

Predicting Pacific Decadal Variability

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The case is advanced that decadal variability of climate in the Pacific sector is driven by tropical atmosphere-ocean interactions and communicated to the extratropics. It is shown that tropical decadal variations in the last century *could* arise as a consequence of the regional subset of physics contained within an intermediate model of the El Niño-Southern Oscillation. These decadal changes in ENSO and tropical mean climate are more predictable than chance years in advance but even in these idealized experiments forecast skill is probably too small to be useful. Nonetheless, forecasts of the next two decades indicate that, according to this model, the 1998 El Niño marked the end of the post 1976 tropical Pacific warm period.

Observations and atmosphere general circulation models are interpreted to suggest that decadal variations of the atmosphere circulation over the North Pacific between the 1960s and the 1980s are explained by a mix of tropical forcing and internal atmospheric variability. This places a limit on their predictability. The ocean response to extratropical atmosphere variability consists of a local response that is instantaneous and a delayed response of the subtropical and subpolar gyres that is predictable a few years in advance.

It is shown that the wintertime internal variability of the Aleutian Low can weakly impact the ENSO system but its impact on decadal predictability is barely discernible.

1. INTRODUCTION

For four years prior to fall 2002 the mid-latitudes of both the Northern and Southern Hemisphere experienced substantially less rain than usual. In the United States and across Southern Europe into Central Asia wells ran dry, crops failed and forests caught fire. The causes of this dry period have been linked to

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variations of the tropical atmosphere-ocean system in the Indo-Pacific region [Hoerling and Kumar, 2003]. After the enormous El Niño of winter 1997/98 the equatorial Pacific remained cooler than usual until early 2002 when a weak El Niño developed. It could be that this cold period marks the end of the most celebrated decadal variation in the Pacific sector: the warm shift in 1976 [Zhang *et al.*, 1997].

After 1976 the tropical Pacific Ocean has been warmer than in the preceding decades while the central and western North Pacific Ocean have been colder and atmospheric pressure has been lower over the mid-latitude North and South