Low Level Jet Structure from NOAA WP-3D Measurements during the SALLJEX

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http://www.nssl.noaa.gov/projects/pacs/salljex/p3/

Introduction

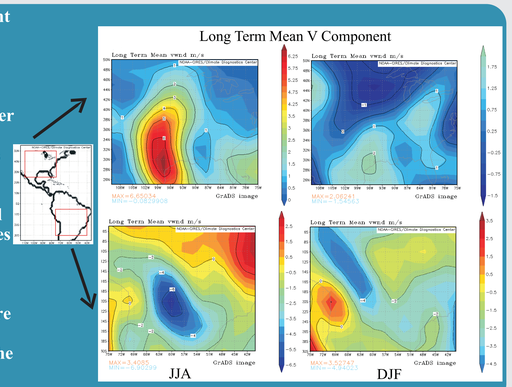
The South American Low Level Jet Experiment (SALLJEX) was the most comprehensive field experiment to date to describe, quantify, and analyze the Low Level Jet (LLJ) that is found east of the Andes.

The scientific objectives of SALLJEX are to understand the role of the South American low-level jet in moisture and energy exchange between the tropics and extratropics, and related aspects of regional hydrology, climate and climate variability.

During a 30 days period of the SALLJEX, a NOAA WP-3D research aircraft was used to describe with higher spatial resolution the LLJ structure than possible with the upper air sounding network.

This poster shows an overview of the observations made with the WP-3D aircraft as well as some basic observational features of the LLJ and other phenomena observed during SALLJEX.

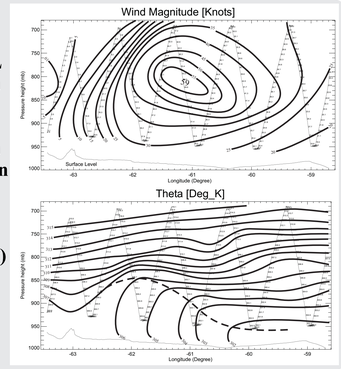
The panel on the right shows the long term meridional wind (NCEP/NCAR-Reanalysis) for the same-sized region over North and South America. These plots show the jet-like structure east of the Rockies (upper panel 925mb) and the Andes (lower panel 850mb) during summer and winter. Although the poleward jet structure in South America is weaker in summer, the moisture flux is higher.



LLJ Structure

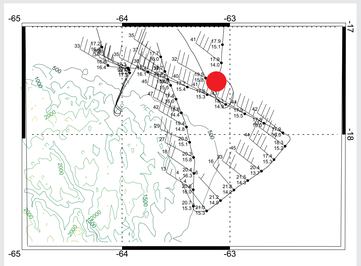
Topographic effects, baroclinic environments, inertial oscillations and PBL processes working together can produce an intense LLJ east of the Andes.

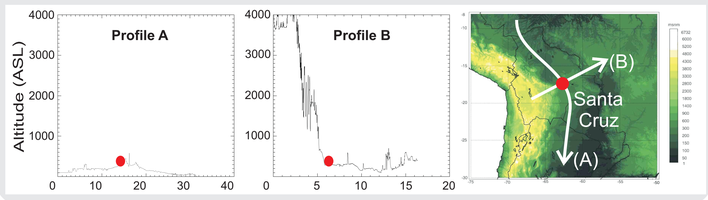
Maximum winds of 60 Kt were observed in the LLJ event of February 7. A cross section analysis near-normal to the LLJ flow was plotted with a 20-second average window, see panel on the right. Wind speed (upper plot) and potential temperature (lower plot) show features common to the jet flow on several days.



