

WORLD METEOROLOGICAL ORGANIZATION

INTERGOVERNMENTAL OCEANOGRAPHIC
COMMISSION (OF UNESCO)

DATA BUOY COOPERATION PANEL

DBCP-28/ Doc. 8.2
(28-Aug-12)

TWENTY-EIGHTH SESSION

ITEM: 8.2

FREMANTLE, AUSTRALIA
2-6 OCTOBER 2012

ENGLISH ONLY

**PROGRESS REPORT ON PILOT PROJECT ON THE IMPACT OF SLP FROM DRIFTERS ON
NWP**

(Submitted by Luca Centurioni, USA)

Summary and purpose of the document

This document provides information on progress regarding the DBCP Pilot Project on the impact of Sea Level Pressure (SLP) from drifters on Numerical Weather Prediction (NWP). It particularly provides feedback on the outcome of the DBCP Pilot Project workshop that was held in Sedona, USA, on 21 May 2012.

ACTION PROPOSED

The Panel will review the information contained in this report and comment and make decisions or recommendations as appropriate. See part A for the details of recommended actions.

Appendices: A. Impact studies of SLP data from buoys

-A- DRAFT TEXT FOR INCLUSION IN THE FINAL REPORT

8.2.1 The Panel recalled its decision a DBCP-27 to start a pilot project on the impact of SLP measurements from drifters on NWP chaired by Dr Luca Centurioni (USA). To this end, the Pilot Project organized a workshop to assess the state of the art and establish a robust background to support the pilot project operations. The workshop was held in Sedona, Arizona, on May 21, 2012, in conjunction with the fifth WMO Workshop on the Impact of Various Observing Systems on NWP. Workshop attendees : Carla Cardinali (ECMWF), Luca Centurioni (Chair, SIO, USA), Ronald Errico (NASA, USA), John Eyre (UKMO, UK), Ron Gelaro (NASA, USA), Rick Lumpkin (co-Chair, AOML, USA), Jean-Francois Mahfouf (Météo France, France), Wenjian Zhang (WMO Secretariat). Several participants gave a presentation. A full report of the workshop and the presentations are available on the web¹. The questions posed to the attendees were:

- 1) What is our understanding of the impact of SLP from drifters on NWP and are further investigations needed for a quantitative assessment?
- 2) What are the correct metrics to assess the impact?
- 3) Are we ready to summarize the state of the art on the subject in a manuscript that could be submitted to a peer-reviewed journal such as BAMS?

8.2.2 The Panel noted the main conclusions, also available in the workshop report, as listed below:

- One repeated theme was the value of the adjoint approach (i.e. impact studies) vs. OSEs, and OSSEs (the latter require much bigger efforts than OSEs). Using the adjoint approach, the value of observations can be quantified quickly, with little extra effort. Some OSE efforts are underway and OSSEs can answer questions that can't be fully addressed with the adjoint and OSE approaches, such as what would be the effect of doubling the number of Southern Ocean barometer drifters.
- Several studies presented in this workshop and in the fifth WMO workshop grouped all buoys (drifting and moored) or all buoy and all ship measurements together. From the pilot project perspective, there is still the need to isolate drifter SLP data from other data buoys. This could also be done for subsets of the drifting buoy data, for example for low-latitude observations to evaluate the NWP value for following the DBCP recommendation that all drifters be outfitted with barometers.
- All studies are based on dry or wet total energy metrics, i.e. integrated over the full depth of the atmosphere. The best metrics to evaluate impact of the drifter data should be identified or at least further discussed. Should they focus on lower troposphere? It was suggested that the most straightforward approach would be to focus on surface energy: surface wind (kinetic energy), and perhaps temperature (potential energy).
- A North Atlantic case study (ECMWF) demonstrates that the drifter data makes particularly significant impacts during cyclogenesis. This result emphasizes the need to examine particular cases in other regions: globally averaged metrics don't emphasize peak events during cyclogenesis, but rather average these intermittent events with long periods of relatively quiescent weather.
- Degraded wind forecasts would also degrade wave nowcasts/forecasts, something not considered in the various presentations.
- There was an overall consensus among the attendees that the results presented at this workshop are sufficient in novelty and scope to be adaptable to a BAMS paper on this subject. A lead author, preferably from the NWP community, needs to be identified and Luca Centurioni is talking to possible candidates. A good goal for the time scale of submission would be by the end of 2012 for a variety of practical reasons associated with funding cycles and hardware procurement.
- Even if no further progress is made by next year, the results presented at this workshop

¹ http://www.wmo.int/pages/prog/www/OSY/Meetings/Wshop-Impact-NWP-5/dbcp/dbcp_slp1.html

already present considerable evidence of the value of SLP data from buoys, particularly high-latitude open-ocean buoys (predominantly drifters), even using a metric that doesn't focus on surface observation forecasts.

