ENSO impact on the extratropical middle and upper atmosphere

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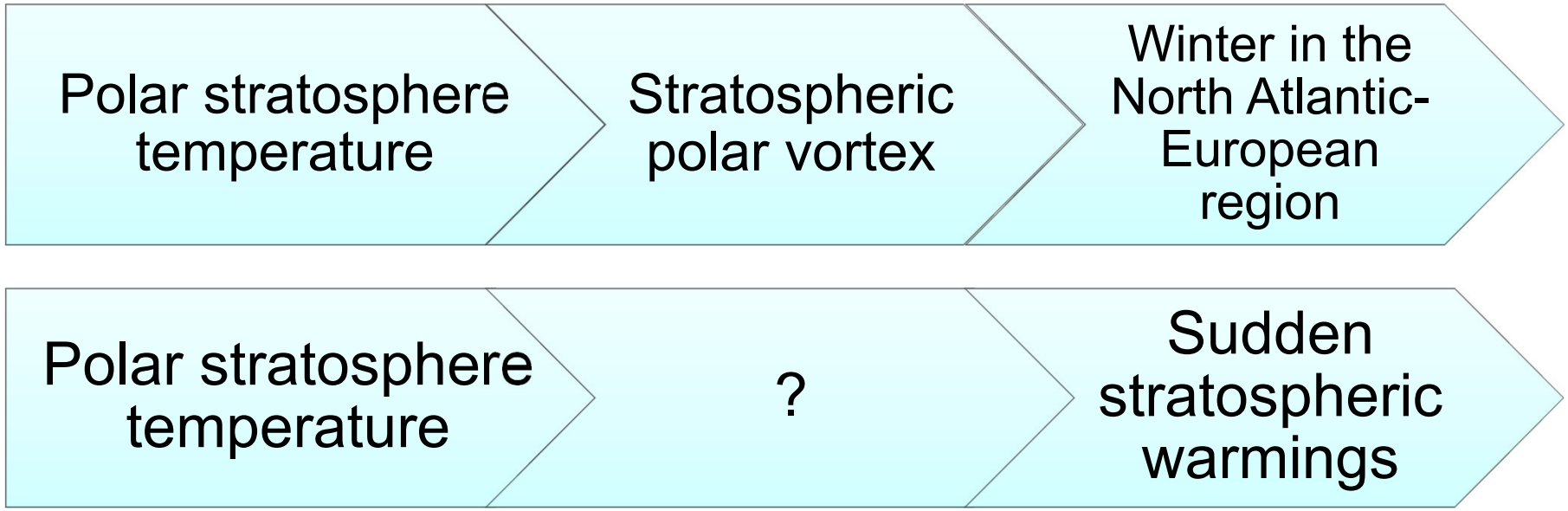
Outline

- Overview
- Data
- Reanalysis results
- Unusual years
- Ensemble results
- Summary

The El Niño-Southern Oscillation (ENSO) is one of the longest-studied climate phenomena.

- Tropospheric temperature
- Precipitation
- Ozone concertation



Data

- **Multivariate ENSO Index (MEI)**
  - Sea-level pressure , zonal and meridional components of the surface wind, sea surface temperature, surface air temperature, and total cloudiness fraction of the sky
  - Region: tropical Pacific
  - Time period: twelve sliding bi-monthly seasons

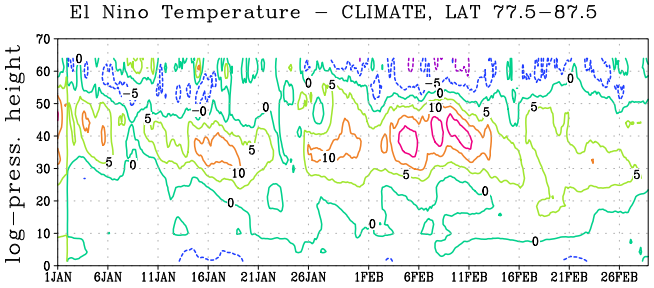
- **MODERN-ERA RETROSPECTIVE ANALYSIS FOR RESEARCH AND APPLICATIONS (MERRA)**
  - Temperature, wind components, geopotential height data during January-February of

