

Time-advancement of Stochastic Models with limitations due to forcing terms

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1 Introduction

An OpenDA Stochastic Model may be limited in the number of time steps that can be advanced without recomputing the forcing terms. Storage of the forcing terms can be quite expensive in memory and may therefore be limited to a maximum.

A problem arises when the first observation, i.e. the first analysis time, falls outside the interval for which the forcing terms are computed. In that case, the first model instantiation already needs to compute new forcing terms, while these terms should still be kept in memory for the other instantiations.

There are two possibilities to circumvent this problem:

- use option `<analysisTimes type="fixed">` in the ModelConfig file to force the stochastic model to stop at a point in time that falls within the interval for which the forcing terms were computed.
- use attribute `flag_barrier` in the model_class file to indicate that the computation of a model instantiation must be temporarily blocked at a certain moment in time until all instantiations have reached this point. Once all instantiations have reached this point, the computation of all model instantiation is advanced until the next barrier moment.

More details on both options are presented in the following sections.

2 Setting fixed analysis times

Fixed analysis time must be specified in the ModelConfig file. For example, the line

```
<analysisTimes type="fixed" timeFormat="dateTimeString">
200701010000,200701010060,...,200701020000</analysisTimes>}
```

forces an OpenDA run to interrupt the computation every hour. This means that the stochastic model is restarted a number of times. Depending on the file I/O that is needed for a restart, this may slow down the OpenDA computation more than necessary.

3 Setting a barrier for a model computation

The CTA_MODELCLASS is created in the model_class file. The line

```
<CTA_MODELCLASS id="modelclass" name="example">
```

may be augmented with the option `flag_barrier`. If this flag is set `true`, then one must also specify a parameter `T_step`, representing the maximum time interval that the model may run without recomputing the forcing terms. This parameter must be specified by the user as only the user knows what the time-stepping limitations of his stochastic model are.

The default unit for `T_step` is Modified Julian Day (MJD). It is also possible to specify the time in hours (HOUR), minutes (MIN) or seconds (SEC). Other time units are not supported yet and it is also not possible to use a combination of units.

Examples:

- set a maximum time step of 0.1 Modified Julian Day:

```
<CTA_MODELCLASS id="modelclass" name="example"
flag_barrier="true" T_step = "0.1">
```

which is equivalent to:

```
<CTA_MODELCLASS id="modelclass" name="example"
flag_barrier="true" T_step = "0.1 MJD">
```

- set a maximum time step of 1 hour and 30 min:

```
<CTA_MODELCLASS id="modelclass" name="example" flag_barrier="true"  
T_step = "1.5 HOUR">
```

OR

```
<CTA_MODELCLASS id="modelclass" name="example" flag_barrier="true"  
T_step = "90 MIN">
```

OR

```
<CTA_MODELCLASS id="modelclass" name="example" flag_barrier="true"  
T_step = "5400 SEC">
```