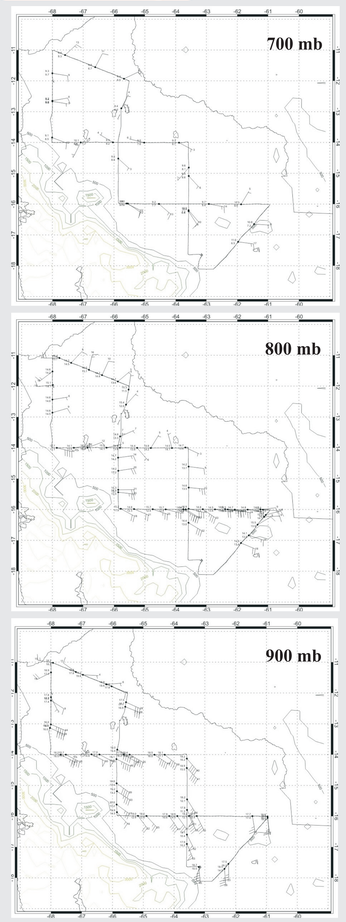
Topographic Effects

The change in orientation of the Andes near Santa Cruz-Bolivia (red circle) has an important effect on the LLJ flow. Winds at 850mb (January 11 flight) show the large gradient in the wind field just to the south of Santa Cruz. Altitude profiles parallel and perpendicular to the flow are shown below in the profiles A and B, respectively.

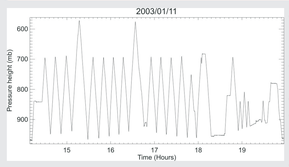




Cold Surge



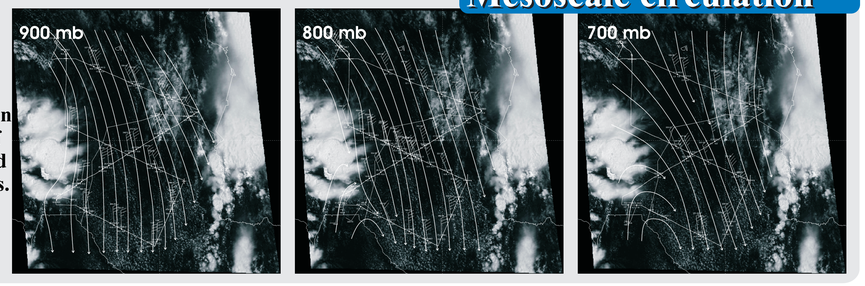
Aircraft operation summary



- WP-3D operations between January 11 and February 8 2003. See tracks and mission type of every flight at the edges of the poster (figures were plotted at 850mb).
- 120 hours, 20 Test and Ferry to Santa Cruz-Bolivia plus 100 Research.
- 13 flights with an average time of 7.5 hours per flight.
- The basic plan was a "Z"-shaped pattern in the horizontal with a sawtooth pattern in the vertical, see figure on left.
-WP-3D standard flight level data, and tail and belly radar.

Mesoscale circulation

February 07
Flight -LLJ event-
Streamline analysis illustrating the return flow down-stream of the Andean bend and associated cloudiness.
Background GOES Ch1 image (17:45 UTC).



Future Work

Final aircraft data has only recently become available.
Future work will describe mesoscale features that cannot be shown with the regular upper air network.
We will attempt to describe mean characteristics of the LLJ.
The observations will be used for validation of mesoscale model output.

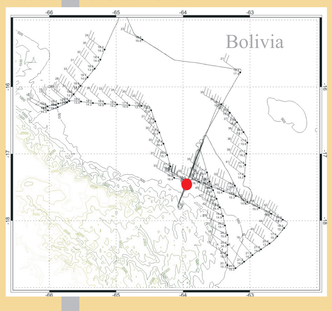
Acknowledgements

NOAA Office of Global Programs is funding this work.

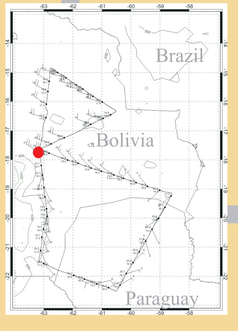
JAN 11 (14 - 20 UTC)
Type of Mission:
LLJ-Test aircraft operating procedures

JAN 15 (13:04 - 20:20)
Type of Mission: LLJ Flight was successful in obtaining many profiles of a weak jet; may be useful for model validation.