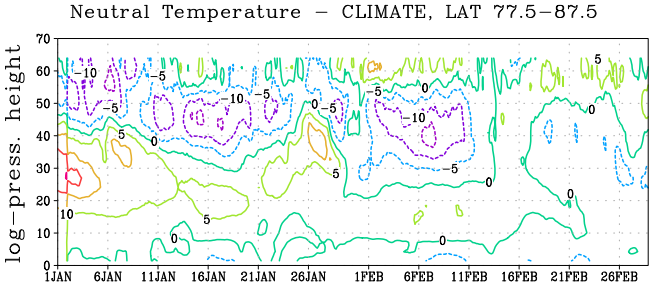
  El Niño years (1983, 1992, 1998, 2003, 2010),

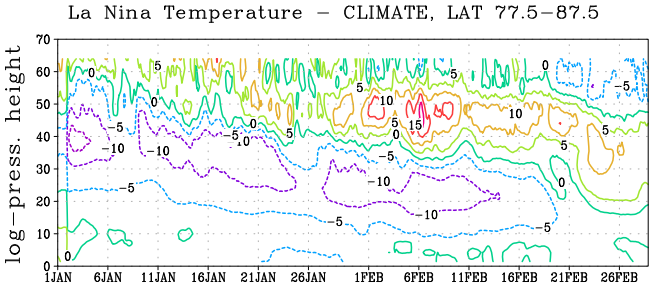
  La Niña years (1989, 1999, 2000, 2008, 2011),

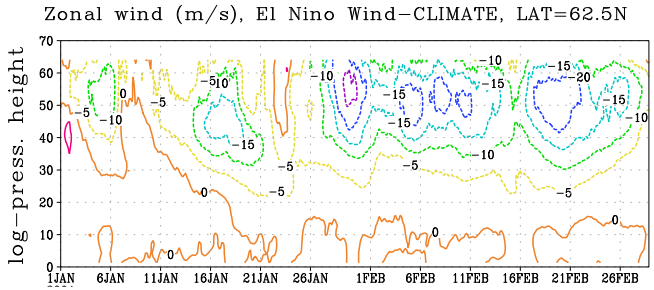
  Neutral phase years (1982, 1991, 1994, 2002, 2004)
  - CLIMATE: 1979 - 2015

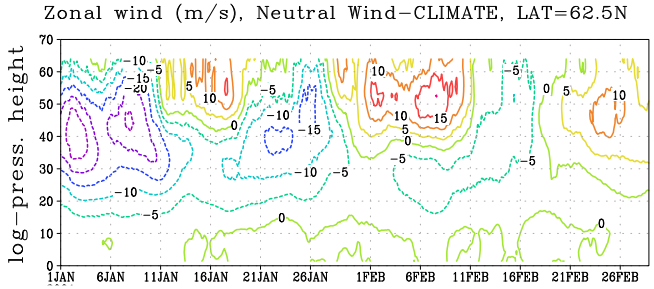
Reanalysis results on temperature and mean zonal wind

