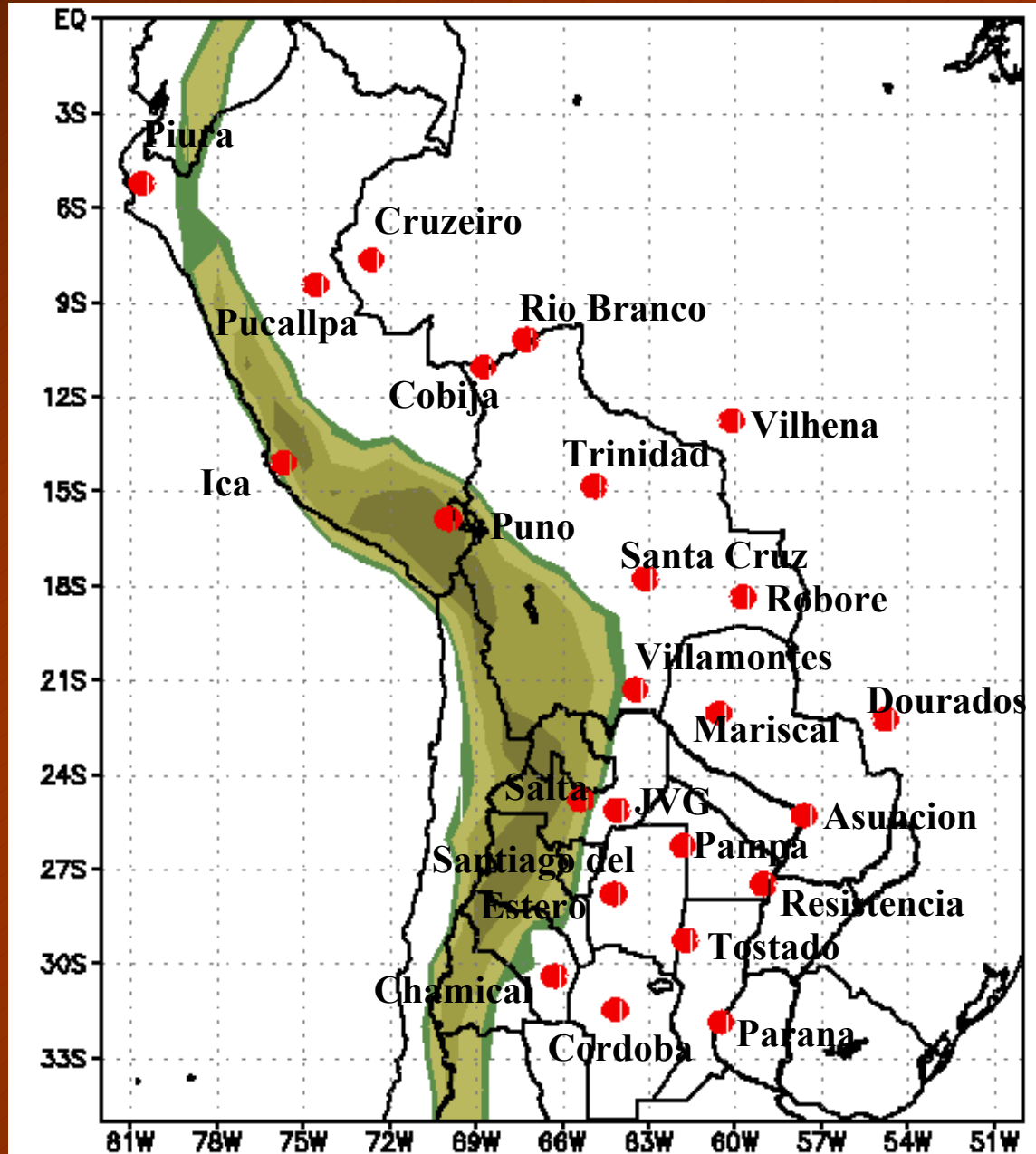


Diurnal Cycle of the SALLJEX

M. Nicolini, P. Salio and J. Paegle
SALLJEX Data Workshop Program,
10-12 December 2003

SALLJEX UPPER AIR NETWORK

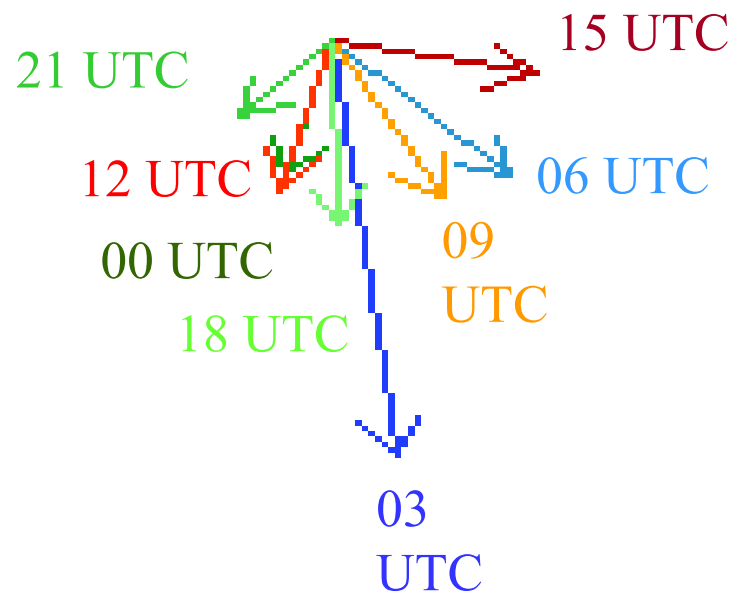


Observational Evidences

- Hodographs at most SALLJEX sites reveal the oscillatory nature of the wind as it rotates direction over the diurnal cycle.
- Bonner's (1968) assumption of a smooth progression of the hodograph through the intermediate times in his 6-hour data over the Great Plains is rarely found during SALLJEX as Mitchell et al. (1995) has already observed for that region.

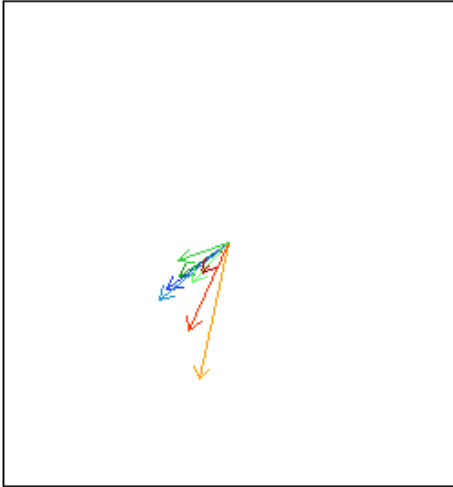
- There is evidence of transitions between different time intervals instead of a regular progression. Theoretically there are at least 3 different components effecting the rate of turning of the direction: inertial oscillation, subsynoptic pressure gradient related to mountain-valley differential diurnal heating/cooling and interaction of large-scale pressure gradient with the subsynoptic circulation.
- During nighttime the wind accelerates and turns anticlockwise (mostly from 03 to 12 UTC) consistent with an enhanced rate of rotation as the inertial oscillation is in the same direction of the two other components.

- After sunrise the wind direction stays uniform through the morning (up to 15 UTC). During the afternoon the wind slows down and "eventually" (because we don't have hourly observations) it turns clockwise (18 UTC). At the sites near the mountains this turning of the wind variation respect to the daily mean is consistent with a "valley breeze" component towards the west.
- Before and after sunset (mostly before 03 UTC) the rate of rotation is reduced by the large-scale (dominated by a northerly flow) and subsynoptic (mountain breeze) components that oppose the inertial oscillation.

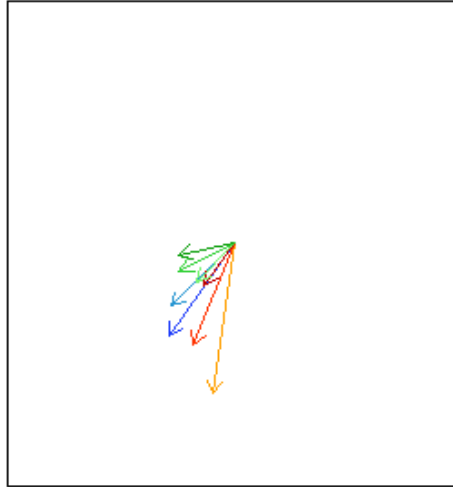


Santiago del Estero

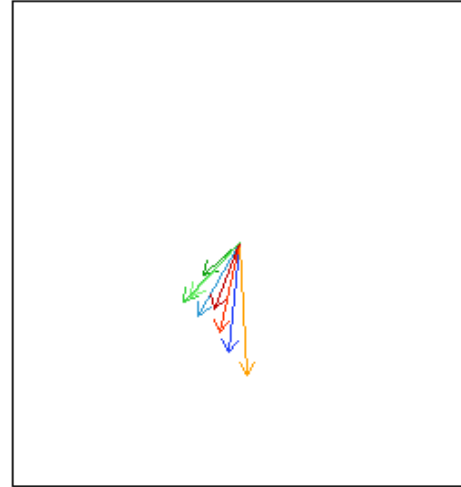
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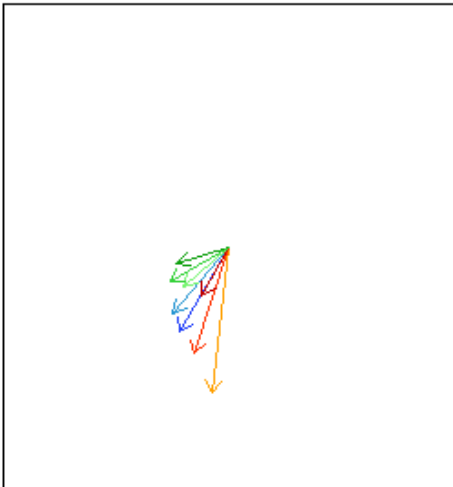
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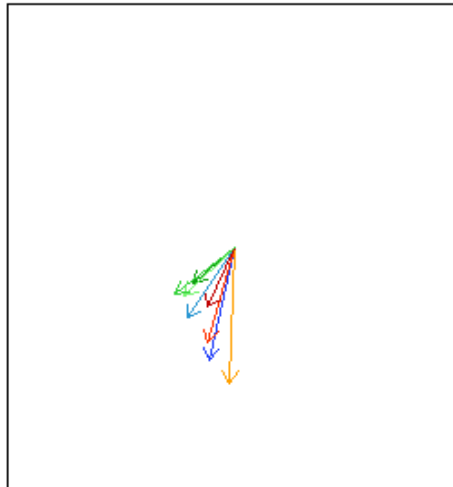
1400



