

## Slimline decadal prediction proposal

### Version 3.2

#### Basic model runs:

- 1.1 10 year integrations with initial dates towards the end of 1960, 1965, 1970, 1975, 1980, 1985, 1990, 1995 and 2000 and 2005 (see below).  
Ensemble size of 3, optionally to be increased to O(10)  
Ocean initial conditions should be in some way representative of the observed anomalies or full fields for the start date.  
Land, sea-ice and atmosphere initial conditions left to the discretion of each group.

Model run time: 300 years (optionally, an additional 700 years)

- 1.2 Extend integrations with initial dates near the end of 1960, 1980 and 2005 to 30 yrs.  
Each start date to use a 3 member ensemble, optionally to be increased to O(10)  
Ocean initial conditions represent the observed anomalies or full fields.

Model run time: 180 years (optionally, an additional 420 years)

#### Further details on these runs:

- Calendar start date can be 1<sup>st</sup> September, 1<sup>st</sup> November, 1<sup>st</sup> December or 1<sup>st</sup> January, according to the convenience of the modeling group. Dates should allow complete years/decades to be analysed, eg start 1<sup>st</sup> Sep 1960, 1<sup>st</sup> Nov 1960 or 1<sup>st</sup> Jan 1961.
- Actual integration length should be long enough to produce 10 or 30 complete calendar years. We expect any extra ‘initial’ months to be discarded in the analysis.
- Choice of initial conditions is up to each group, subject to the principle that they should represent the observed anomalies for the start date. Analyses of past ocean states and/or anomalies are available. Methods to transfer such analyses into an ocean model’s initial condition exist. Most experience so far is of using observed anomalies on top of the coupled model climate, but initializing with the full state is also allowed, and will be used by some groups.
- All forcings should be included as observed values for past dates, with prescribed concentrations of well-mixed GHGs. The details should be the same as used in the CMIP5 historical (20<sup>th</sup> C) runs, with the same flexibility on the treatment of ozone and aerosol and the same specified observational datasets.
- For future dates, the RCP4.5 scenario should be used if possible. Specification of reactive species and aerosols will follow those used in CMIP5.
- Any deviations from the standard specifications should be properly documented.
- If sea-ice needs to be specified instead of being modeled, then “no cheating” applies: values cannot be specified using observations later than the start of the run. Persistence of ice from eg the year or decade prior to the start of the run is allowed.
- Note the treatment of volcanic aerosol: observed values should be used for past dates, as per CMIP5, but values to be used after 2005 should be specified based on the

- assumption of no further volcanic eruptions. The model runs are thus configured to predict what will happen to climate, relative to the observed past, if no major eruptions take place, which is a possible outcome for a thirty year period.
- **Optional:** Additional runs from 1960, 1975, 1980, 1985 and 1990 should be made without including the Agung, El Chichon and Pinatubo eruptions. This allows an assessment of the impact of volcanic eruptions on decadal predictions. It also allows an estimate of “overall skill” of decadal prediction to be made, complementing a dual analysis of “expected skill conditional on no big volcano” and “possible impact of volcano”. These runs could either all be 10 years long, or the 1960 and 1980 runs could be 30 years to assess the longer term impact of the volcanoes.

Requested model runs (not compulsory, but part of coordinated comparison)

- 1.3 10 year integrations from near end of 2001, 2002, 2003, 2004, 2006 (2007, ..)  
Each start date to use a 3 member ensemble, optionally to be increased to O(10)  
Runs from 2007 onwards encouraged where possible  
These runs make use of the recent well-observed era, and are a step towards possible real-time prediction.

Model run time: 150+ years (optionally, an additional 350+ years)

- 1.4 For those models that are able to produce 20<sup>th</sup> Century climate runs, the CMIP5 20<sup>th</sup> Century / RCP4.5 runs should be increased in number to create an ensemble of the desired size of continuous runs extending to 2035. Details as per CMIP5 long term integrations. Ensemble size to match those used in 1.1 and 1.2.

These runs form a “control” against which the value of initializing short-term climate and decadal forecasts can be measured.

- 1.5 For models which do not have 20<sup>th</sup> Century and other standard runs, it is requested to make a 100 year control integration, and a 80 year run with a 1% per year increase in CO<sub>2</sub>, starting 20 years into the control run. These integrations will allow an evaluation of model drift, climate sensitivity and ocean heat uptake, and give some idea of the natural modes of variability of the model.

(For groups that want to use an anomaly initialization method, a transient run with observed forcings might be run from the end of the control. With due consideration to the ‘cold-start’ problem, this could give a late 20<sup>th</sup> century model climate which can be compared to the observed ocean climate for the purpose of defining initial condition anomalies to be inserted into the model. However, this is considered part of the initialization method - it is up to each group to choose the most suitable approach, and data from such runs will not be collected.)

2. Further studies which would be of interest

- Comparison of initialization strategies - for example, a repeat of runs (1.1) using an alternate initialization strategy or alternate initial data.
- Repeat of the 1.1 2005 forecast with a high and/or low anthropogenic aerosol scenario
- Repeat of the 1.1 2005 forecast with an imposed “Pinatubo” eruption in 2010
- Impact of Interactive Ozone chemistry
- Air quality

Summary of runs

Section	Experiment	# years (3 members)	# years (10 members)
1.1	10 year runs	300	1000
1.2	30 year runs	180	600
1.1+1.2	Volcanoes removed	150-270	500-900
1.3	ARGO era 1 year interval	150+	500+
1.4	Additional CMIP5 members		
1.5	Simple reference runs		
<b>Totals</b>	1.1 - 1.2 basic set	480	1600
	1.1 - 1.3, 10yr volcanoes	780	2600

Additional notes

- The output of the model integrations needs to be defined. We start with the assumption that the output will be the same as that requested for the long term CMIP5 runs.
- Data handling needs to be defined. It is hoped that data from section 1 of this proposal can be archived as part of the general AR5 archive, to allow access by the wider scientific community.