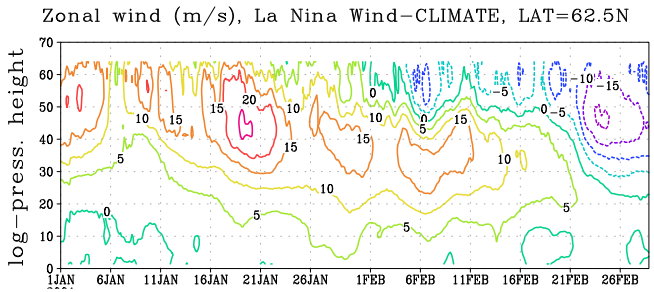




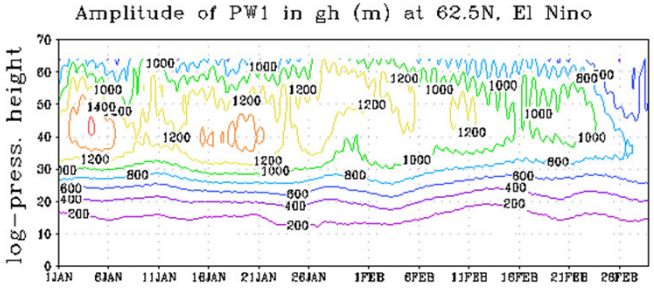


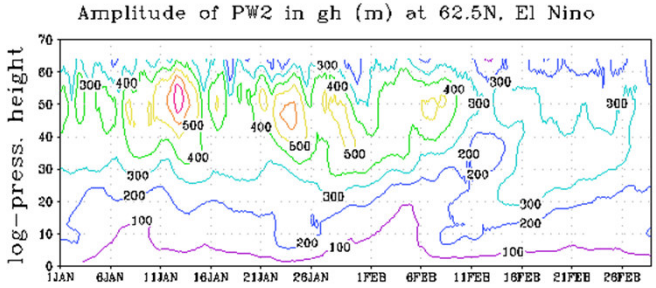


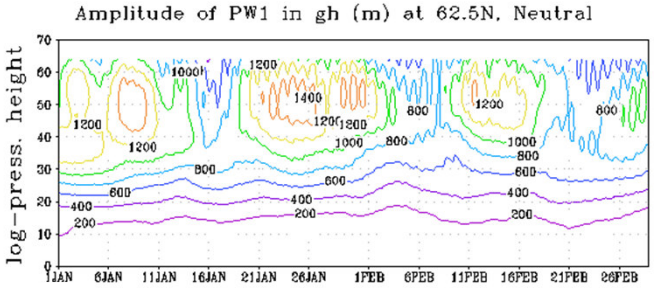


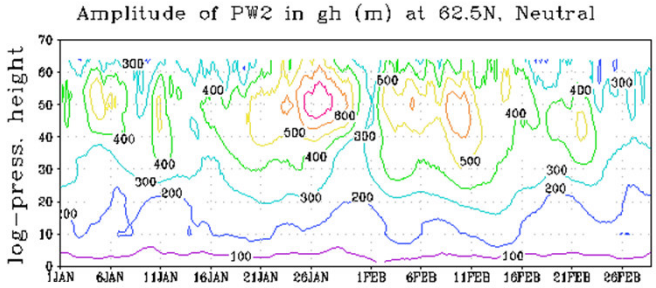