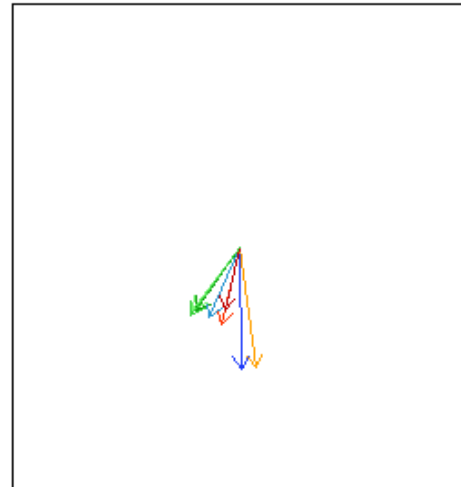
1000



1200



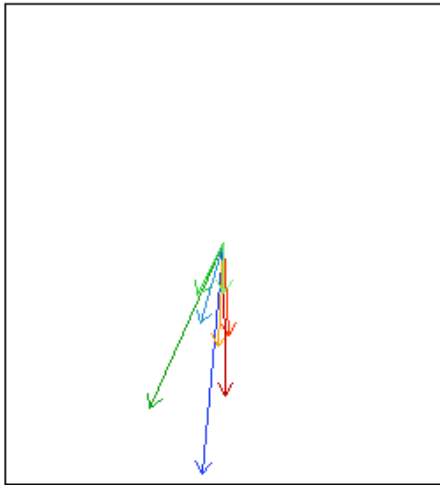
1600



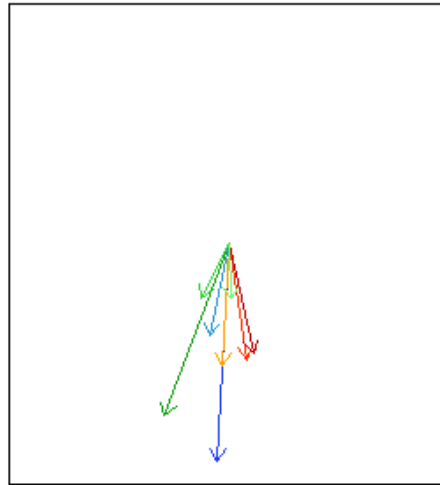
→
10 m/s

Mariscal Estigarribia

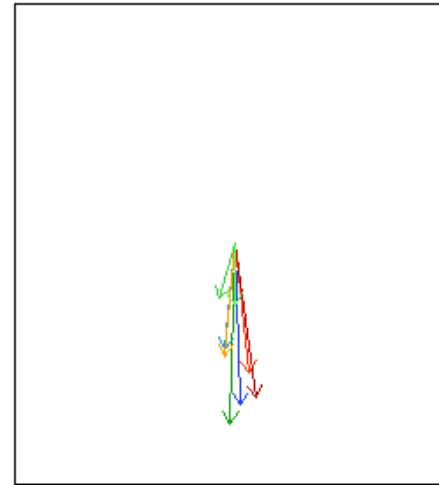
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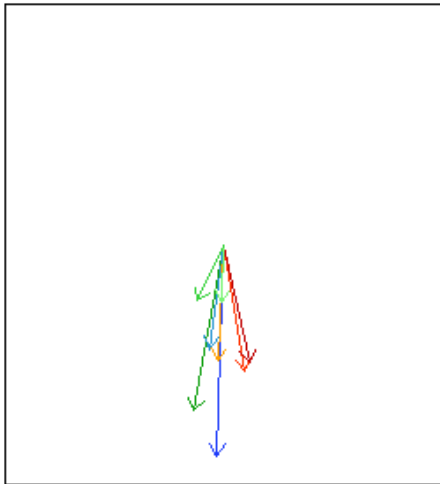
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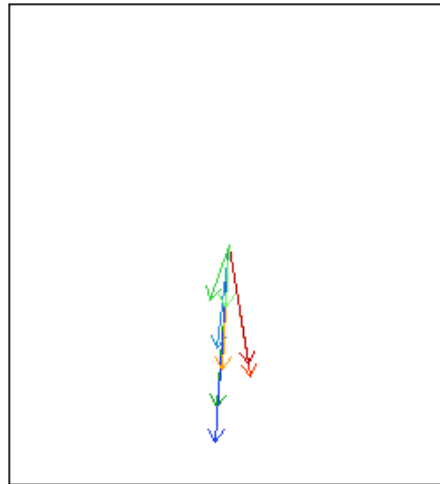
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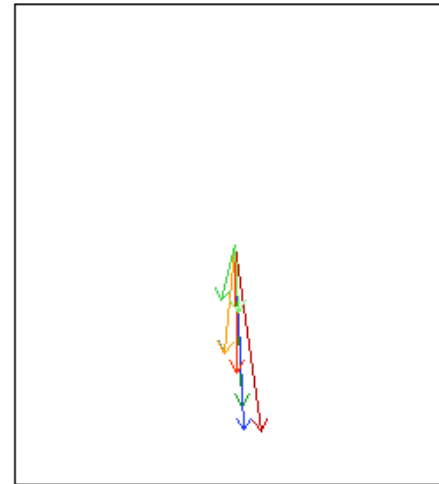
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1200



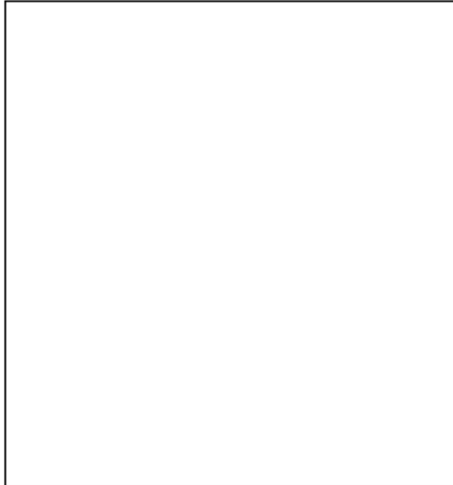
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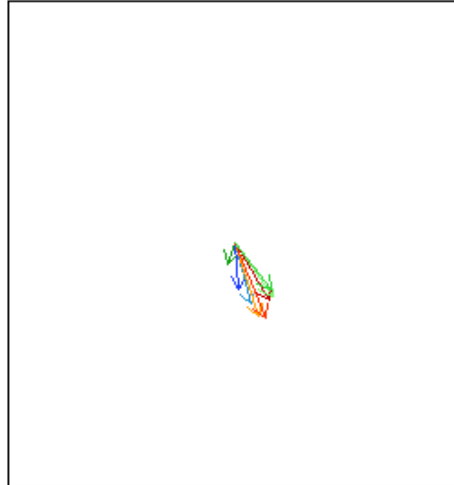
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10 m/s

Vilhena

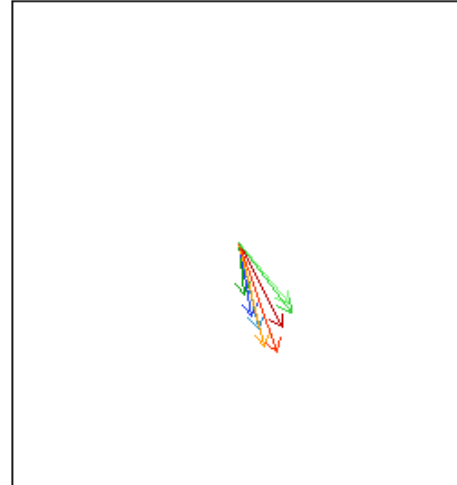
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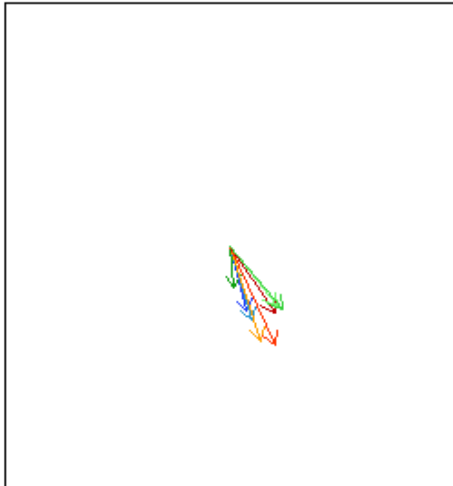
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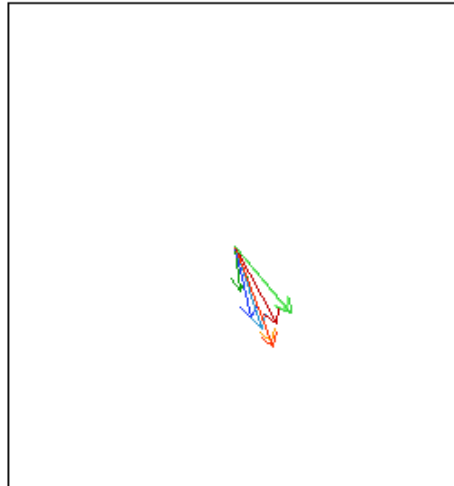
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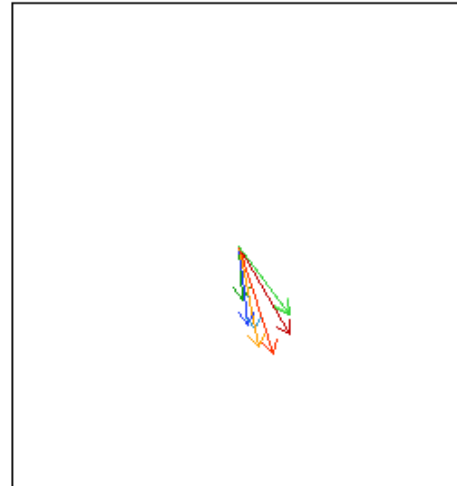
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1200

