



## **Key observing locations for advancing beyond the winter predictability barrier of Indian Ocean dipole event predictions**

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In this paper, we explored the key observing locations (i.e. the sensitive areas for targeted observations) of positive Indian Ocean dipole (IOD) events to advance beyond the winter predictability barrier (WPB) using the Geophysical Fluid Dynamics Laboratory Climate Model version 2p1 (GFDL CM2p1). The sensitivity analysis is conducted through perfect model predictability experiments, in which the model is assumed to be perfect and so any prediction errors are caused by initial errors. The results show that the initial errors with an east-west dipole pattern are more likely to result in a significant WPB than random initial errors; the areas where the large values of the dipole pattern initial errors are located have great effects on prediction uncertainties in winter and provide useful information regarding the sensitive areas. Further, the prediction uncertainties in winter are more sensitive to the initial errors in the subsurface large value areas than to those in the surface large value areas. The results indicate that the subsurface large value areas represent the sensitive areas for targeting and if we carry out intensive observations across these areas, the prediction errors in winter may be largely reduced. This will lead to large improvements in the skill of wintertime IOD event forecasts.