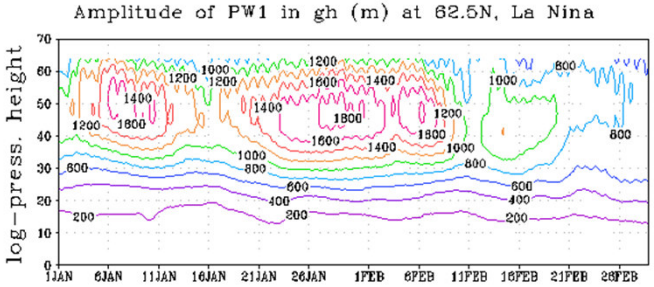
Reanalysis results on SPWs

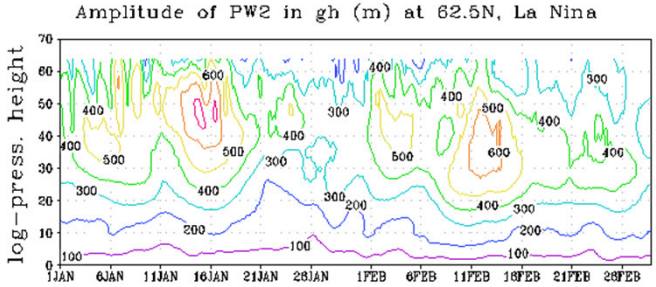




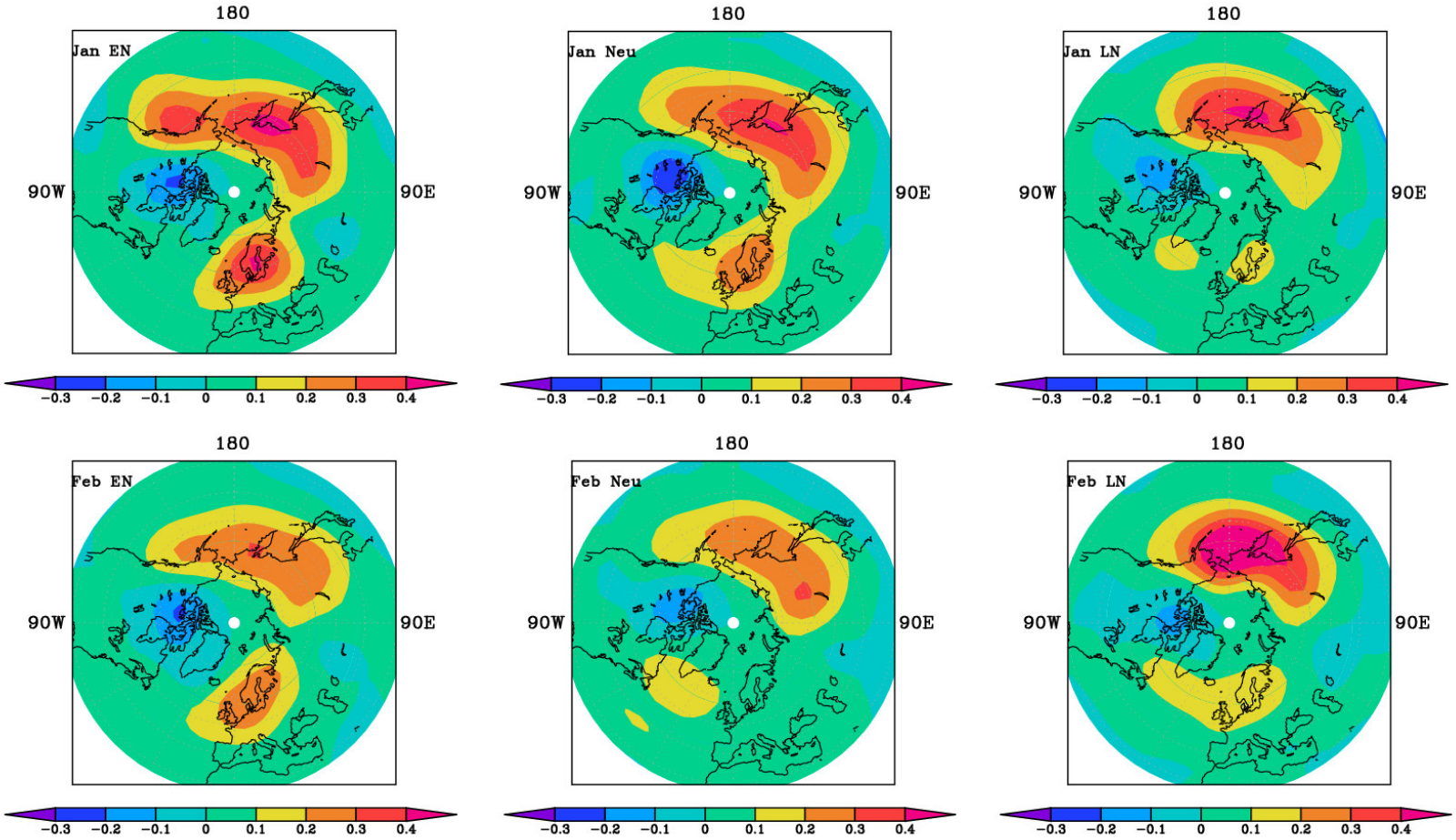




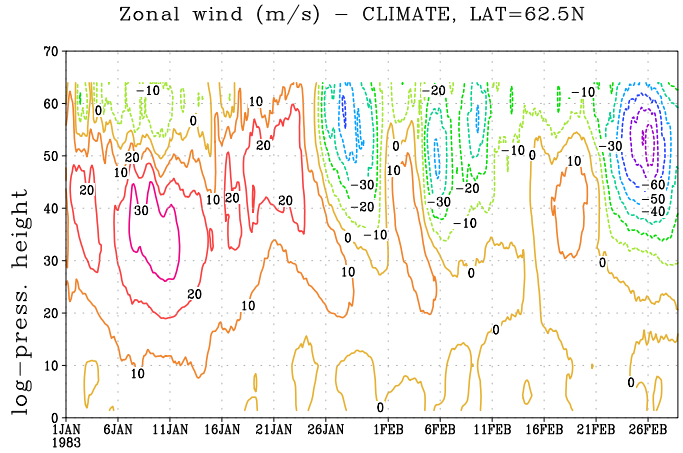