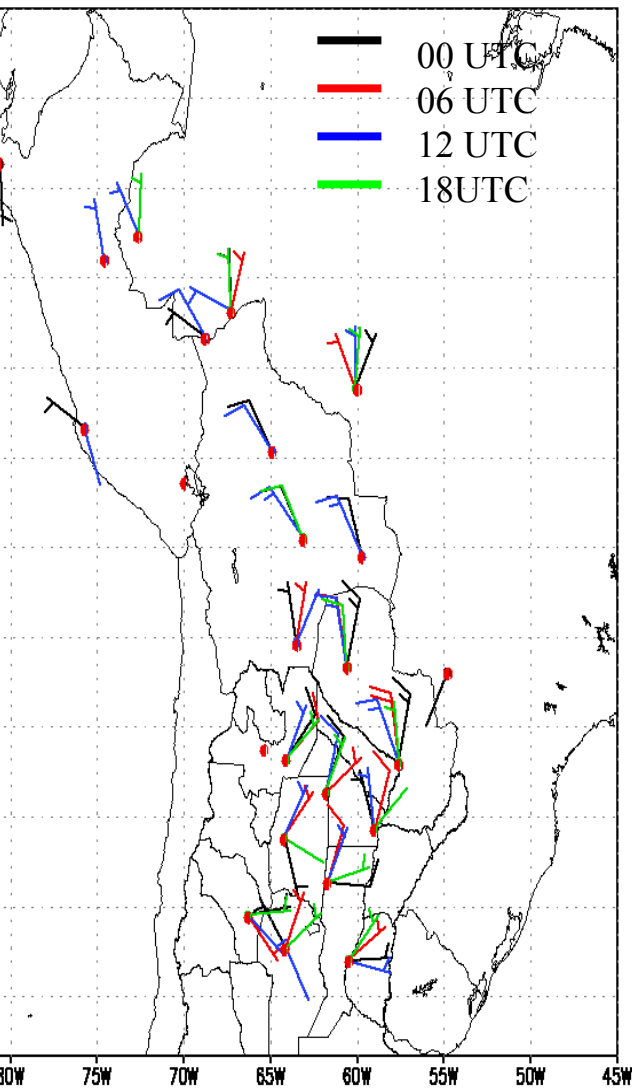


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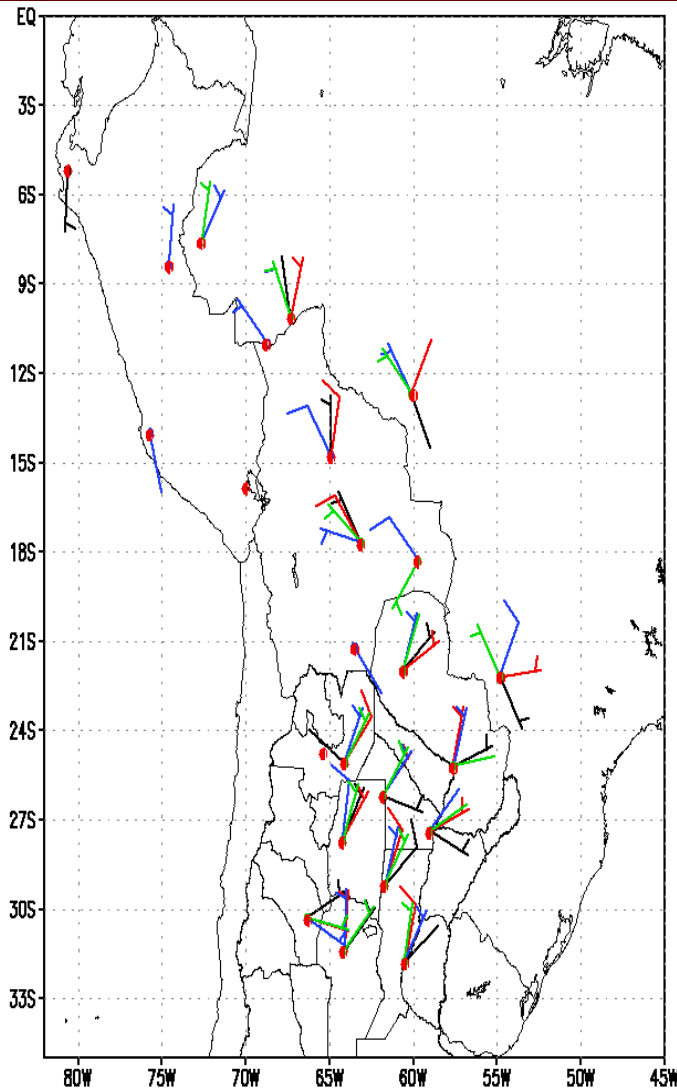