8.2.3 The Panel agreed on the following, and tasked the Pilot Project Chair to lead these actions and report on the outcome at the next Panel Session (**action; L. Centurioni; DBCP-29**):

- To compile and submit the BAMS paper before the end of 2012 and use pilot funds to pay for the publications fees;
- To invite colleagues from the Naval Postgraduate schools in Monterey (California) to join the discussion;
- To invite colleagues from the Meteorological community to publish online, routinely, the results of their impact studies (adjoint) for drifters only, and link such information to the DBCP web page;
- To continue the discussion with colleagues from the Meteorological community on whether it is more valuable entertain a new OSE data denial experiment targeting drifters only or investigate specific cyclogenesis episodes for which SLP from drifters had a particularly significant impact and compile a comprehensive list of such cases;
- Based on the results of 8.2.4, to move forward by commissioning, with the pilot funds, an OSE study or the analysis of cyclogenesis episodes with concurrent SLP drifter data (by partially supporting a post-doc at ECMWF).

Appendix: 1

APPENDIX A

IMPACT STUDIES OF SLP DATA FROM BUOYS

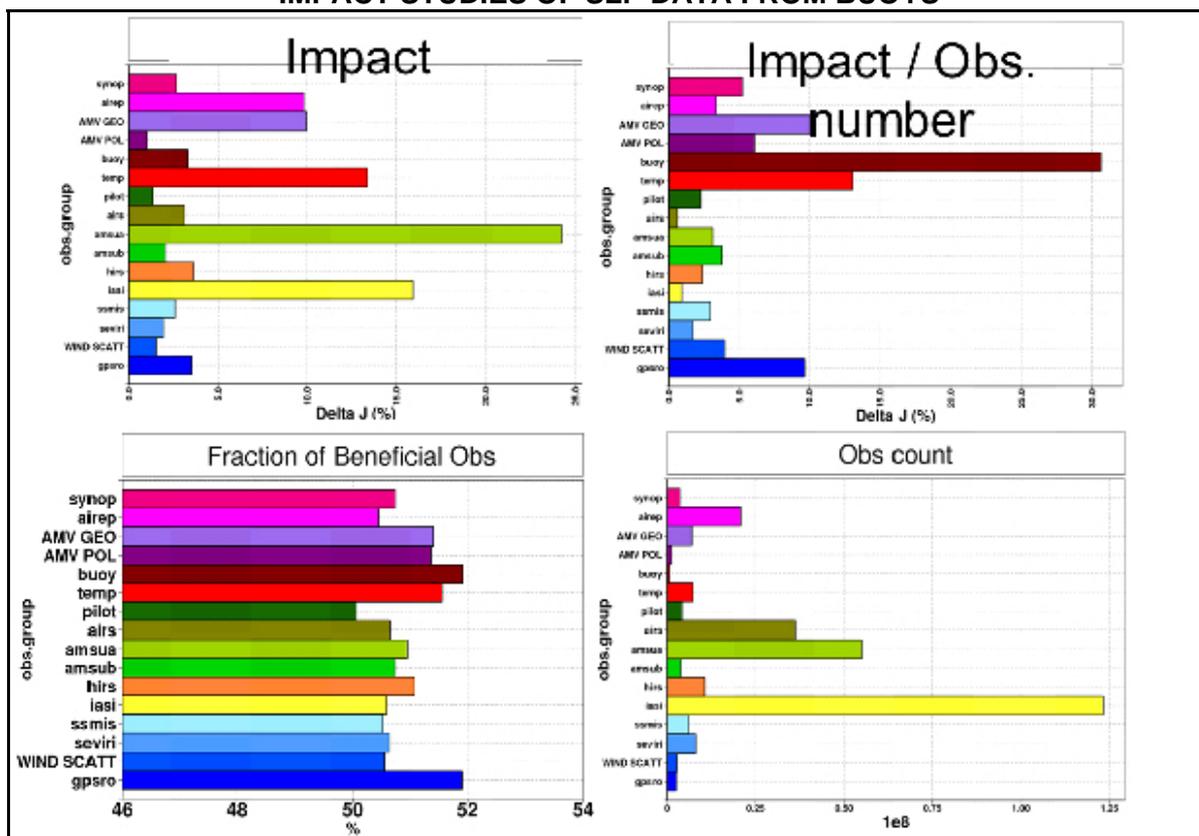


Figure 1: Impact of SLP data from buoys (drifting and moored) in the Adjoint with 4-D var assimilation Meteo-France system. December 2010 to January 2011. . The global impact (reduction of the dry energy norm) is relatively small in absolute terms, but largest when normalized by number of observations, and the fraction of beneficial observations is very large (anything above 50% is considered very good). From Jean-Francois Mahfouf, Meteofrance

