This is an instruction for using the Adaptive Stochastic Integrated Assessment Model (ASIAM) based on the DICE model. To access the original DICE model please visit http://www.econ.yale.edu/~nordhaus/homepage/dicemodels.htm

The model can be run under 5 different modes: deterministic, stochastic, tipping points, stochastic with tipping points, and adaptive (Bayesian) stochastic with tipping points.

All models here are built based on the value iteration algorithm; at each time step the cumulative value of the future states are approximated to give the observed value of the current state. This observed value is used to update the approximation of the current state value in next iteration.

To run all models, first you need to download the initialization supporting scripts: ***Initialset.m*** which contains the initial values of key parameters in the model based on the DICE 2007 model.

1- **Deterministic Model**

In this model, the climate sensitivity parameter (***deltaT***) is assumed fixed. To run this model:

a. Download: ***Utility.m***, ***NextState.m***, ***VI_D.m***
b. Run ***VI_D.m***
c. The State values are stored in variable ***S***, the optimal values of the emission control rate is (decision variable) is stored in ***action***. To obtain the optimal values of the objective function type in ***Vhat(1)*** in the command line.

2- **Stochastic Model**

In this model, the climate sensitivity parameter (***deltaT***) is assumed to be drawn from a truncated lognormal distribution. To run this model:

a. Download: ***Utility.m***, ***NextState.m***, ***lognorm_trunc.m***, ***lognorm_trunc_dist.m***, ***lognorm_trunc_inv.m***, ***VI_S.m***
b. Run ***VI_S.m***
c. The State values are stored in variable ***S***, the optimal values of the emission control rate is (decision variable) is stored in ***action***. To obtain the optimal values of the objective function type in ***Vhat(1)*** in the command line.
d. Simulation paths are stored in ***deltaT_path***

3- **Tipping point Model**

In this model, the climate sensitivity parameter (***deltaT***) is fixed but a new parameter is introduced to the model to account for the uncertainty in tipping point events. To run this model:

a. Download: ***Utility_Tip.m***, ***NextState_Tip.m***, ***VI_T.m***
b. Run ***VI_T.m***
c. The State values are stored in variable ***S***, the optimal values of the emission control rate is (decision variable) is stored in ***action***. To obtain the optimal values of the objective function type in ***Vhat(1)*** in the command line.
d. Simulation paths are stored in ***x***

4- Stochastic Tipping point Model

In this model, the climate sensitivity parameter (***deltaT***) is drawn from a truncated lognormal distribution. In addition, a new parameter is introduced to the model to account for the uncertainty in tipping point events. To run this model:

To run this model:

a. Download: ***Utility_Tip.m***, ***NextState_Tip.m***, ***lognorm_trunc.m***, ***lognorm_trunc_dist.m***, ***lognorm_trunc_inv.m***, ***VI_ST.m***
b. Run ***VI_ST.m***
c. The State values are stored in variable ***S***, the optimal values of the emission control rate is (decision variable) is stored in ***action***. To obtain the optimal values of the objective function type in ***Vhat(1)*** in the command line.
d. Simulation paths are stored in ***deltaT_path*** and ***x***

5- Adaptive Stochastic Tipping point Model

In this model, the climate sensitivity parameter (***deltaT***) is drawn from a truncated lognormal distribution. In addition, a new parameter is introduced to the model to account for the uncertainty in tipping point events. These two random parameters are updated through a Bayesian mechanism. To run this model:

To run this model:

a. Download: ***Utility_Tip.m***, ***NextState_Tip.m***, ***lognorm_trunc.m***, ***lognorm_trunc_dist.m***, ***lognorm_trunc_inv.m***, ***deltaT_update.m***, ***VI_BST.m***
b. Run ***VI_BST.m***
c. The State values are stored in variable ***S***, the optimal values of the emission control rate is (decision variable) is stored in ***action***. To obtain the optimal values of the objective function type in ***Vhat(1)*** in the command line.
d. Simulation paths are stored in ***deltaT_path*** and ***x***
e. The updated climate sensitivity probability distribution when no tipping point is observed after 60 period is accessible in ***deltaT_pdf_NT***