→
10 m/s

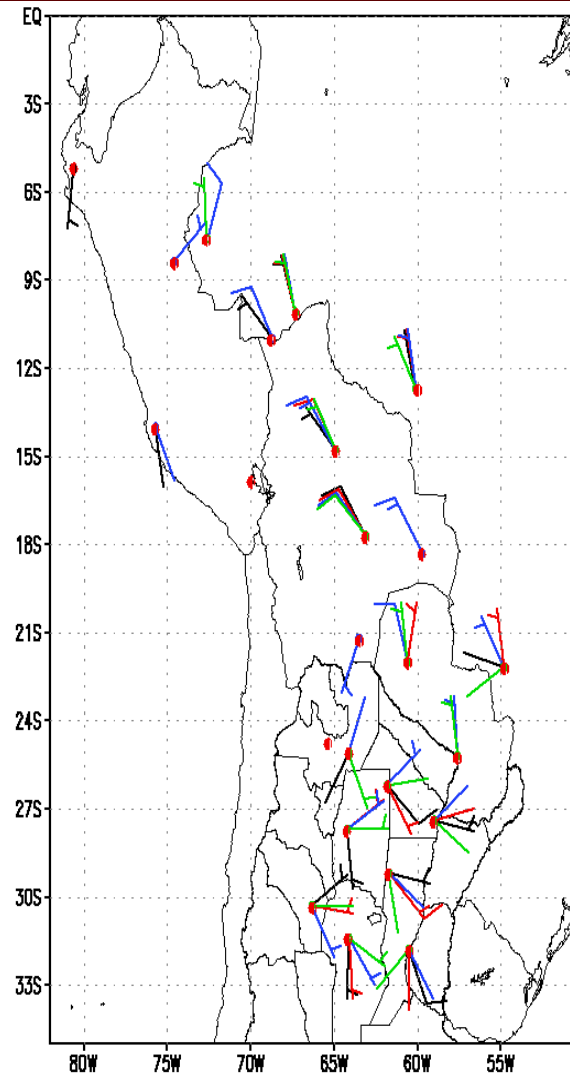
700 m asl



**SALLJ
Chaco**

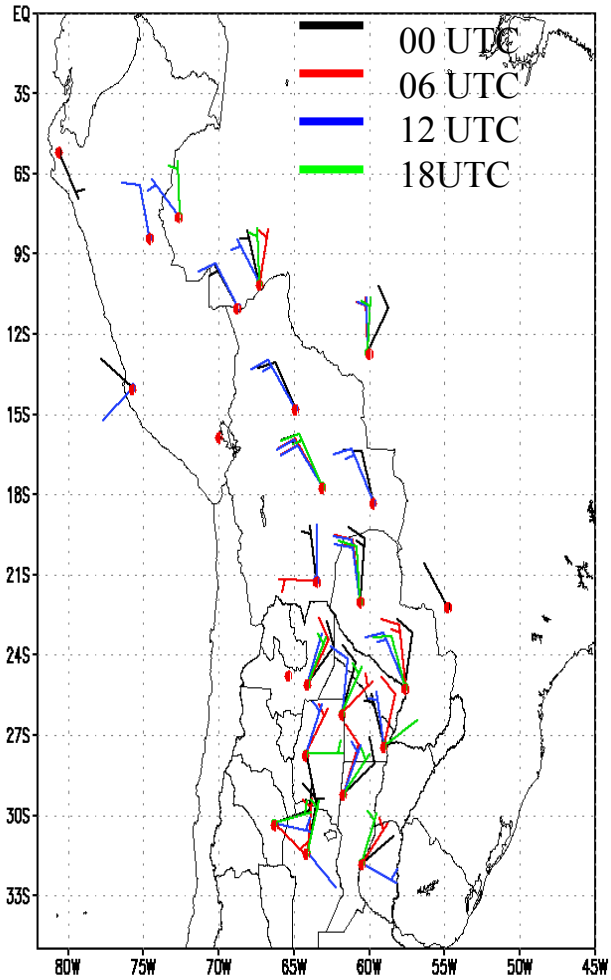


no-SALLJ

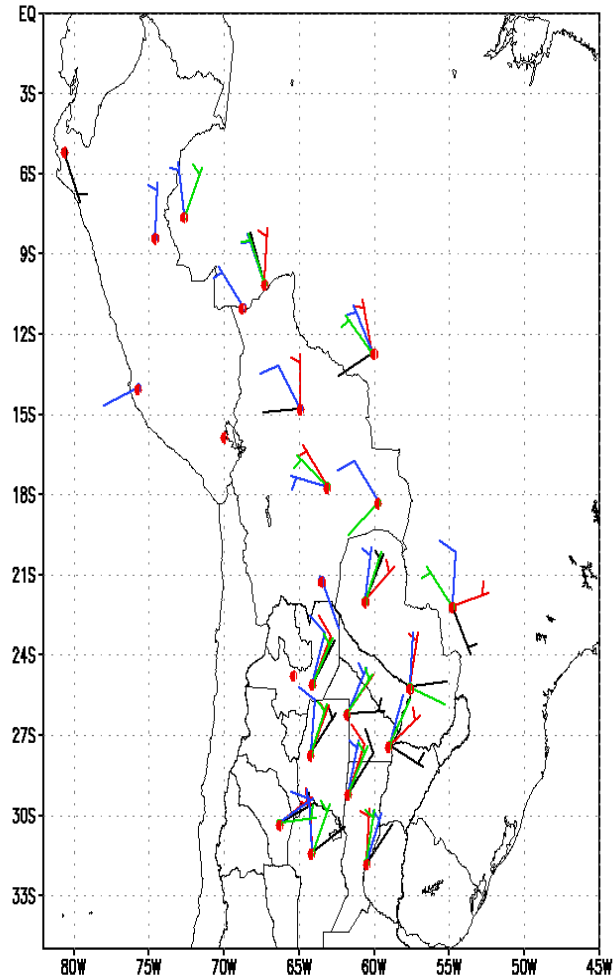


**SALLJ
noChaco**

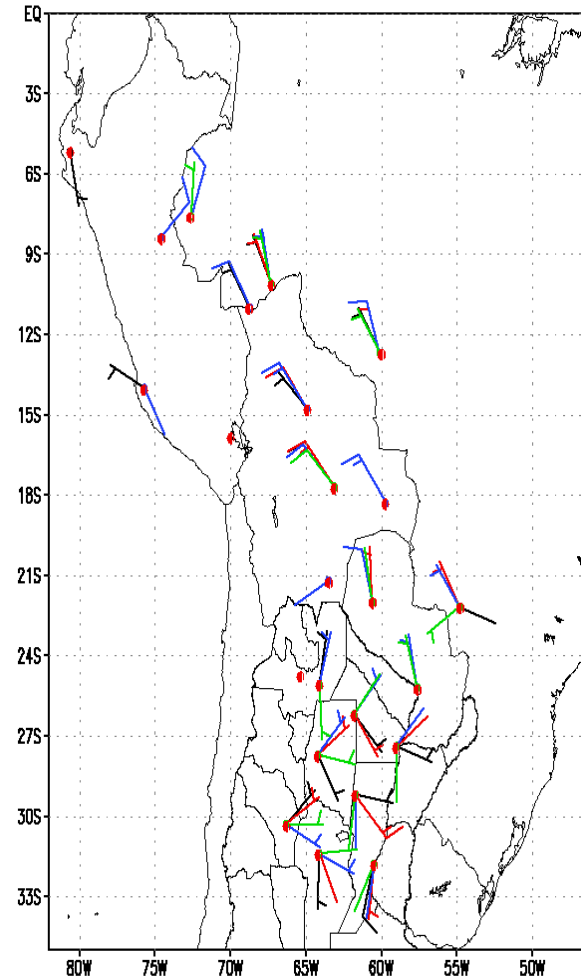
1000 m asl



**SALLJ
Chaco**

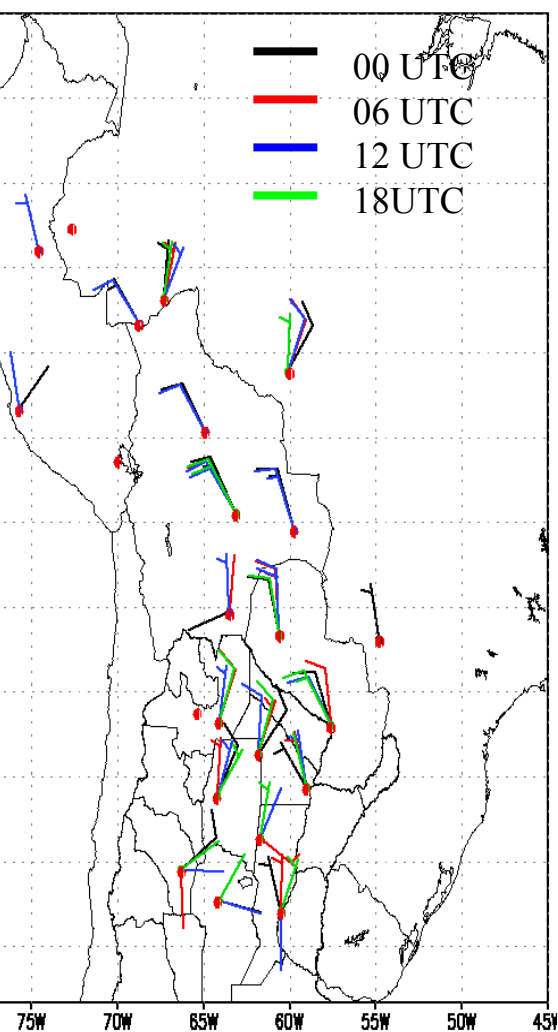


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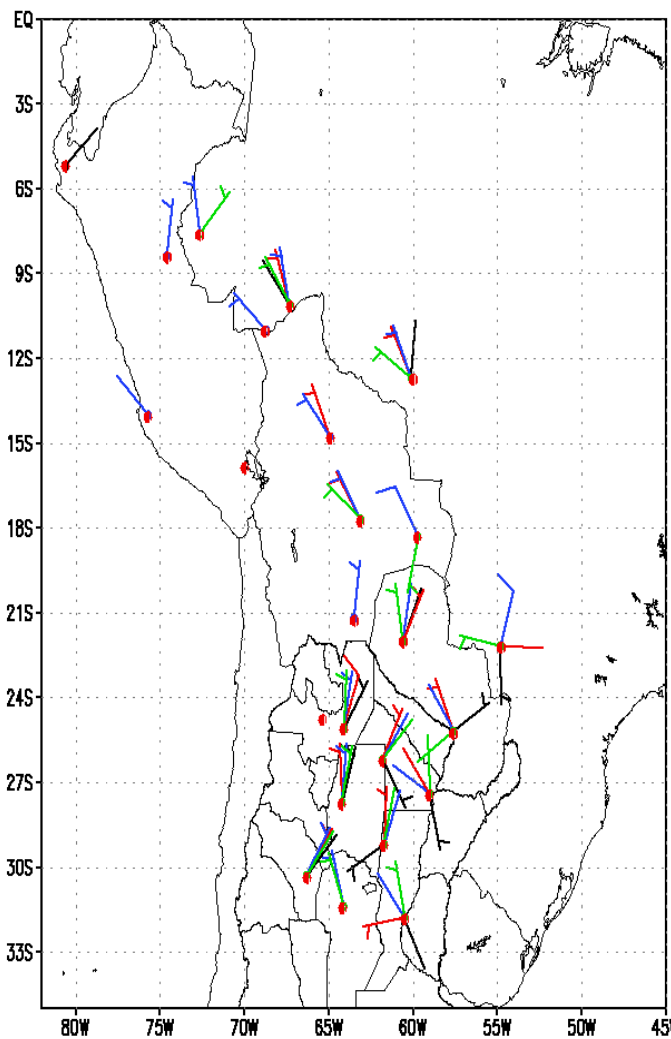