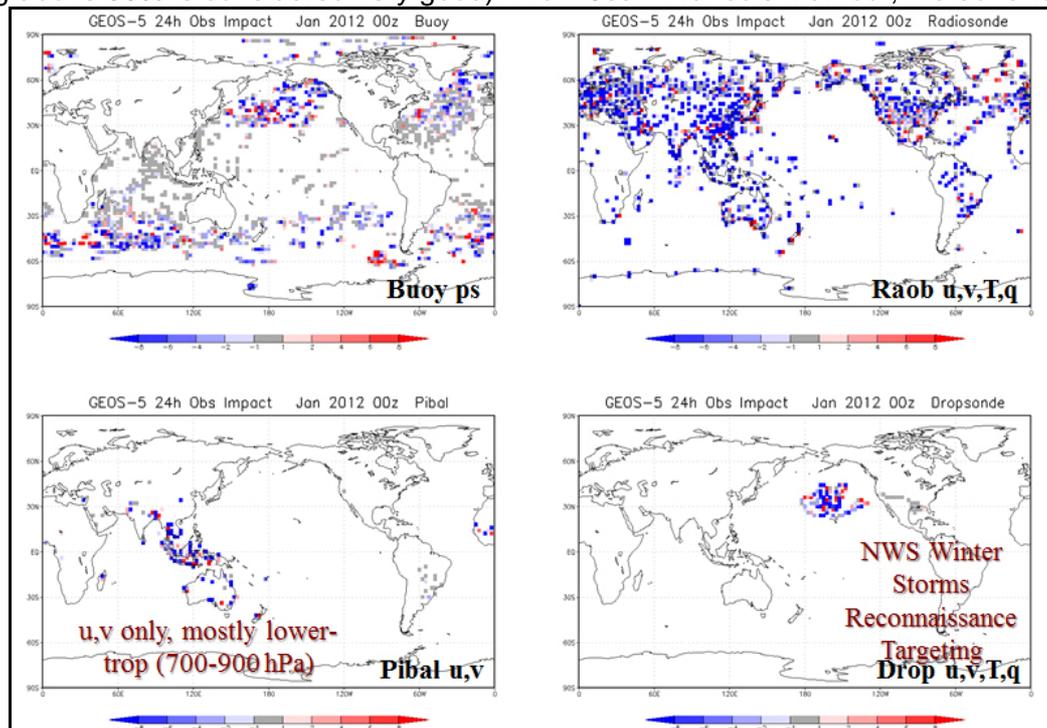


Figure 2: Impact of buoys (moored and drifting) from GMAO's adjoint of the GEOS-5 atmospheric data assimilation system in January 2012. The geographical distribution of buoys' impact (blue is very good) shows, especially in the open ocean, the impact of drifters. Note the very positive effect in the southern ocean North Pacific/North Atlantic in boreal winter. From Ron Gelaro, GMAO-NASA.

