	100% 80% 40% 1.0	0.5 K 1 K 3 K 1.0		15 km 100 km 500 km 1.0	0.3 km 0.5 km 1 km 1.0	60 min 6 h 24 h 1.0	6 min 30 min 6 h 1.0
256 1.0	GNWP	T	UTLS	Global	100% 70% 30% 1.0	100% 80% 50% 1.0	0.5 K 1 K 3 K 1.0		15 km 100 km 500 km 1.0	0.3 km 1 km 3 km 1.0	60 min 6 h 24 h 1.0	6 min 30 min 6 h 1.0
257 1.0	GNWP	T	PBL	Global	100% 70% 30% 1.0	100% 70% 30% 1.0	0.5 K 1 K 3 K 1.0		15 km 100 km 500 km 1.0	0.3 km 1 km 3 km 1.0	60 min 6 h 24 h 1.0	6 min 30 min 6 h 1.0
…												
739 1.0	Space Weather	Electron differential directional flux	Geo, Leo, Meo	Global	100% 1.0	100% 1.0	5 % 10 % 25 % 1.0		45 degrees 90 deg 180 deg 1.0		60 sec 5 min 10 min 1.0	60 sec 10 min 100 min 1.0
740 1.0	Space Weather	Electron differential directional flux	L1	Global	At L1 Not at L1 1.0	100% 1.0	5 % 10 % 25 % 1.0		360 deg 360 deg 360 deg 1.0		60 sec 5 min 10 min 1.0	60 sec 10 min 100 min 1.0
…												
731 1.0	Aeronautical Meteorology	Precipitation intensity at surface (solid)	Near-Surface	Point (Comment: At the aerodrome)	Full compliance with siting / exposure standards 1.0	Full compliance with siting / exposure standards Representative of aerodrome 1.0	0.1 mm/h 0.2 mm/h 1 mm/h 1.0				30 min 60 min 2 h 1.0	5 min 10 min 30 min 1.0

FIGURE XI.1: This table shows in red the addition of relative priority ratings. All priorities are set to 1.0 by default, which is the maximum of the possible values, until changed by the User. The values convey the relative priorities between the attributes within one Requirement (one row of blue cells) or, in the case of the general priority overall for the Requirement, as a rating of relative priorities between the different Requirements of this particular User / Application Area. Note the two additional columns proposed to represent the extent of the vertical coverage and the extend of the horizontal coverage. This allows the user to specific a threshold, goal and breakthrough levels for specifying how well the specified vertical layers and the horizontal coverage should be met.