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noChaco**

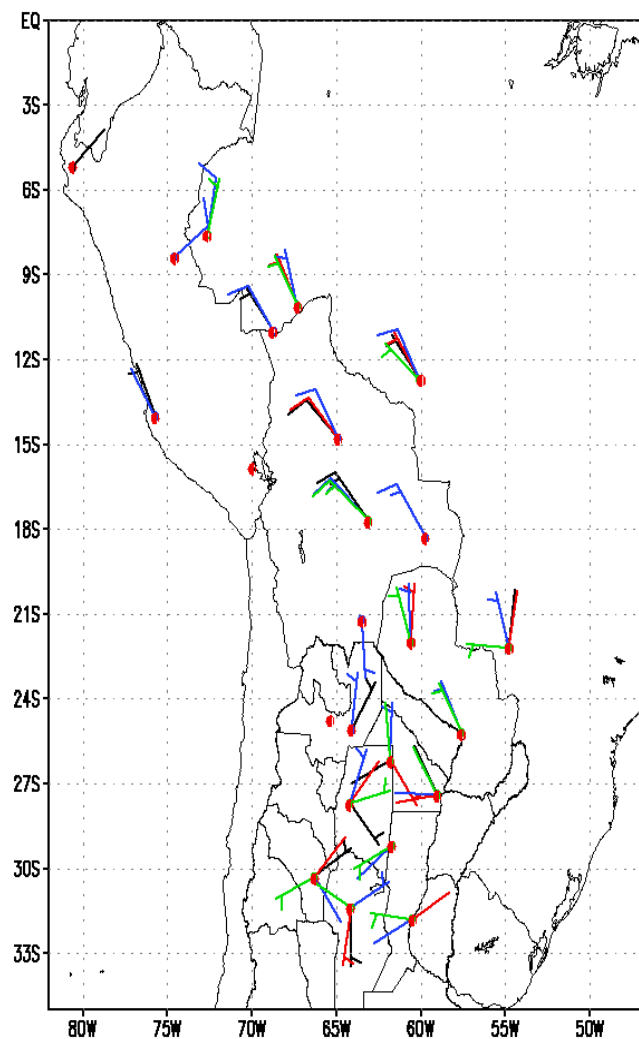
2000 m asl



**SALLJ
Chaco**

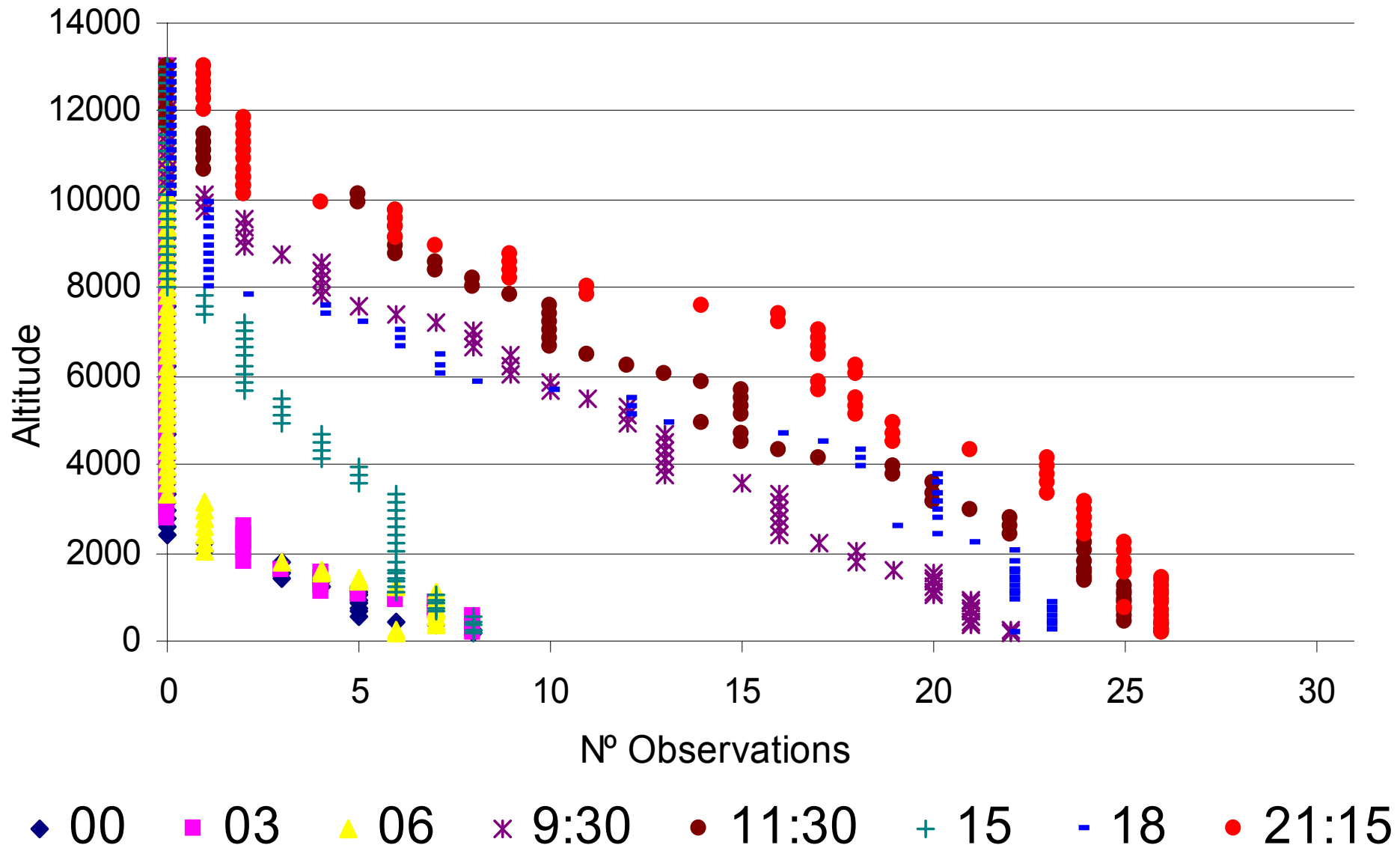


no-SALLJ



**SALLJ
noChaco**

Tostado - January

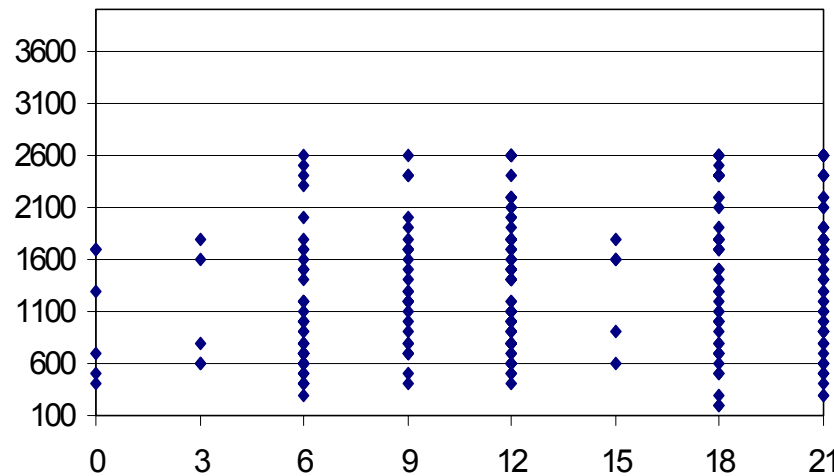


Height Vmax

Bonner

Mariscal Estigarribia

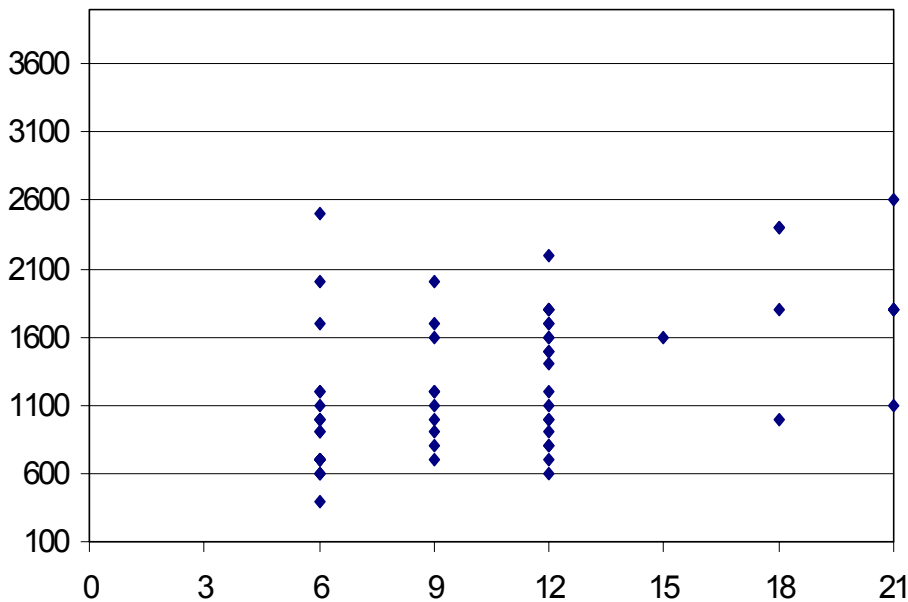
Season



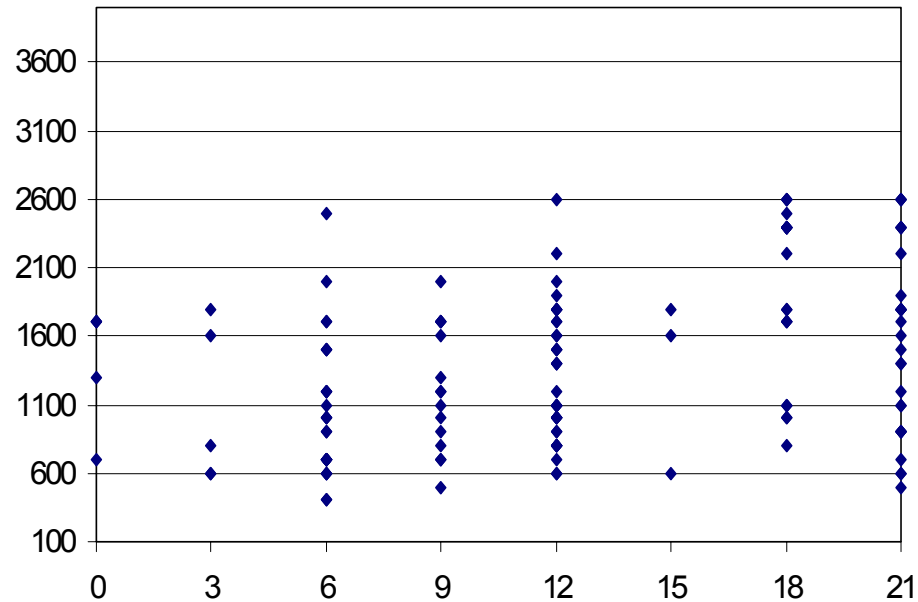
Northerly

$|V| > 10$ m/s

Mariscal Estigarribia



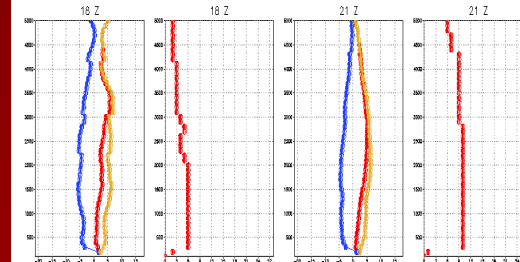
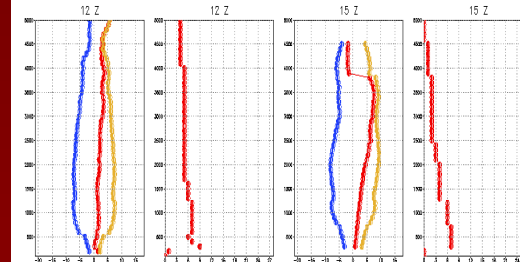
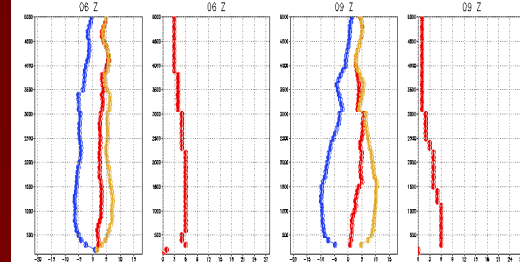
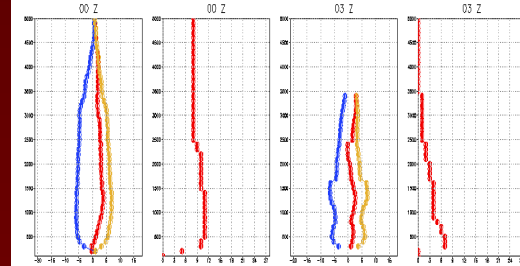
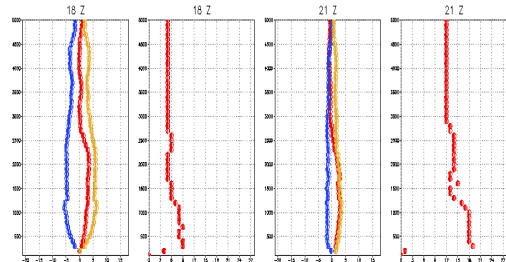
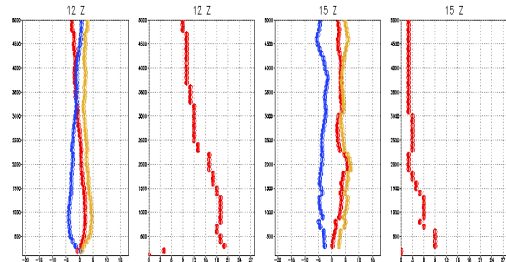
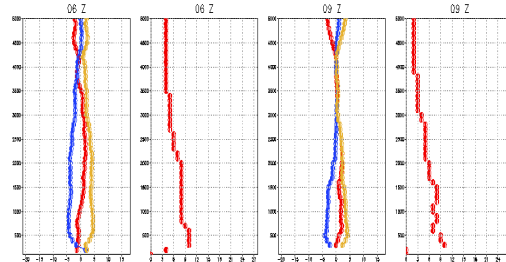
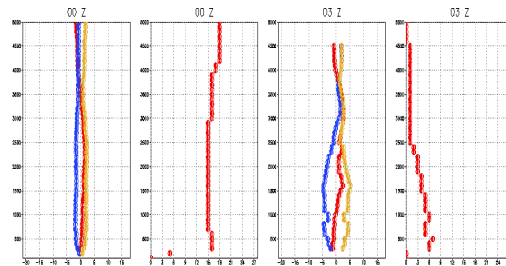
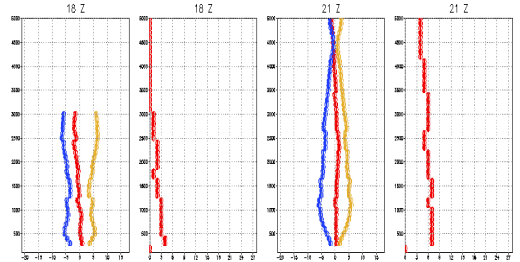
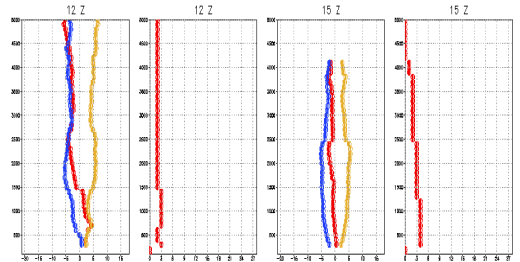
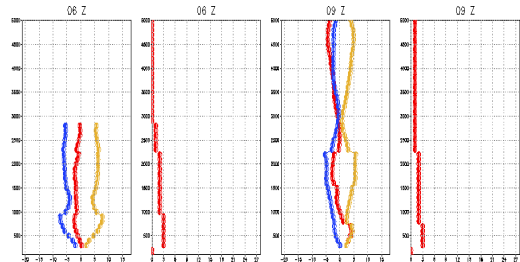
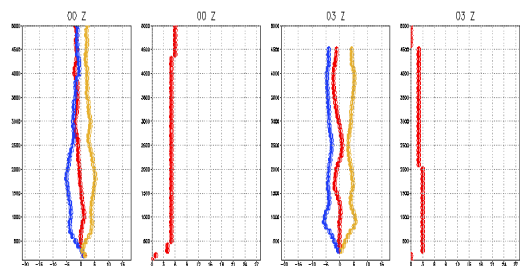
Mariscal Estigarribia



