World Weather Research Programme (SSC-11)

Data Assimilation and Observing Systems (DAOS)

Co chairs: Carla Cardinali and Daryl Kleist

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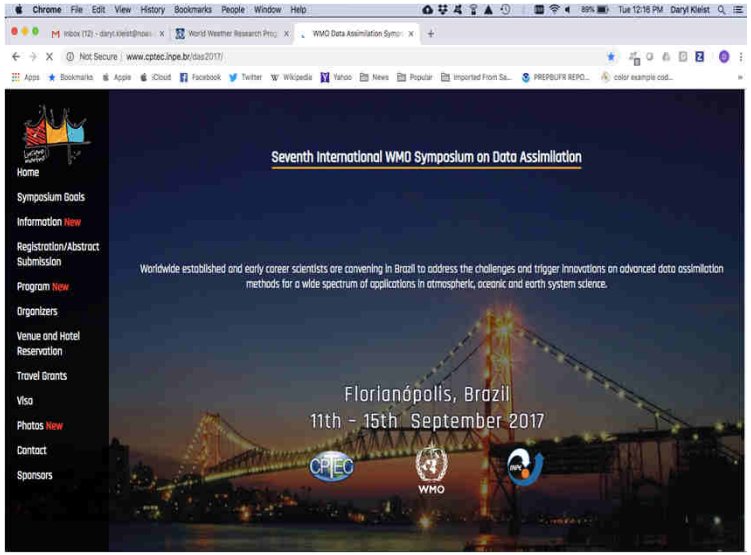
Highlights

- 7th WMO DA Symposium (Brazil, September 2017)
  - Quadrennial event, summary paper in review to be published as a WMO report
  - Presentations available on symposium website: http://www.cptec.inpe.br/das2017/
  - 204 participants from more than 20 countries, 42% women presenters, heavy early career scientist presence. Huge success.
  - WG discussion on future symposia (many DA meetings out there now)



- Coordination with International Symposium on Data Assimilation
  - Near-annual event, smaller in size and scope
  - 6th ISDA in Munich, March 2018. DAOS co-chairs served on program committee

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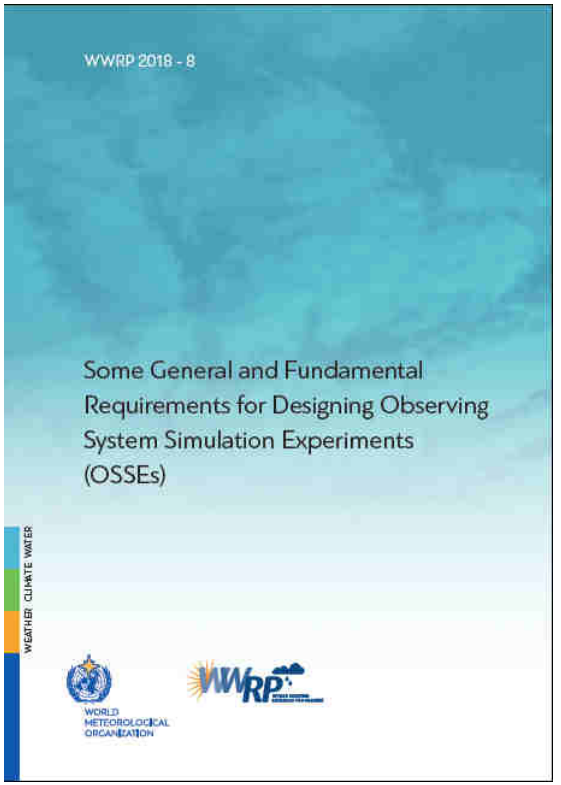
Highlights

- Organized white paper on OSSEs. Reviews completed and now published online:
  - https://www.wmo.int/pages/prog/arep/wwrp/new/documents/Final_WWRP_2018_8.pdf

- DAOS working group member (Sharan Majumdar) co-leading review paper in BAMS on nowcasting and forecasting High Impact Weather



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Highlights

- Annual working group meeting held jointly with Mesoscale and Nowcasting
  - Identified areas of mutual interest and potential projects. Will participate in having an assimilation session at the upcoming nowcasting symposium.
  - Discussions on DA inter-comparison for km-scale, involvement in current (RELAMPOGO) and future (Paris Olympics demonstration) campaigns, joint workshops

- Designated liaisons to projects/WGs with varying degrees of activity

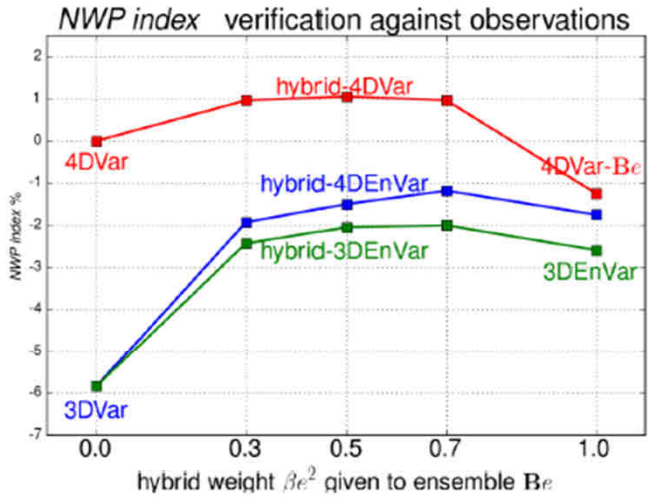
Highlights: DA Algorithm (Global NWP)

