Proposed organizational structure for a WCRP intercomparison project for reanalyses

By the Task Team for Intercomparison of Reanalyses (TIRA)

Background

The Task Team for Intercomparison of ReAnalyses (TIRA) was established by the WCRP Data Advisory Committee (WDAC) to gauge the need for a broad WCRP reanalysis intercomparison project and determine potential ways to implement this group within WCRP. Reanalyses combine model and observation data through data assimilation to produce a complete and consistent set of data that describes many components of the Earth system over the historical period of weather observations. As such, their data can be relevant to the missions of many WCRP efforts and to the society in general. However, new reanalysis data are being regularly released, and some centers are producing reanalyses with different levels of observing systems (e.g. satellite, radiosonde or only surface observations). The methods to handle the observations and models are quite complex and as with any such data product reanalyses exhibit uncertainties, but users of these data need to understand which systems are most appropriate for needs. Further, depending on the application, on the region in question or on the spatial / temporal resolution needed, a different reanalysis might be the best choice. However, for a user not familiar with the complex systems behind the reanalyses or with the time and means to engage in a comparison of the multitude of available data sets, these information should be made available to the users to support them in understanding reanalysis results. This is true for both new users and more advanced users who are not involved with reanalysis systems development.

Reanalyses have been available for research purposes since the mid 1990s. However, there has not been a WCRP group or panel dedicated to the status and interaction with reanalyses developers until reanalyses were incorporated into the WDAC at its formation in 2011. The WDAC has since tracked the developments in reanalyses and hosted the recent WCRP International Conference on Reanalyses (4th in 2012 and 5th in 2017). This proposal recommends the formation of an Earth System Reanalysis Intercomparison and Evaluation (ESRIE) group (panel, committee, project to be determined) to foster and manage reanalysis intercomparison projects as they are initiated or needed across the all/multiple WCRP core efforts. At this time, the precise organizational location of the group will need to be determined during the implementation of the recent WCRP Strategic Plan.

Recent reanalysis intercomparison project have succeeded on their own (e.g. SPARC Reanalysis Intercomparison Project – SRIP and CLIVAR's Ocean ReAnalysis Intercomparison Project – ORA-IP), which is very encouraging, both in the need for and future of this proposed ESRIE group. These projects provide some initial guidance on how discipline specific projects can be organized. So that, one of the goals of the ESRIE group will be to maintain and propagate the lessons learned and best practices on to the next reanalysis intercomparison projects. This also suggests that the ESRIE group should work collaboratively with the science groups and panels in WCRP. From the outset, this effort will be necessarily multidisciplinary, as reanalyses at numerical weather prediction centers are evolving toward coupled Earth system representation, but also because there are existing communities of disciplinary reanalysis-type systems for land, ocean and chemistry models and observation analysis science and development.

Proposed Objectives

The main purpose of the group is to provide the WCRP efforts a conduit with the reanalysis developers and other users, to better understand and utilize the many forms of Earth System Reanalyses. ESRIE will provide a resource for standards and best practices when evaluating reanalyses. In addition, reanalysis development centers, and discipline specific experts will have standing membership in the committee/group in order to convey the institutional knowledge and experience to both users and the executive members of WCRP. We expect that active reanalysis intercomparison projects (RIPs), populated with active participants, will regularly report to ESRIE (annually) and possibly also maintain a cross connection with a relevant WCRP science panel. RIPs may be initiated in WCRP's panels, within the Entity or through a collaboration of both. In addition, there will be connections with data centers and tools that provide intercomparison and/or evaluation services. These tools are useful to users and aim to provide access to the many formats of different data sets. Lastly, the group/committee/panel will promote and encourage the use of reanalyses within the diverse disciplines depending on or related to retrospective information on the Earth system's state. This includes straight forward scientific support for users such as climate services or policy-makers but also the provision of data necessary to enable downstream applications in various fields serving societal interests and needs such as hydrology, agriculture, renewable energy or economics..

Organization

ESRIE membership will consist of representatives of the reanalysis development centers and representatives from the WCRP panels (who have interest or are using reanalyses in their WCRP efforts). At-large members from the broader scientific community may also be invited to the committee/panel/group, if their active area of research may contribute to the objectives. We would look for 2 or 3 co-chairs to spread the travel and workload requirements, and term limits will be established. Membership will rotate on a renewable 3 year term basis. We will maintain term limits for members and co-chairs to allow for new ideas and experiences to be brought to the committee/group/panel management, but can have second terms based on interest and activity.