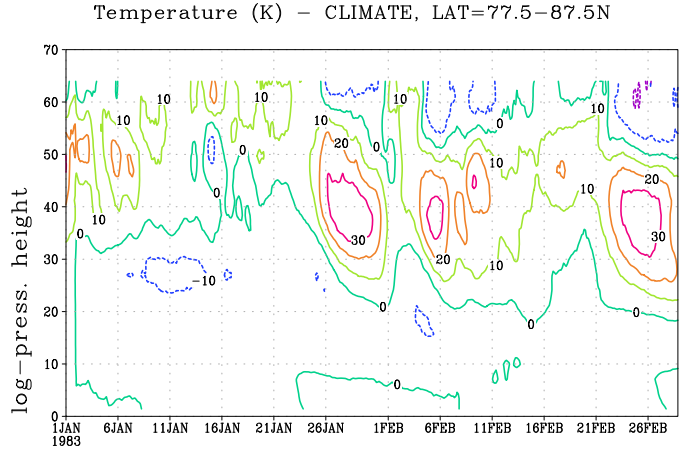


Reanalysis results on EP flux at 15 km



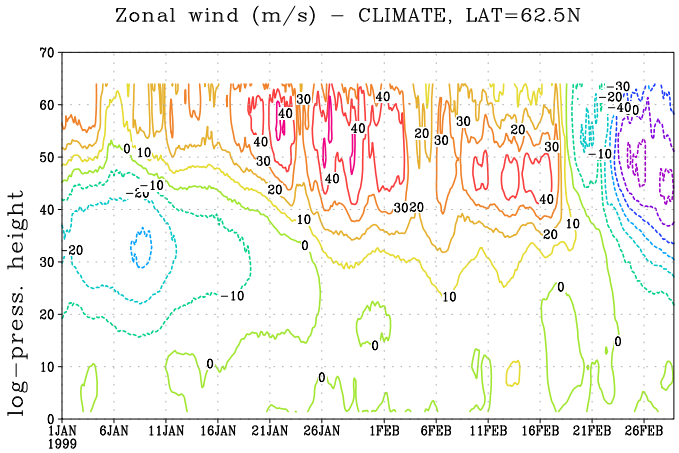
Years that are exceptions: 1983 – El Niño conditions

