BoM Model Description

Name: BoM POAMA Ensemble

The S2S database contains real-time forecasts from BoM from 1st January 2015, and the full set of re-forecasts.

1. Ensemble version

Ensemble identifier code: P24
Short Description: Global ensemble system that simulates initial uncertainties using coupled bred vectors and ensemble data assimilation and model uncertainties due model errors using three slightly different model versions. The ensemble system has 33 members (11 from each of the 3 model versions) run twice a week (Sunday and Thursday at 00Z) up to 9 months.

Research or operational: Operational
Data time of first forecast run: 22/05/2013

2. Configuration of the EPS

Is the model coupled to an ocean model? Yes from day 0
If yes, please describe ocean model briefly including frequency of coupling and any ensemble perturbation applied: Ocean model is ACOM2 (Schiller and Godfrey 2003), which is based on GFDL MOM2 with 2 degree zonal resolution and 0.5 meridional resolution and 25 vertical levels.
Forecasts are initialized from the PEODAS (POAMA Ensemble Ocean Data Assimilation System, Yin et al. 2011) that assimilates sub surface temperatures and salinity with an approximate Kalman filter. Surface forcing (stress and evaporation minus precipitation) during ocean assimilation cycle for the hindcast reanalyses is taken from ERA-interim reanalyses and for real time system from the BoM global NWP system. Frequency of coupling is 24-hourly.

Is the model coupled to a sea ice model? No - Sea ice is specified to vary with climatological seasonal cycle.
If yes, please describe sea-ice model briefly including any ensemble perturbation applied: N/A

Is the model coupled to a wave model? N/A
If yes, please describe wave model briefly including any ensemble perturbation applied: N/A

Ocean model: ACOM2 (based on GFDL MOM2)
Horizontal resolution of the atmospheric model: T47 (~250km)
Number of model levels: 17
Top of model: 10 hPa
Type of model levels: sigma
Forecast length: 9 months
Run Frequency: twice a week (Sunday 00Z and Thursday 00Z)
Is there an unperturbed control forecast included? Yes
Number of perturbed ensemble members: 32
Integration time step: 30 minutes

3. Initial conditions and perturbations

Data assimilation method for control analysis: Nudging from 4dVar reanalysis
Resolution of model used to generate Control Analysis: T47
Ensemble initial perturbation strategy: Coupled bred vectors
Horizontal and vertical resolution of perturbations: T47
Perturbations in +/- pairs: no

Initialization of land surface:

1. What is the land surface model (LSM) and version used in the forecast model, and what are the current/relevant references for the model? Hydrology (soil moisture) is a bucket following Manabe and Holloway 1975. The land model has 3 soil layers for temperature.

Are there any significant changes/deviations in the operational version of the LSM from the documentation of the LSM? No

2. How is soil moisture initialized in the forecasts? realistic

If “realistic”, does the soil moisture come from an analysis using the same LSM as is coupled to the GCM for forecasts, or another source? Please describe the process of soil moisture initialization. The land surface (temperature and moisture) is initialized by nudging the atmospheric model to the ERA-40 reanalyses beginning in 1980. The process is described in Hudson et al. (2011). In essence, the land surface is initialized by responding to observed surface fluxes.

Is there horizontal and/or vertical interpolation of initialization data onto the forecast model grid? If so, please give original data resolution (s). N/A

Does the LSM differentiate between liquid and ice content of the soil? If so, how are each initialized? No

If all model soil layers are not initialized in the same way or from the same source, please describe.
3. How is snow initialized in the forecasts? realistic

If "realistic", does the snow come from an analysis using the same LSM as is coupled to the GCM for forecasts, or another source?

Please describe the process of soil moisture initialization. Snow is accumulated appropriately if the atmospheric model in the spin up run (nudged to ERA-40) makes snow and temperatures are below freezing.

Is there horizontal and/or vertical interpolation of data onto the forecast model grid? If so, please give original data resolution(s)

Are snow mass, snow depth or both initialized? What about snow age, albedo, or other snow properties? Snow mass is initialized by above process. Albedo is prescribed.