ESRIE will manage and facilitate the specific sub-groups, and the members may or may not be directly involved with a sub-group. At least two types of sub-groups are planned. Firstly, Reanalysis Intercomparison Projects (RIPs) will handle the bulk of the intercomparison or evaluation efforts. These may be cross connected to a WCRP panel or scientific effort, but that connection is not required. The RIPs will need to have objectives relevant to WCRP strategic goals. Recommended procedures and structures of RIPs will be documented based on successful past efforts (e.g. SRIP and ORA-IP). We also anticipate the need for Working Groups (WGs). WGs will be used to address specific questions or issues that may only need a short amount of time or otherwise do not fit a RIP paradigm. They may also be initiated to develop position statements or provide specific guidance. For example, data providers and intercomparison methods may be examples of working groups. All of the entity's sub-groups will have active membership and demonstrable consistent progress to maintain status. This model is generally

following the GEWEX Hydroclimatology Panel (GHP) template, where they manage Regional Hydroclimatology Projects (RHP) and Cross Cutting studies (CC).

WCRP Organizational Structure

Here, we will describe some similarities and uniqueness' the proposed ESRIE group has with existing groups in WCRP and its areas of support for the new WCRP Strategic Plan. The eventual organizational location of the proposed group will depend on further discussions and the implementation of the WCRP Strategic Plan. Presently, there are no groups focused on reanalysis in WCRP. WGNE does have representatives from NWP centers and include issues of reanalyses, especially data assimilation. These are generally systems development issues, which fit WGNE's objectives of model and forecast skill improvements. As stated before, SPARC and CLIVAR have undertaken reanalysis projects of their own, so this sort of distributed paradigm may also be a viable way forward. This approach, however, would lack continuity over time and collaboration across the WCRP efforts. The WDAC has assumed responsibility for reanalyses, since its inception. The main focus of the WDAC is observational data, which is a fundamental input component of reanalyses, even though they include a significant modeling component which imprints its uncertainty on the eventual data product. Furthermore, atmospheric reanalysis development centers are moving forward with plans for couple Earth system reanalyses, which will require the expertise spanning the efforts of WCRP. Reanalyses can provide certain fields useful in present day model evaluations, but, physical fields originating from model dynamics as well as relying on parameterizations (e.g. precipitation) also require good observations for evaluation.

Within the new WCRP Strategic Plan, the proposed entity fits mainly into Objective One, Fundamental Understanding of the Climate System. The analysis of observations provides consistent spatial climate fields on various spatial scales (global and regional) based on the observations. Reanalyses were conceived as a significant climate data tool. In addition, as reanalyses develop, they are becoming not only more useful but sometimes essential in societal decision making, and so relate to Objective Four, Bridging Climate Science and Society. For example, reanalyses data are widely used and often constitute the sole meteorological information source for renewable energy applications (transition to renewable energy). Lastly, reanalyses tie into the Strategic Plan's need for Critical Infrastructure through Simulation Tools, Observations and High-end Computing / Data Management. As with all data sets, reanalyses have uncertainties, because their structure and utility sit at the cross roads of models and observations, which also contributes their utility. The extensive number of variables and uses, encompassing the breadth of the Earth system, preclude reanalyses incorporation with any individual WCRP panel or project. ESREI should cross cut the rane of applicable Earth system research.

Initial Implementation

Recognizing that there is substantial discussion remaining on the configuration of the ESRIE group, we offer some potential initial components. The group will be drawn from TIRA members willing to shepherd the startup of ESRIE. There are some potential initial RIPs as well. WGNE is pursuing a MJO effort that includes reanalyses. The reanalyses intercomparison/evaluation component of that effort would make a point of collaboration. In addition, TIRA began a RIP in an effort to use a case study to assess the process of intercomparison and evaluation. This informal effort focused on the global energy budget in reanalyses. This effort may be able to partner with the GEWEX Data Analysis Panel (GDAP) effort on global energy terms and/or the Earth Energy Imbalance effort to form another collaborative RIP.

A potential working group could be formed to provide guidance and foster development of the CREATE and WRIT data and evaluation projects. These tools will be instrumental in facilitating intercomparison and evaluation, but they require substantial upkeep to keep existing and new products up to date. Likewise, it will be of critical importance to begin linking the science of reanalyses to the applied use of the data for climate services, decision making and downstream applications relevant to society.

The efforts of the TIRA team have led to significant preparations for this group. This proposal represents an initial plan for discussion of how to organize reanalyses science in the new strategic plan and its implementation. We expect that adjustments and revisions may be needed as this process evolves, and look forward to working with the greater WCRP community regarding reanalyses.