

## The Perfect Ocean for Drought

Martin Hoerling  
NOAA Climate Diagnostics Center, Boulder, CO 80305  
mph@cdc.noaa.gov

Arun Kumar  
NOAA Climate Prediction Center, Washington D. C.  
akumar@ncep.noaa.gov

Evidence is presented that the sustained and severe droughts inflicting the United States, the Mediterranean, and Southwest Asia since 1998 are part of a hemisphere-wide climate state that has been strongly determined by the tropical oceans. The oceanic conditions of importance have been the cold, La Niña-like, sea surface temperatures (SSTs) in the eastern tropical Pacific, coexisting with above normal SSTs in the western tropical Pacific and Indian oceans. Such a combination is shown to be unprecedented in the instrumental record. To be sure, La Niña, and a preference for multi-year recurrence, are not unusual. But such events have historically been accompanied by cold SSTs throughout the tropical oceans, rather than the pervasive warmth of recent years. This latter Indo-Pacific warming is symptomatic of a trend that has emerged in the last half century, and is not linked to an interannual fluctuation of the ocean. Four different climate models, forced with the history of SST variations since 1998, are shown to replicate the drought pattern. These results clarify that the drought's origin has been largely in the boreal cold season, and is associated with an abnormal poleward shift of the westerly jets and their attending storm tracks. The results of additional model simulations indicate that such climatic disruptions are symptomatic of the atmospheric sensitivity to both La Niña conditions and warm Indo-Pacific SSTs. It is thus proposed that the unique, and sustained tropical oceanic states since 1998 were ideally suited to engage a sustained atmospheric pattern conducive for drought in the middle latitudes.