Met Office

Hybrid-4DVar versus hybrid-4DEnVar

Performance difference

- Hybrid-4DEnVar operational at ECCC and NCEP. Semi-operational with KIM.
- **However**, ~2% worse than hybrid-4DVar at the Met Office:



- But much cheaper than hybrid-4DVar, so we can use it as the basis for a new ensemble…

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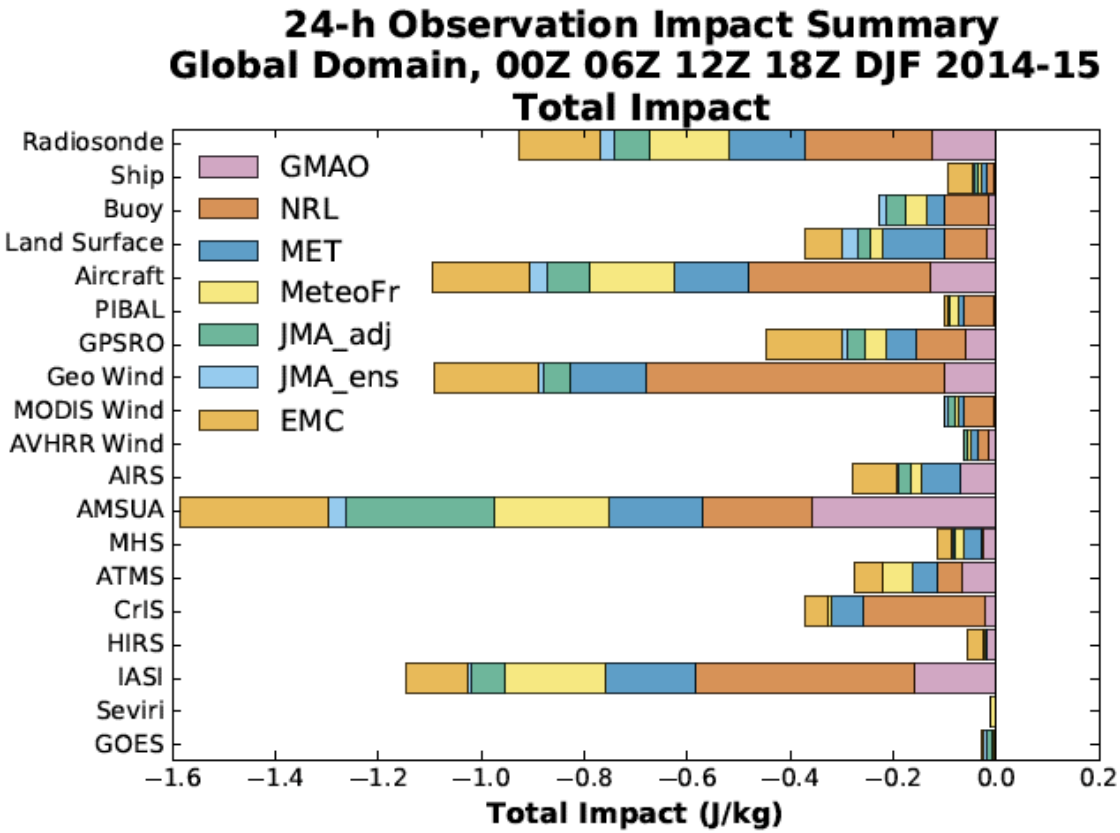
Priority 1: AA15 – Support Facilities

- DAOS has a history of facilitating inter-comparison efforts. In the past year, we have begun exploring the formalizing of a Forecast Sensitivity to Observations Impact (FSOI) inter-comparison effort.

- Recent study led by JCSDA in the US



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Priority 1: AA15 – Support Facilities

- In the next two years, build upon this effort to
  - Bring in additional centers for additional FSOI inter-comparison for periods of interest
  - Standardize database for exchange of FSOI information
  - Establish real-time facility for operational centers to contribute such information to the standardized database
  - Identify a Lead Center for collection of information
  - Expand and generalize database for exchange of additional information
    - Observation space: Assimilation usage, observation errors, quality control, bias correction, O-F, O-A, etc.
    - Analysis increments (extremely useful for diagnosing model bias)

- This has huge potential for use of the observations in other assimilation systems, better understanding, verification, etc.

