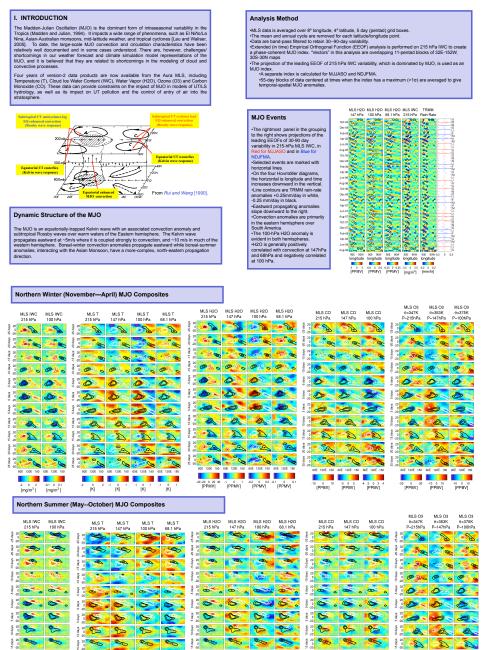
# MJO in Four Years of MLS UT/LS **Temperature and Composition Michael J Schwartz**



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0 2 -0.1 0 0.1 g/m<sup>3</sup>] [mg/m<sup>3</sup>]

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# MJO Composite Anomalies

 Composites formed by averaging multiple 55-day blocks of data are shown at the lower left. The upper row shows an average over 10 phase-synchronized boreal-winter MJO events and the lower shows averages of 11 MJO events in boreal summer. •TRMM rain-rate (3B42) contours are overlaid: +1,+2 mm/day in white, -1, -2 mm

### Ice Water Content (IWC)

-IWC has vertically-coherent anomalies which are all strongly-positively correlated with TRNM rain-rate anomalies up to 68 hPa. Amplitudes of these anomalies are  $\pm 3 mg$  m<sup>3</sup> at 215 hPa and drop to  $\pm 0.51 mg/m^3$  at 100 hPa and drop to  $\pm 0.51 mg/m^3$  at 100 hPa and both sm f  $\pm 0.51 mg/m^3$  at 100 hPa and both sm  $\pm 0.51 mg/$ Boreal winter (NDJFMA) anomalies propagate eastward with the Kelvin wave from the Indian Ocean into the Western Pacific, and pop up again in South America. Borea Summer (MJJASO) INC propagate with the TRMM anomaly from the Indian Ocean to the northeast

The projection of the leading EEOF of the 215-hPa IWC has been used as the select the averaged events for boreal winter and summer, separately. These are not shown, but they look very much like normalized versions of the 2 composeles.

### Temperature (T)

MLS 215 hPa Temperature anomalies are not well correlated with the convection anomaly, showing a positive correlation with amplitude less than cold biases in the presence of thick cloud may be masking warming due to late release. Anomalies associated with the correction anomaly.

magnitude than these desicutive way we concern the concernent of the second sec In Hormöller diagrams of temperature (not shown), equatorial anomalies tropopause propagate around the globe with the Kelvin wave at longitudes wi is no convective anomaly.

# Water Vapor (H2O)

+H2O at 215 hPa is strongly, positively correlated with convectio

147 hPa H2O anomalies are correlated with convection in boreal winter, but not s clearly so in boreal summer.

At 100 hPa, H2O is positively correlated with temperature, which a sig from the convective anomaly in the boreal summer.

At 68 hPa, H2O is positively-correlated with the convection anomaly. This correlation noted in preliminary analysis of MLS v1.5 boreal winter data, is seen here in bot easons and it presists when analysis is done on isertinopic surfaces. The amplitude of this signal is small ( $\pm 0.05$  ppmv) compared to the ~3-ppmv amplitude of the seasons of update the level.

# Carbon Monoxide (CO)

•CO at 100 hPa has a positive correlation with convection. The amplitude of the si (less than ±5 ppbv) is small compared to the 30-ppbv amplitude of the seasonal ( recorder) cycle at this level.

1etCUDBY cycle as unserve. At 215 hPa and 147 hPa, near the "head" of the CO stratospheric tape CO MJO composite is rather muddled. Convection is not sufficient to en troposphere (UT) with CO; as source of CO in the boundary layer (from bio or anthropogenically polluted air) is also required.

Further analysis MLS CO is warranted to investigate the role MDO in modulating CO in the UT. This analysis will need to account for the inhomogeneity of CO in the boundary layer, with focus on the African and South American burning seasons and South Asian polition.

# Ozone (O3)

•MLS ozone anon

MLS 347K 03 (near 215 h/a at the equator) is positively-correlated with convection. One would expect convectively-lotted Indian-ocean boundary-layer air to be relatively coran-poor, although convectively-lifted air might be somewhat enriched by lightning. This result bears further investigation and validation.

-At 353K (near 147 hPa at the equator), O3 is negatively correlated with convection with eastward-propagating convection leading the O3 anomaly. The magnitude of the 353-K O3 anomalies are ±12 ppby, compared to an equatorial seasonal cycle -50 ppb

# Conclusions MLS IWC MJO anom TRMM rainfall anomalic

TRMM rainfall anomalies. •At 147 and 100 hPa, MLS temperature convection, but have significant subtro

•Water Vapor anomalies are positively correlated to 68 hPa. Water vapor anomalies are positively co 100 hPa

CO and O3 anomalies provide insight into the influence of MJO on the entering the stratosphere. This is definitely a work in progress.

MLS IWC and water vapor help provide a comprehensive picture of hydrology and provide important tests/constraints for validating and representations of the M.IQ.

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