Río Branco

-20 0 +15
(interval 5m/s)

0 27

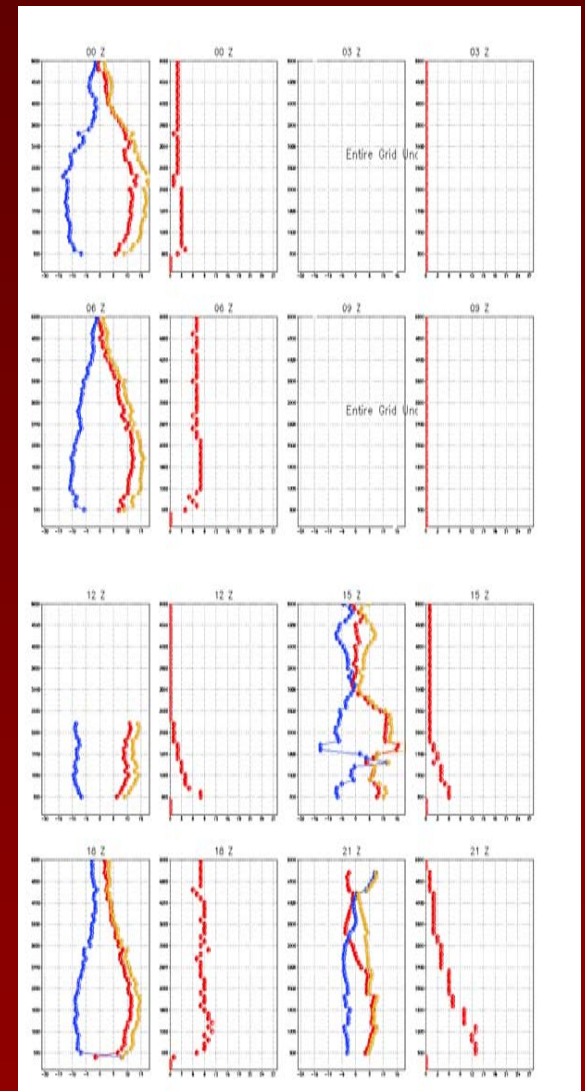
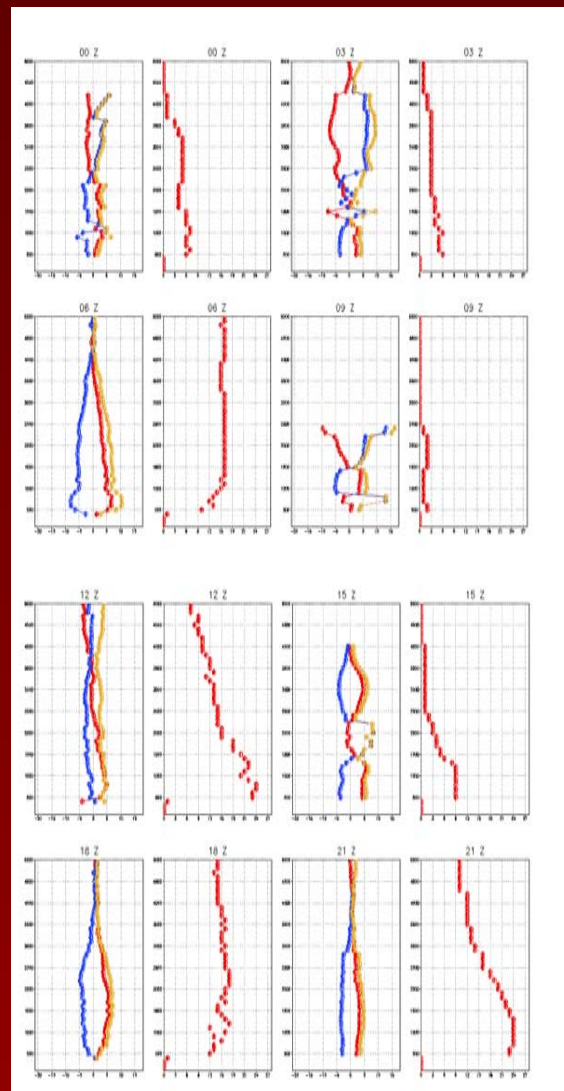
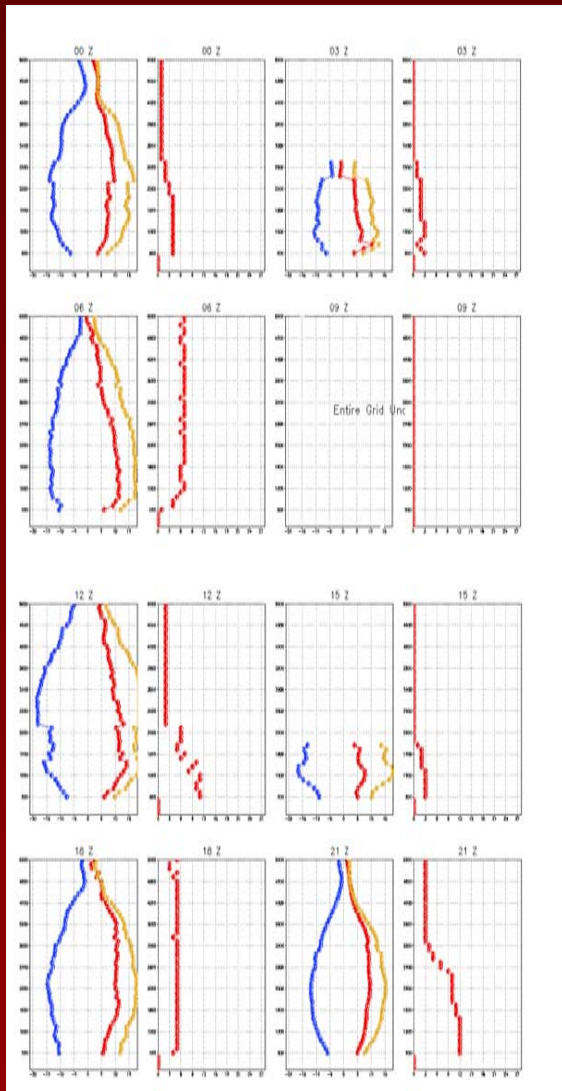


SALLJ Chaco

no-SALLJ

SALLJ noChaco

Santa Cruz

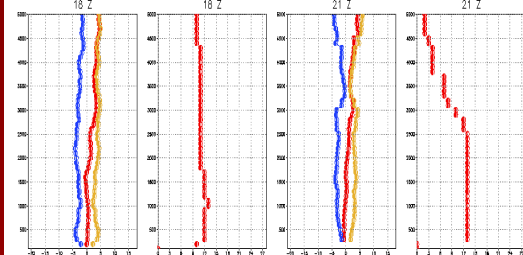
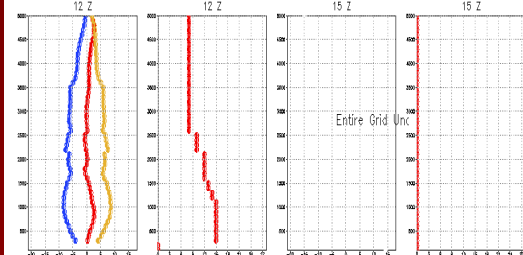
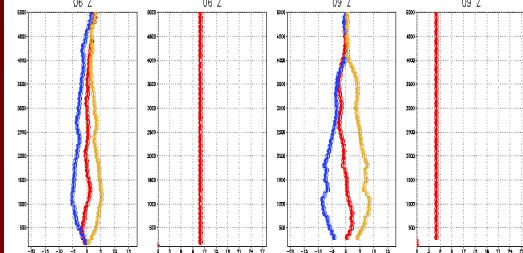
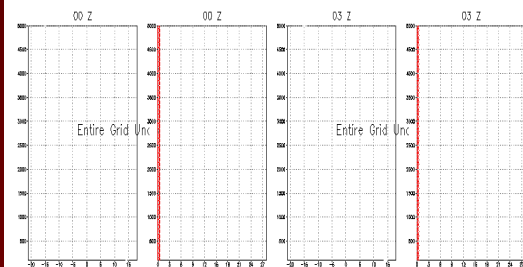
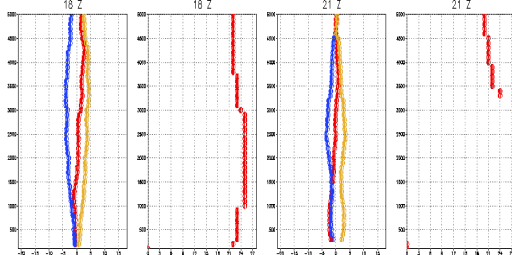
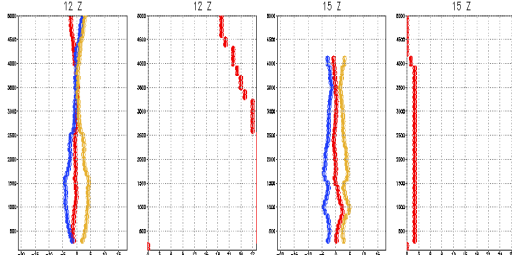
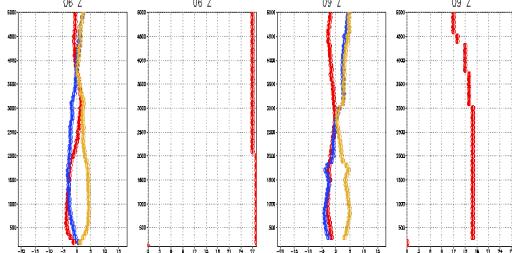
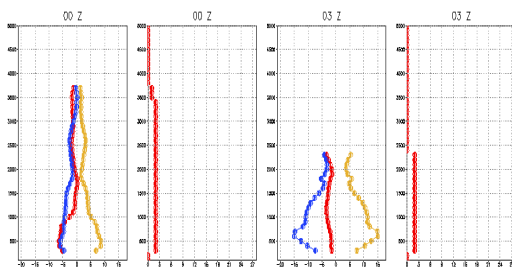
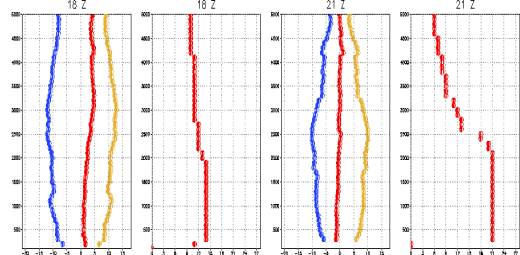
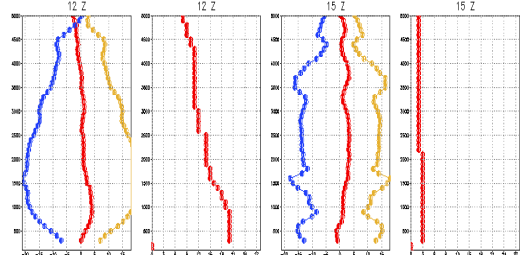
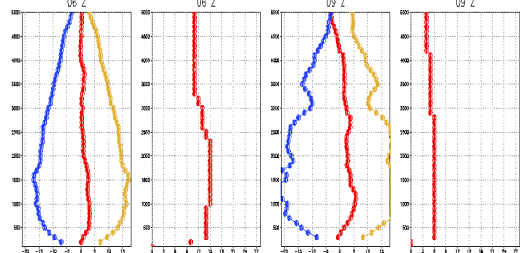
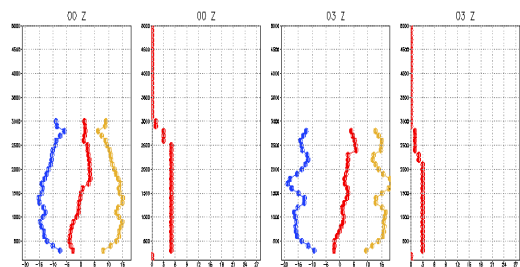