Priority 1: AA15 – Support Facilities

- Open source, object-oriented (shared) infrastructure

The Joint Effort for Data assimilation Integration (JEDI) is a collaborative development spearheaded by the JCSDA:

1. **For research and operations** (including O2R/R2O). Facilitate innovation to address next DA scientific challenges, and optimize code performance
2. From toy models to **coupled Earth system models**
3. **Separation of concerns** to increase science productivity, and scale with distributed developments
4. **Mutualize components** (across observations, model grids, applications) without imposing one approach

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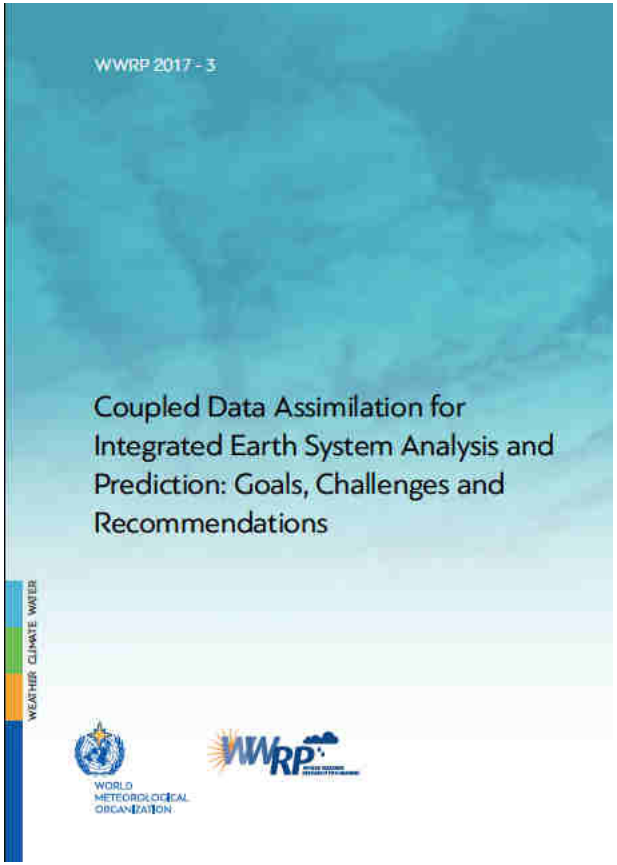
Priority 2: AA3 – Fully Coupled

- DAOS has been involved in exploring, supporting, and making recommendations for coupled data assimilation for the past several years
  - 2016 Coupled DA Workshop and White Paper
    - https://www.wmo.int/pages/prog/arep/wwrp/new/documents/Final_WWRP_2017_3_27_July.pdf
  - Coupled DA Session at 2017 WMO DA Symposium
  - One motivation for the OSSE white paper was to provide guidance on new OSSEs for coupled earth system models



- View this is as a critical research frontier for S2S, PPP, and HiWeather

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Priority 2: AA3 – Fully Coupled

- Continue to promote research into how strongly to couple components
- Exploration of initialization within context of coupled data assimilation and modeling
- Observing System Experiments and Observing System Simulation Experiments for coupled models
- Promotion of additional observations at the interfaces (fluxes, for example), timely delivery of observations (ocean, etc.)
- ***Coupled Reanalysis***

Priority 3: AA18 – Future GOS

- DAOS has historically played a role in OSEs and FSOI inter-comparison to assess value of assimilation of observations into NWP
  - Including targeted observation recommendations
  - Needs to be expanded to km-scale and coupled modeling

- Need research on better exploitation of current global observing system
  - All sky radiances for NWP
  - Adaptive selection and thinning
  - AI for extraction of maximal information content
  - Coupled DA

- New missions: quantitative evaluation of ADM Aeolus winds; testing/recommendations on hyperspectral IR from geostationary?

Priority 3: AA18 – Future GOS

- Identification of other weaknesses, gaps, and grand challenges
  - Land/Hydrology
  - Middle/Upper Atmosphere
  - Constituent/Composition
  - Interfaces & Fluxes

- Proposing to establish formal FSOI inter-comparision project and regular contributions from operational centers
  - Once database is established, expand to other DA-related information such as data usage, quality control, bias correction, O-F, O-A, and increments in physical space

- Help design experiments to better understand and explore needs of the three projects from an assimilation perspective

- Non-traditional and private sector observations

General matters

- DAOS needs to make a concerted effort to re-emphasize the ***O*** in our working group. Joint workshop on capture/use of unconventional obs.
- WG is about to experience extremely high turnover. Need to put some thought into membership
- DAOS really needs to connect to WCRP on reanalysis activities, strengthen connections to RDP/FDP activities.
- Strong will from our working group to push for observation database; standardization and exchange of assimilation-related information. Do the projects and WGs see value?
- Joint working group meetings have worked really well. We could even explore joint symposia for topics of interest
- Begin planning for next WMO DA Symposium (2021). DA training (with or separately from symposium)?

Working Group Membership

- *Carla Cardinali*
- **Daryl Kleist (NOAA/NWS/NCEP)**

- **Tom Auligne (JCSDA USA)**
- *Mark Buehner (ECCC)*
- **Nadia Fourrie (Météo France)**
- *Stefan Klink (DWD)*
- **Ulrich Löhnert (Univ. of Köln)**
- *Sharan Majumdar (Univ. of Miami)*
- **Saroja Polavarapu (ECCC)**
- **Juan Ruiz (CIMA-UBA Argentina)**
- *Bin Wang (CMA)*

Thank you
Merci

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