4th WCRP International Conference on Reanalysis

Wrap Up

Friday, 11 May 2012, Silver Spring MD

Keynote: Adrian Simmons

Ongoing business remains challenging and important

–recovery of observational data from past years

–improvement of assimilating models

–improvement of assimilation methods, including the treatment of model error

But we tend to shift from direct use of tried-and-tested NWP systems

–adjusting (statically or dynamically) background errors for earlier, more poorly observed periods

–developing longer-window data assimilation, in which reanalysis can benefit from additional observations made after the analysis time

And there are questions to be asked

–should we expect a single method to be optimal across the centuries?

–how quickly and fully should coupling be introduced with the ocean circulation, with atmospheric chemistry, …?

should global producers provide global downscaling to higher resolution?

Keynote Cont.

How do producers secure funding with a sufficient time horizon?

–to enable appropriate planning, preparation and execution of reanalyses

–to allow appropriate international coordination

How many comprehensive global reanalyses do users need?

–covering which periods, how often refreshed, when to be terminated?

–are three or four main centres producing for global consumption enough?

–how many from around the Capital Beltway?

–is regional reanalysis a better focus for potential new entrants?

To what extent is international coordination needed?

- ***development of input datasets*** (observations, forcing fields, emissions, …)

–over timing of mainstream production

–over running of supplementary data assimilations and model integrations

–over linking of activities with climate modelling ***(ESG-ongoing)***

- ***Contributions to State of the Climate***

and how formal can or should this be?

Status and Plans

- GMAO - Developing IESA components; MERRA Innovations quick look
- NCEP - CFSRL underway with noted improvements - Hybrid 3D-V EnKF
  - Collaborations with GMAO on Assim. e.g. cloud affected radiances
- ESRL - Sfc based reanalysis shows skill throughout the Trop., need long record - extremes and CMIP5
- JRA **go go**! shows improvement - planned are a family of experiments

Status and Plans Cont.

- ECMWF - ERA CLIM - Building a succession of reanalyses - ensemble model, pressure, land, satellite era
- Ocean Reanalyses - Thriving - data record issues, new data opportunities GRACE, SMOS Aquarius

- Are there too many? No
- When to run a new reanalysis? If a development represents a contribution beyond current capability

Atmospheric Reanalyses

- Why Bother?
  - Regional reanalyses provide value-added information beyond the global reanalyses (e.g. Surface met.)
- Regional Ensembles
  - Ensemble mean provides some additional benefit, uncertainty
  - Systematic bias in the forcing reanalysis can have adverse impact on regional downscaling
- Extremes
  - Climate models need only represent well the first 4 moments of daily variability, but long reanalyses are needed for statistical significance

Atmospheric reanalysis Cont.

- Arctic shows variability among global reanalyses; uncertainty related data volume
- Reanalyses initialize model simulations
  - Can expose errors in GCMs
  - Need assimilated obs (and Innov./Feedback)
  - Better characterization of reanalysis uncertainty
- An underlying objective of reanalysis is to improve the background models

Integrated Analysis

As reanalyses have evolved a broad range of Earth system research activities are growing

Aerosol - Sulfate, pollution, fire assimilated and interacting - Increments provide assessment

Land - SM, Snow, T - Coupling strength

Isotope - Proxy modeling for Paleo

Arctic – regional reanalyses to get at the rapid changes in sea ice - Glacier mass budgets

Ocean Reanalyses

- A large number of ocean reanalyses are being produced - ensembles have benefit
- Need to control biases, but how:
  - e.g. bias correcting forcing data, variational correction via EnKF
- Biases also affected changing observing system, how to address the radical variations of the ocean observations
- Historical reanalyses El Nino looks promising; High ensemble skill
- Resolution may improve MOC

Land Reanalysis

- Precipitation bias correction of atm reanalysis needed for hydrologic application
- ET from recent global reanalysis products, e.g., CFSR, MERRA, MERRA-Land, ERA-Interim, JRA, can be useful in land-atmosphere coupling studies.
- Hourly surface data should have benefit, resolve the diurnal, evaluate parameterizations
- NCEP CFSR GLDAS replay to improved spin-up initial conditions and one continuous simulation to support the proposed Global Drought Monitor activities.
- Full assimilation: soil moisture, snow, temperature to be realized; but subject to observing system variations

Data assimilation

- emerging hybrid Var/EnKf, but also other, non-Gaussian techniques such as Particle Filters being explored
- some potential identified in ocean-atmosphere coupling
- stratosphere/mesosphere and deep ocean: poorly observed, difficult (impossible?) to anchoring
- model and obs covariances: many open questions (background, update, inflation, localization, multivariate, balance)
- bias correction: several methods but noted both models and obs have biases
- Weak constraint 4dVAR – estimate/correct model bias
- seamless nesting to work across scale with heterogeneous grids

User Applications

- Examples were presented:
  - drought
  - precipitation extremes
  - tropical cyclones
  - climate projections
  - regional downscaling
  - wind farm investment and reinsurance
  - ...

But there exist discrepancies between reanalyses (uncertainty), need to factor this into the decision making

In Situ Observations

- Homogenization of radiosondes has had tremendous positive impact, further developments are crucial
- Integrated Global Radiosonde Archive (IGRA): potential to double data base, focus on 'big wins'
- changes in radiosonde hardware and processing sometime difficult to identify
  - humidity homogenization important, but very difficult
- ICOADS input to almost all reanalyses, essential for community but budget cuts
- GRUAN essential because non ref observations have biases, need some redundancy to constrain structural uncertainty and detect trends; How to best use GRUAN?

Remotely Sensed Observations

- Conflicting goals in atmospheric reanalyses
  - time homogeneous data sets
  - utilization of the best newest data sets
  - response: Families of reanalyses
- Reprocessings are critical (e.g. AMV)
- How to make better use of sat data bias estimates? Entrain data reprocessing? Intercalibrations?
- centralized and decentralized facilities: expand potential for applications
- geolocation land/ocean boundaries

Next Steps

- Next Conference?
  - 4-5 years, likely Europe
- Other potential meetings?
  - Reanalysis "Summer School"; grad/ECS training
  - User's Workshop - perhaps geared more toward ECS - may have issues
- International Coordination?
  - Input Observations - share best practices, expertise among all reanalysis developers
  - Processing timing coordination?
  - State of the Climate - coordinated comparisons - possibly through reanalysis.org
  - Reanalysis projects should only use data that can be passed through e.g. feedback files

Report

Excellent work from the rapporteurs!

Will compile a first draft, and ask program committee and session chairs to review

Second draft will be posted online for open review (reanalysis.org) and announced to conference registrants (3-4 week period)

Final doc will be a WCRP report, summary submitted to EOS

Acknowledgements

Session	Chair	Senior rapporteurs	Junior rapporteurs
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