SALLJ Chaco

no-SALLJ

SALLJ noChaco

Mariscal Estigarribia

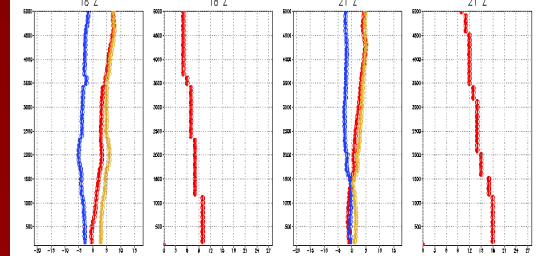
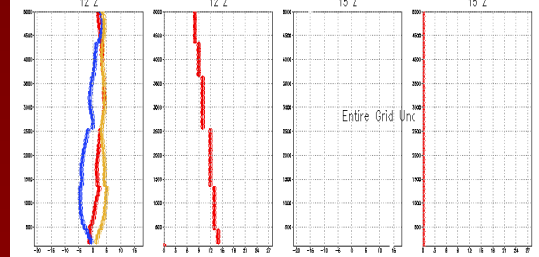
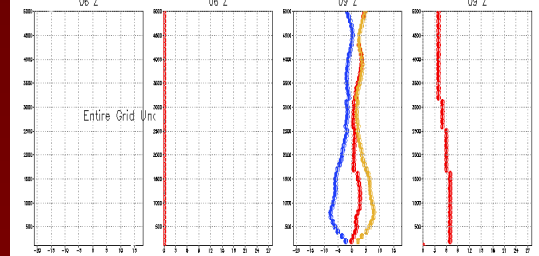
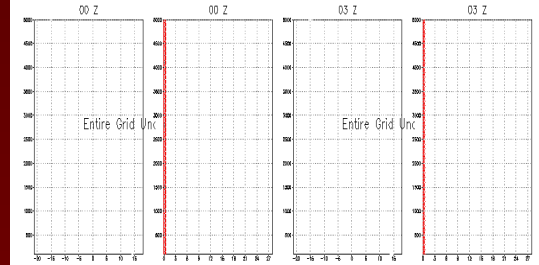
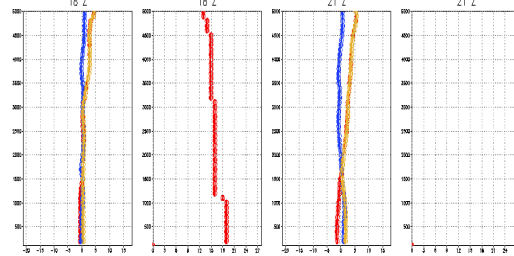
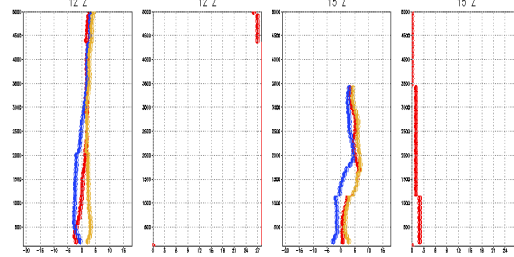
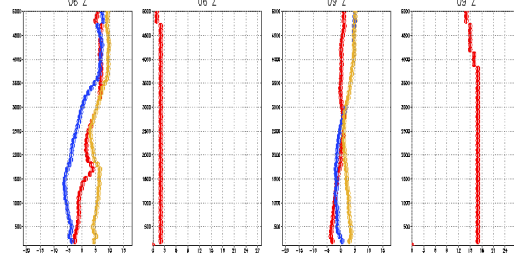
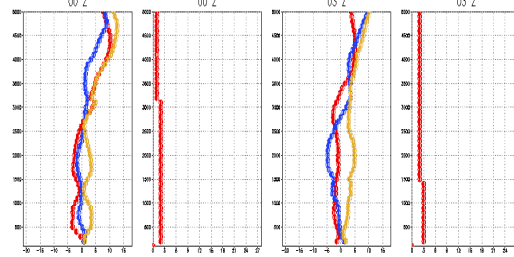
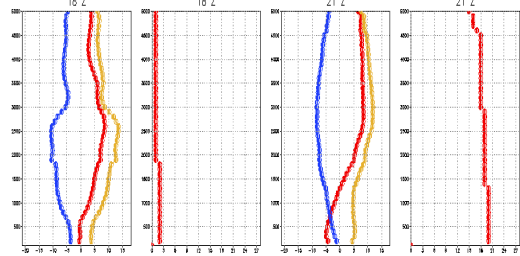
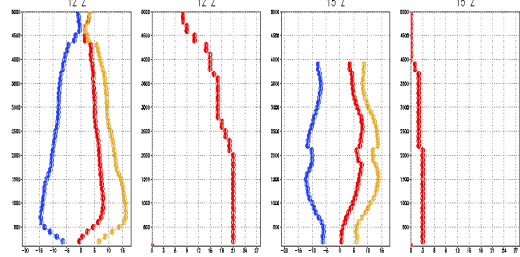
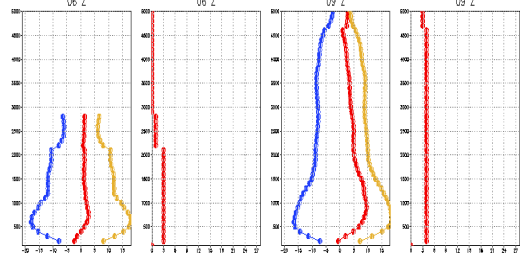
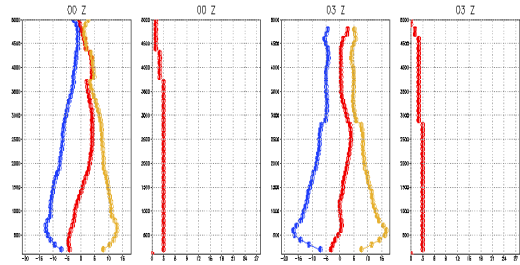


SALLJ Chaco

no-SALLJ

SALLJ noChaco

Asunción

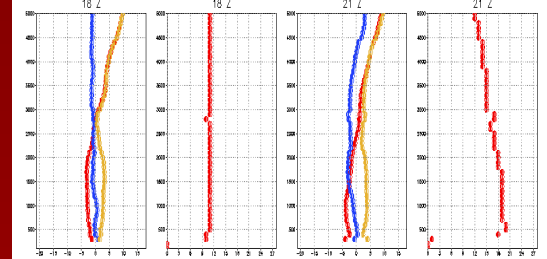
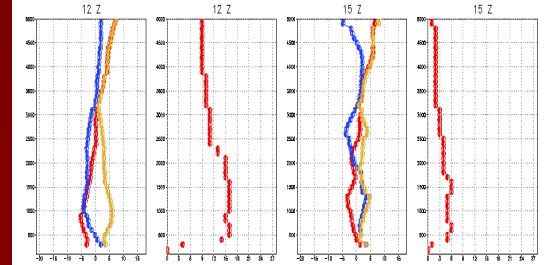
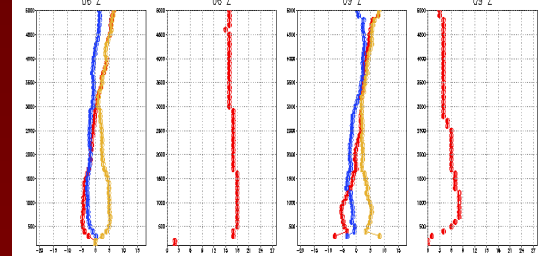
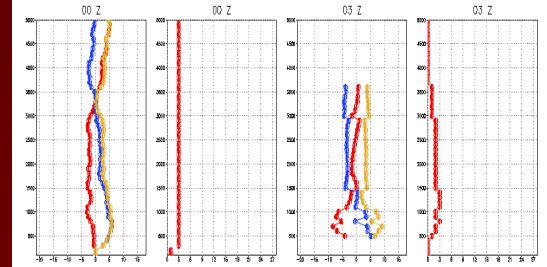
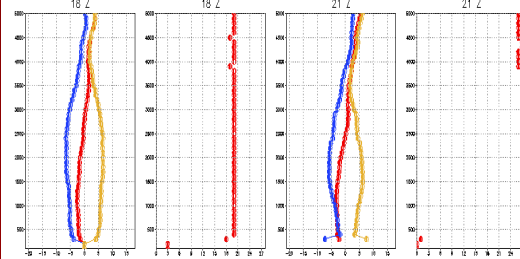
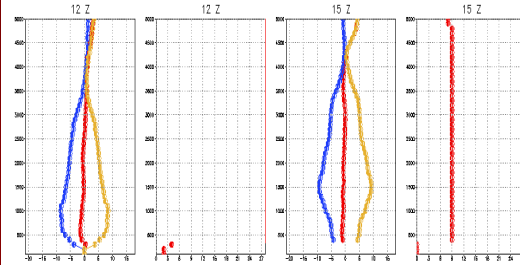
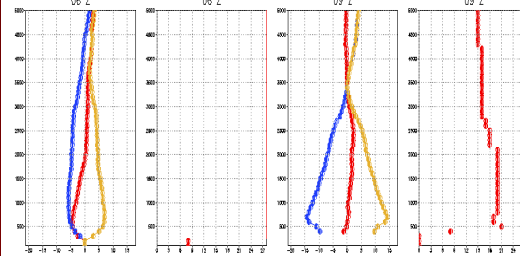
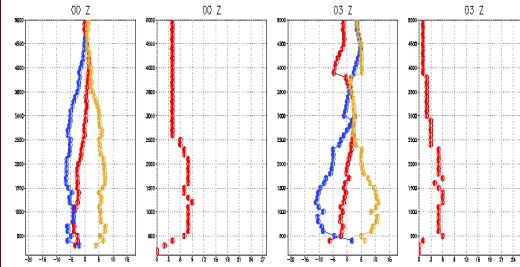
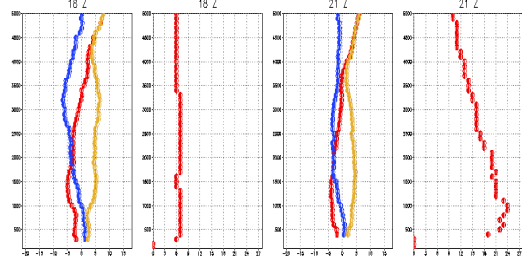
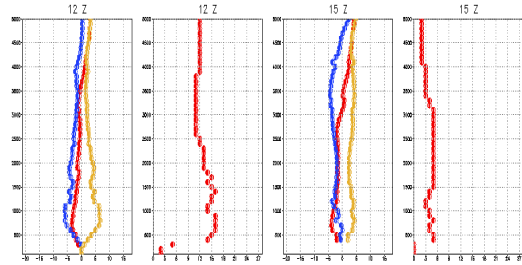
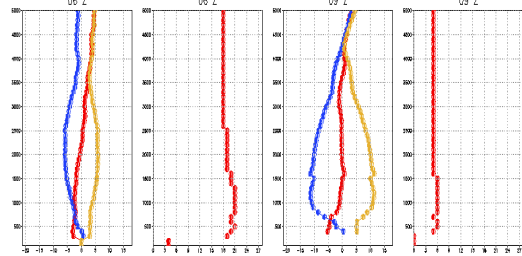
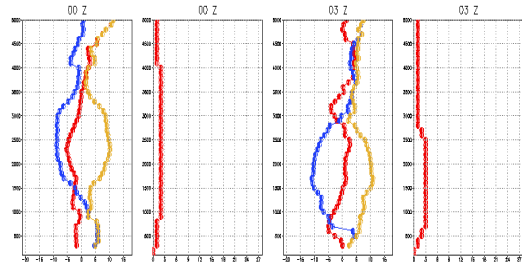