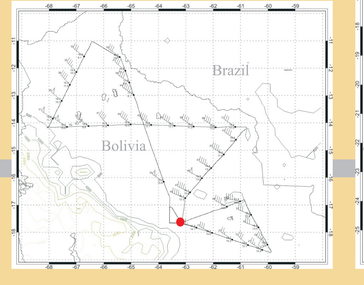
JAN 17 09:49 - 16:07
Type of Mission: LLJ with an emphasis on details of the jet near the topography northwest of Santa Cruz



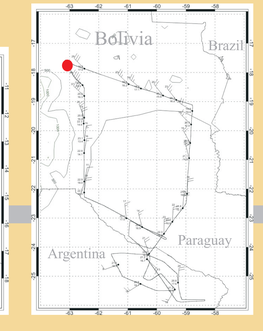
JAN 18 15:07-21:52
Type of Mission: Cold Front/LLJ/MCS
Investigate a cold-frontal-type feature and a MCS



JAN 21 10:39 - 19:17
Type of Mission: LLJ/No significant deep convection along track during flight.

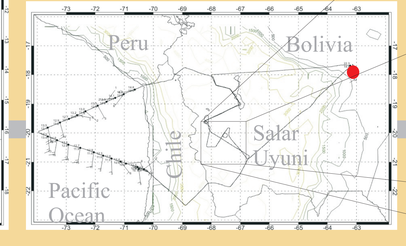


JAN 22 19:04 - 23 03:26
Type of Mission: LLJ/MCS genesis

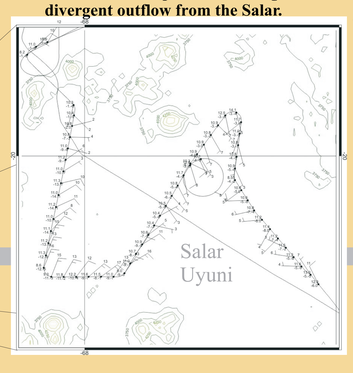


JAN 24 10:53 - 18:24
Type of Mission: Cold surge

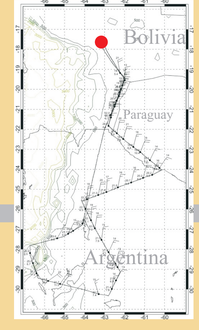
JAN 28 11:57 - 20:44
Type of Mission: Altiplano-Pacific diurnal variations of the mixed layer over varying terrain of the Bolivian altiplano and to describe variations in the boundary layer west of the coast of Chile.

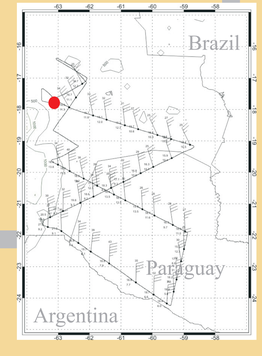


Afternoon wind pattern showing divergent outflow from the Salar.

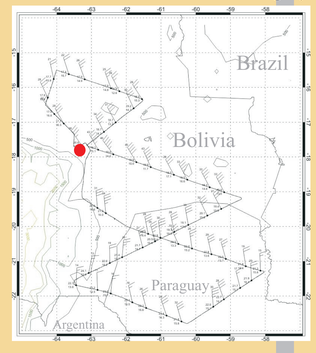


FEB 01 11:57 - 20:32
Type of Mission: Heat low N. Argentina

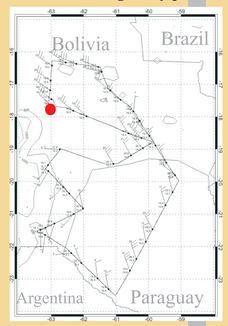




FEB 04 10:54 - 18:41
Type of Mission: LLJ/ Much of the jet lay in northern Argentina. Samples of several convective cells with the tail radar.



FEB 06 11:55 - 19:49
Type of Mission: Moderate LLJ centered over southern Bolivia and western Paraguay.



FEB 07 11:56 - 19:50
Type of Mission: LLJ/ Describe a "classical" (in terms of geographical distribution of wind speeds) low-level jet

FEB 08 10:49 - 17:40
Type of Mission: LLJ/MCS The jet was weak, with maximum winds of about 30-35 kts. Feb 06-08 describes variability of the LLJ during 3 day period.