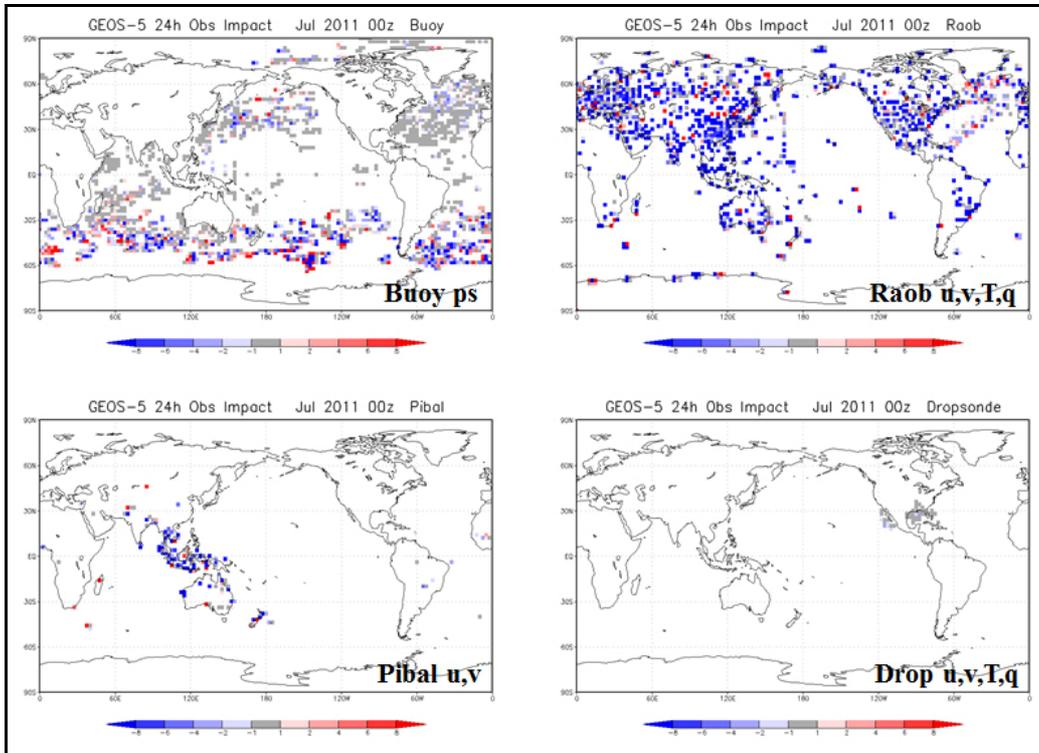


Figure 3: As figure 2 but for July 2011. Note the large impact of the SLP data from drifters in the Southern Ocean during the austral winter and their reduced impact in the North Atlantic Ocean and North Pacific Ocean. From Ron Gelaro, GMAO-NASA.

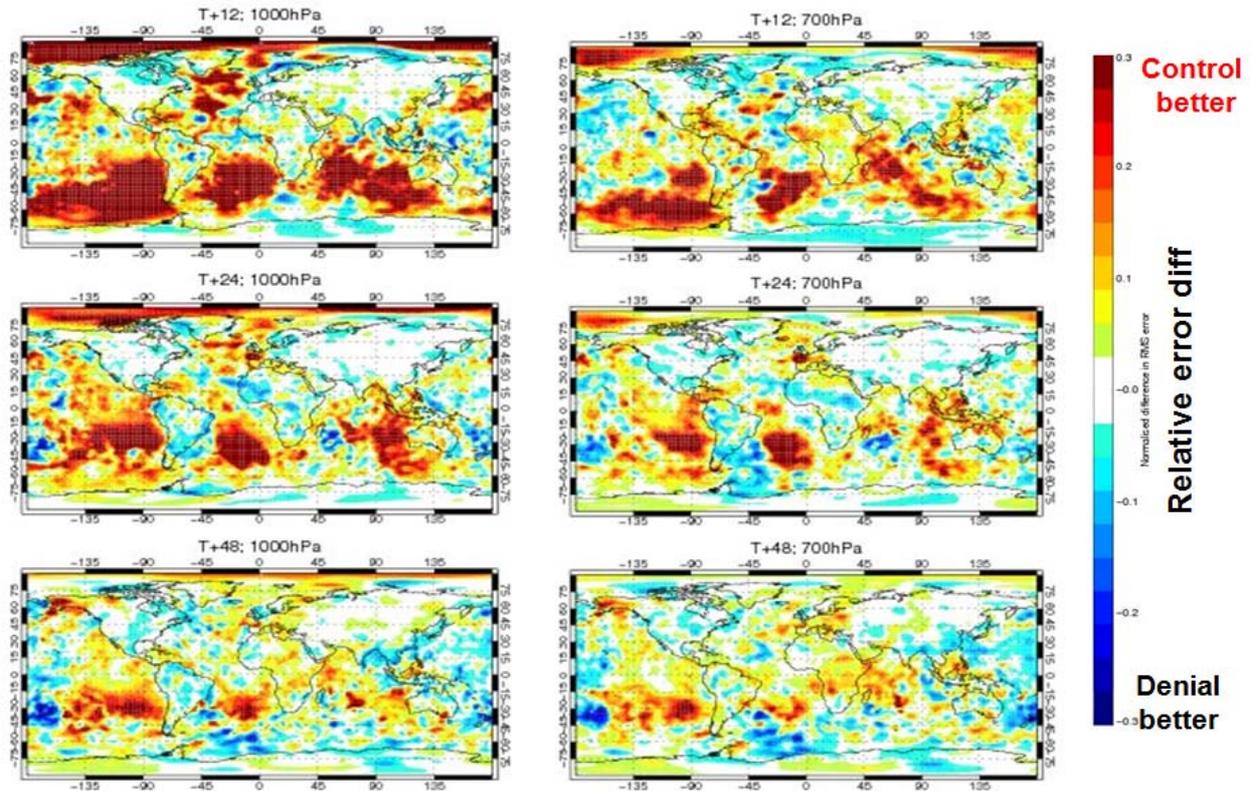


Figure 4: OSE (which constrains the perturbation) assumes the control run is the reference truth (probably a good guess as drifter data is accurate) but also depends on metric used. With total dry energy metric the drifters have a very large positive impact (control run will all data is better) and propagates through the troposphere up to 700 hPa. From Claudia Cardinali, ECMWF.