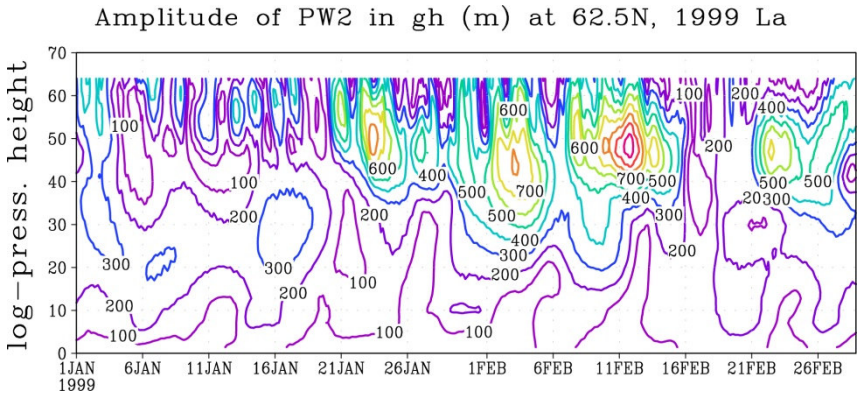


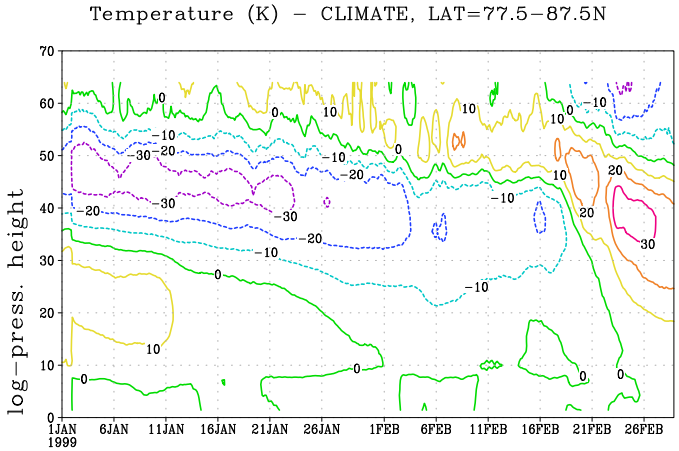


- Possible reason: eruption of El Chichón in April of 1982

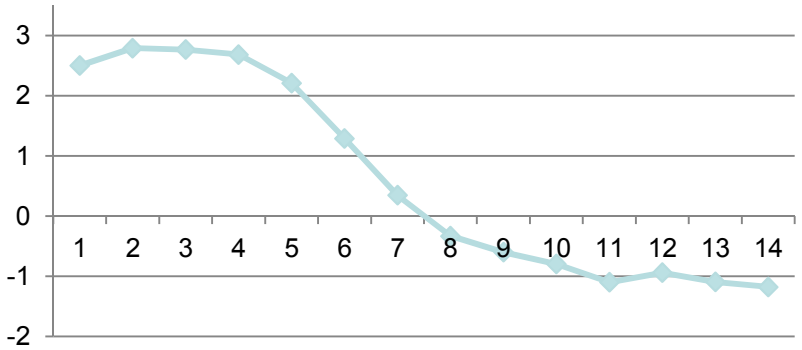
Years that are exceptions: 1999 – La Niña conditions