SALLJ Chaco

no-SALLJ

SALLJ noChaco

Santiago del Estero

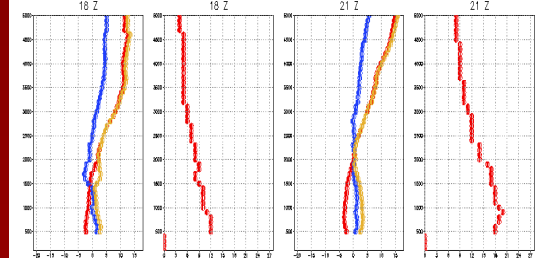
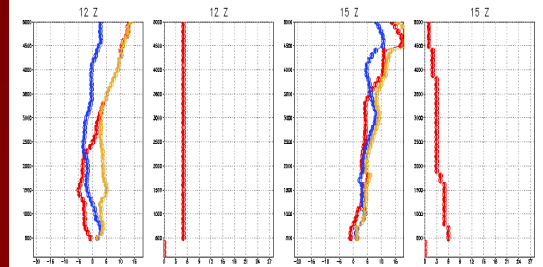
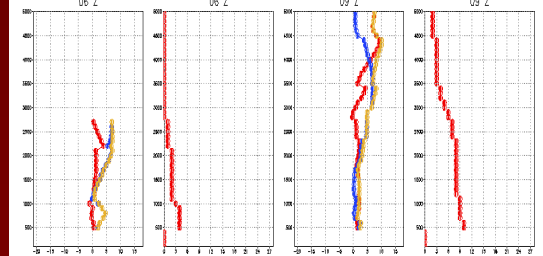
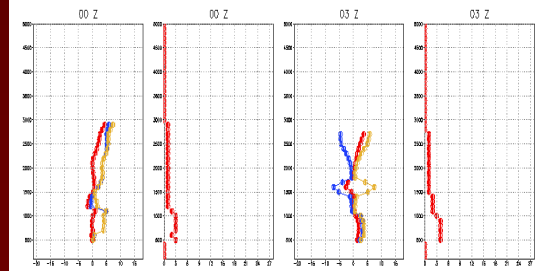
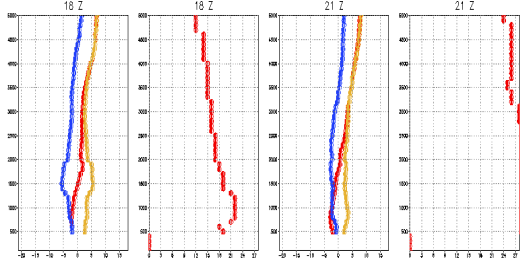
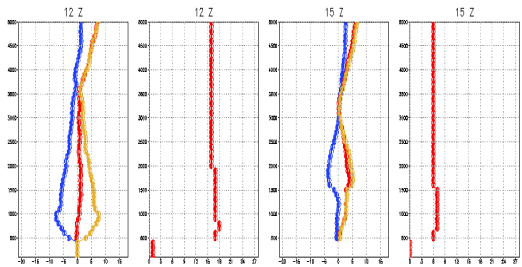
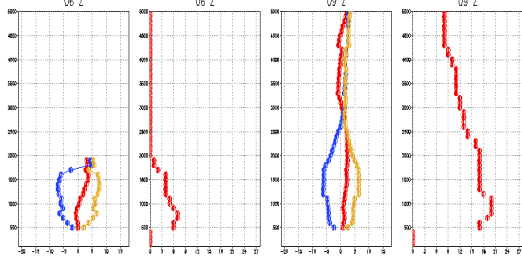
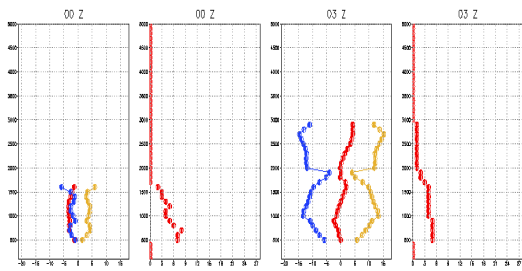
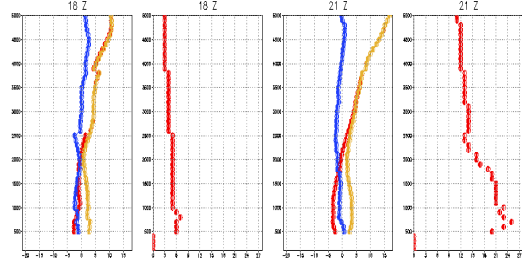
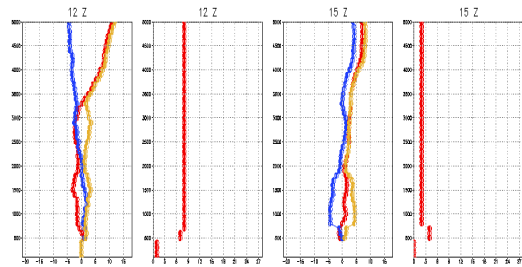
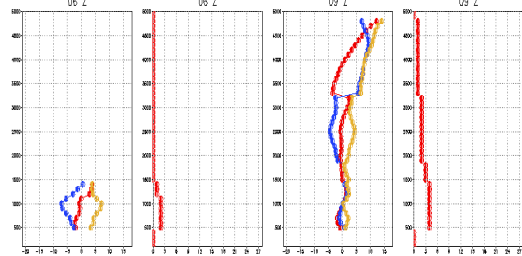
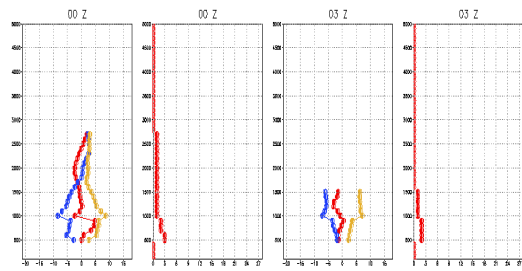


SALLJ Chaco

no-SALLJ

SALLJ noChaco

Córdoba



SALLJ Chaco

no-SALLJ

SALLJ noChaco

What have we learned from the composites of observations regarding diurnal cycle of the low troposphere wind structure?

- Diurnal rotation in the winds is weaker in the northern part of the network increasing toward the south where synoptic variability is stronger.
- Maximum speed altitude varies between 500 m and 3 km with a “tendency” to rise and display a more uniform maximum during daytime hours, consistent with a mixed layer growth. However, both this signal and spatial variability in the time of wind speed maximum are not clear in SALLJEX data.

- At the northern sites (Río Branco) the jet signal is very weak but it becomes stronger during SALLJ events with a maximum (10 m/s) at 9 UTC, in an uniform deep layer.

- At Santa Cruz the wind speed vertical profile shows a strong (~15 m/s) and high (in a 2 km layer) max present at all the available hours (except 21 UTC) during SALLJ events. This signal is still stronger during Chaco events. During no-SALLJ data show a much shallower max. Only at 6 UTC. This analysis needs to be confirmed with more future data.

- Over Paraguay sites the most significant evidence is the difference between Chaco events and all the other days with the occurrence of the strongest jets (>20 m/s, from 6 to 12 UTC, maximizing at 6 UTC). During SALLJ- no Chaco there is a max at ~ 1 km but almost uniform vertical profile. Max. amplitude in diurnal oscillation during Chaco.

- More to the south and near the Andes (Santiago del Estero), during no-SALLJ there is a shallow (~ 500 m) N jet ($V_{\max} \sim 15$ m/s) at 9 UTC that rises during the day up to 1.5 km at 15 UTC. During Chaco events the LLJ is higher (~ 1.5 km) and the amplitude of the diurnal oscillation is stronger than in the other 2 samples.

- Over NE Argentina (Resistencia) a jet is evident only during Chaco events (6 to 15 UTC, maximizing at 9 UTC, very shallow (~500 m) at 6 UTC, rising up to 1.5 km at 15 UTC.

- At the sites near the southern border of the network (Córdoba and Paraná) there is no occurrence of SALLJ. A weak signal of a jet is present during no-SALLJ events as at Santiago del Estero at 9 and 12 UTC. So, these locations allow to determine the southern limit of SALLJ.