4. How is soil temperature initialized in the forecasts (see above)

Is the soil temperature initialized consistently with soil moisture (frozen soil water where soil temperature 0°C) and snow cover (top layer soil temperature 0°C under snow)? yes

• Is there horizontal and/or vertical interpolation of data onto the forecast model grid? If so, please give original data resolution(s)

If all model soil layers are not initialized in the same way or from the same source, please describe.

5. How are time-varying vegetation properties represented in the LSM? N/A

6. What is the source of soil properties (texture, porosity, conductivity, etc.) used by the LSM? N/A

7. If the initialization of the LSM for re-forecasts deviates from the procedure for forecasts, please describe the differences. The only difference is that in realtime, the atmospheric model is nudged to the BoM NWP analyses rather than ERA-40.

4. Model Uncertainties perturbations:

Is model physics perturbed? 3 model versions (two with different treatments of shallow convection, one with flux adjustment)
Do all ensemble members use exactly the same model version? Same
Is model dynamics perturbed? Yes
Are the above model perturbations applied to the control forecast? The control (unperturbed) initial condition is run with the 3 model versions

5. Surface Boundary perturbations:

Perturbations to sea surface temperature? yes, via breeding
Perturbation to soil moisture? Yes, via breeding
Perturbation to surface stress or roughness? Yes, via breeding
Any other surface perturbation? No
Are the above surface perturbations applied to the Control forecast? no
Additional comments

6. Other details of the models:

Description of model grid: spectral transform grid (144,72)
List of model levels in appropriate coordinates:
What kind of large scale dynamics is used? Spectral
What kind of boundary layer parameterization is used? Louis (1983)
What kind of convective parameterization is used? Tiedtke 89
What kind of large-scale precipitation scheme is used?
What cloud scheme is used? Tiedtke 89 convection, Tiedtke 88 shallow convection with Smith (1990) cloud scheme
What kind of land-surface scheme is used? 3-level soil with Manabe and Holloway (1975) bucket
How is radiation parametrized? Fels-Schwarzkopf 1991
Other relevant details?

7. Re-forecast Configuration
Number of years covered: 1981-2013
Produced on the fly or fix re-forecasts? fix
Frequency: on 1st, 6th, 11th, 16th, 21st, 26th of each month. 33-members are run for 9 months for 1980-2013.
Ensemble size: 33 members
Initial conditions: Nudged atmos-land using ERA Interim. Ocean from PEODAS reanalyses. Is the model physics and resolution the same as for the real-time forecasts: Yes
If not, what are the differences: NA
Is the ensemble generation the same as for real-time forecasts? Yes, coupled bred vectors
If not, what are the differences: NA

Other relevant information:
POAMA24 uses 3 model versions (24a, 24b, 24c). There are 11 ensemble members for each version. There are only 11 initial conditions, so the same initial conditions get used by each model version. So, there are 3 control members (1 from each model) and 10 perturbed members from each model version.

The numbering is:
e00 is control for P24a and e01-e10 are perturbed members for P24a
e11 is control for P24b and e12-21 are perturbed members for P24b
e22 is control for P24c and e23-32 are perturbed members for P24c.

The lead-time dependent climatologies for each model are different, so the 3 versions need to be treated separately to form anomalies before forming grand ensemble mean (and/or spread).

8. References:
Comprehensive description of the model physics:

Description of the extended range forecasts/ensemble perturbations:

Description of Ocean Reanalyses/Assimilation:

Description of Atmosphere/Land Initialization:

9. Configuration in the S2S archiving

The BoM re-forecasts dataset is a “fixed” dataset which means that the re-forecasts are produced once from a “frozen” version of the model and are used for a number of years to calibrate real-time forecast. The BoM re-forecasts consist of a 33-member ensemble run 6 times a month (1st, 6th, 11th, 16th, 21st, 26th of each month) from 1981 to 2013. The full re-forecast dataset is now available in the S2S database.

As for the other models, BoM re-forecasts are archived in the S2S database with 2 date attributes:

- hdate which corresponds to the actual starting date of the re-forecast
- date which correspond to the ModelVersionDate. Since the BoM re-forecasts are “fixed” re-forecasts, the ModelVersionDate is the same for all the re-forecasts and equal to 20140101. This variable will change when a new version of the BoM seasonal forecast model will be implemented.