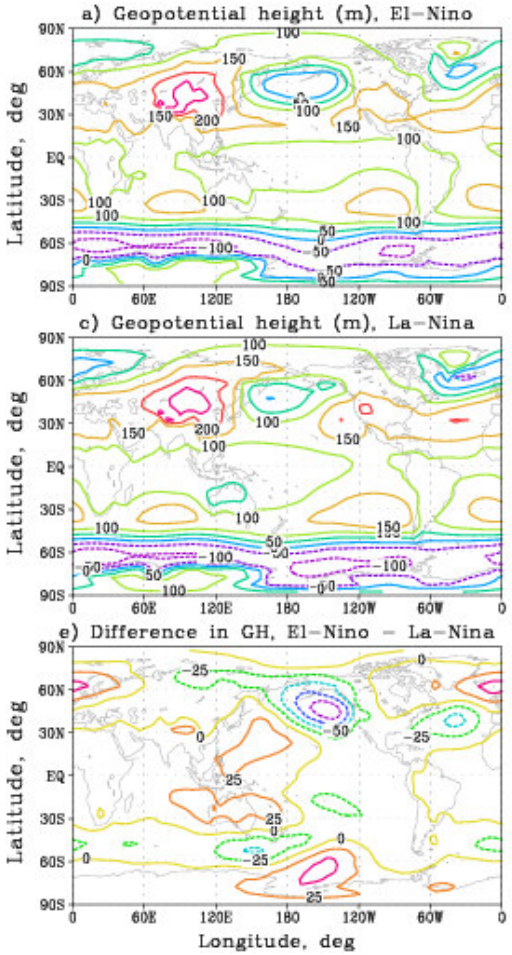


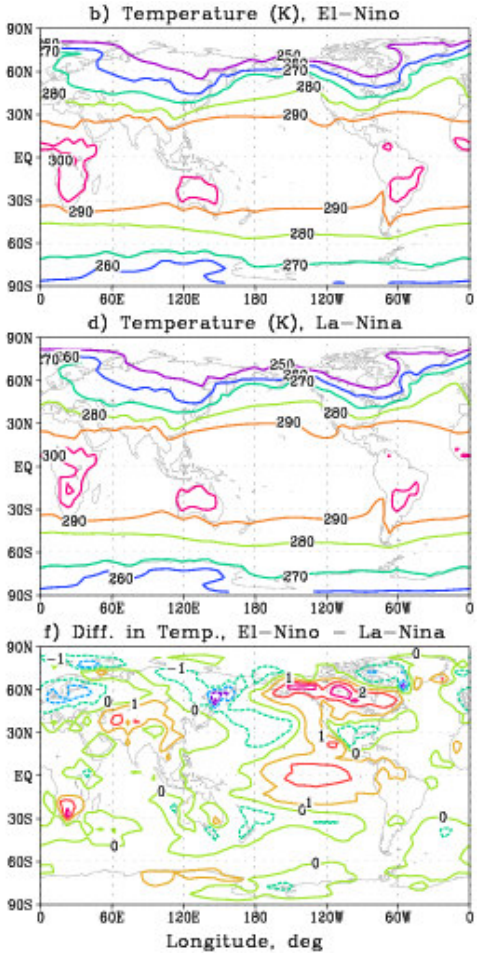
MEI 1998-1999



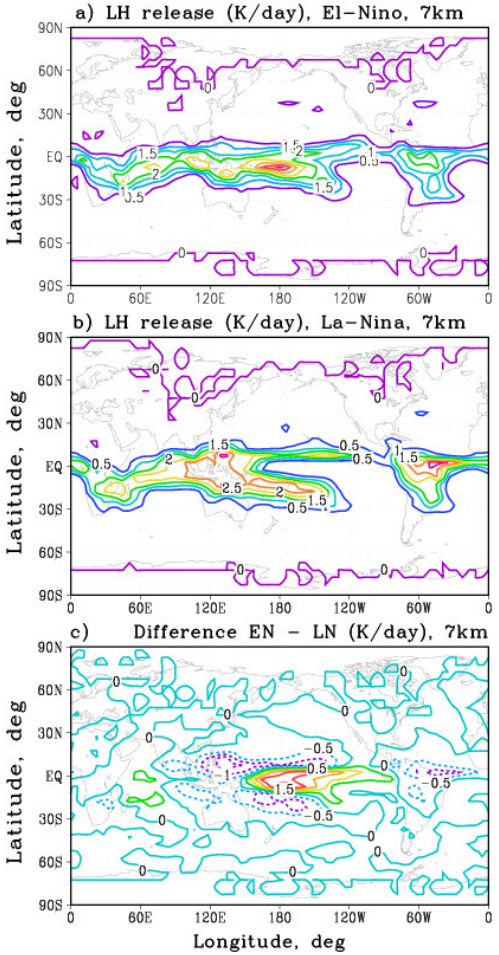
Middle and Upper Atmosphere Modeling (MUAM).

Boundary conditions.

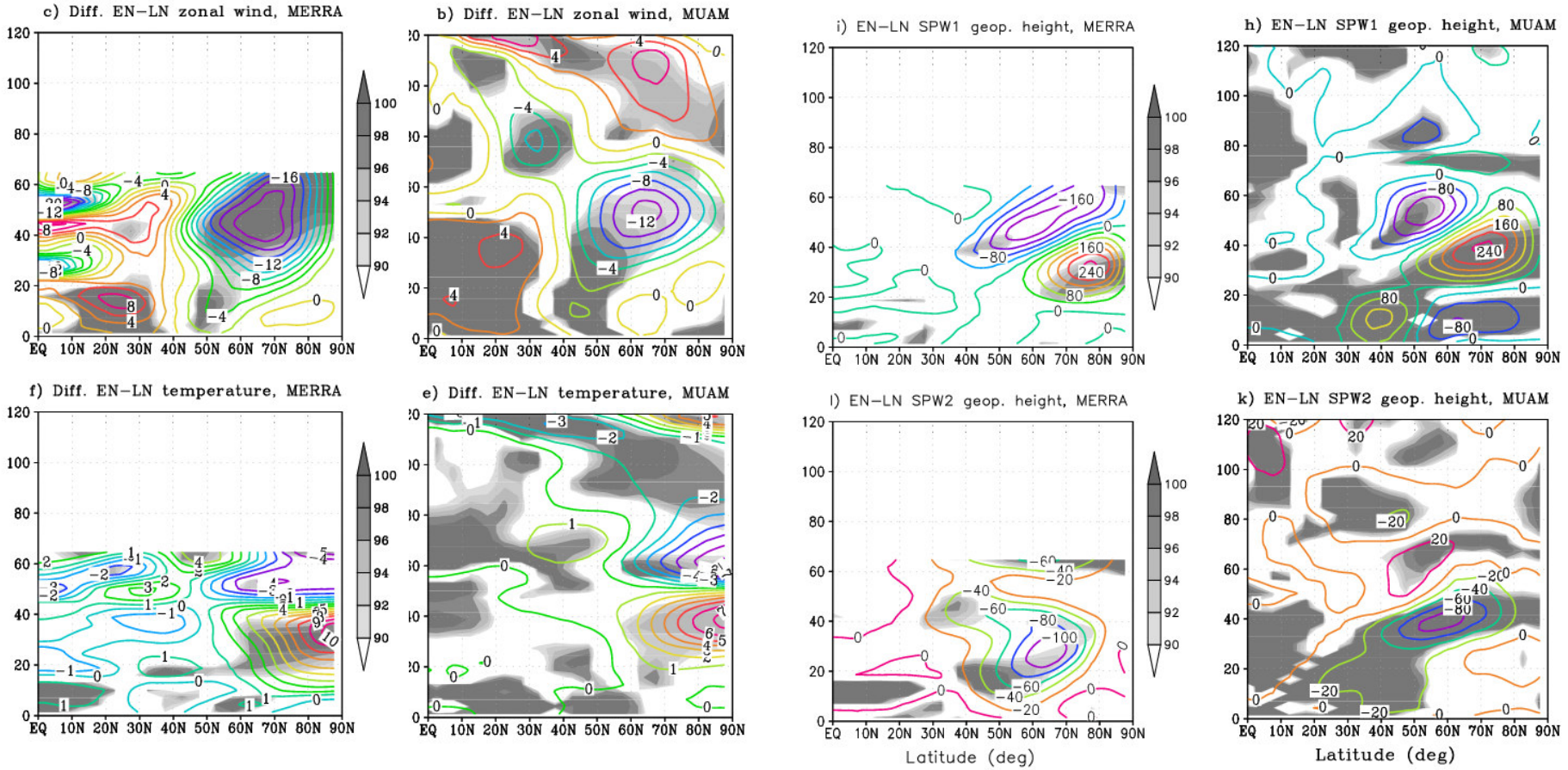




Latent heat release



Modeling results



Summary

- In January-February the stratosphere is warmer and easterly mean zonal wind prevails during positive phase.
- Amplitudes of SPW1 usually are greater during El Niño phase, while maximum of SPW2 amplitudes are observed lower comparing with La Niña and neutral phases.
- The strongest downward EP flux is observed over the Northern Canada in January during neutral phase and the upward EP flux is observed over the Europe in every winter during El Niño in contrast to La Niña winters.

Thank you for your attention!