

ALMA Memo 485

Chajnantor Windroses

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Abstract

Wind speed and direction measurements at Chajnantor are presented in windroses, highlighting seasonal and diurnal patterns.

Introduction

The wind speed and direction at the ALMA site near Cerro Chajnantor, Chile, are recorded every 10 min by an anemometer on an 8 m high mast atop the NRAO instrument container. This anemometer has operated more than 75 % of the time since 1995 April. The overall wind patterns are well established (Radford & Holdaway 1998): the median wind speed is 6 m s^{-1} , the wind blows predominantly from the west-northwest, especially in the winter, and the wind is strongest in the afternoon. In this memo, the wind data are presented in windroses, which provide a visual display of the wind patterns.

Windroses

A windrose presents the joint distribution of the wind speed and direction. At the center of the diagram, a circle shows the fraction of calm winds, regardless of direction. Then pie slices are drawn with outer radii indicating the fraction of winds blowing from each direction. Within each pie slice, arcs show the cumulative fraction of winds of different speeds.

At Chajnantor, the wind blows overwhelmingly from the west, $\approx 80\%$ of the time (Figure 1). There are calm winds ($< 1 \text{ m s}^{-1}$) about one eighth of the time and easterly winds prevail only about 5 % of the time. Furthermore, westerlies are stronger than winds from other directions.

Seasonal Variation

Winds at Chajnantor are strongest during the autumn and winter (April–September), when westerly and northwesterly winds blow almost exclusively (Figure 2). Calm and easterly winds are more common in the summer (January–March) although even then, westerlies are still stronger and more prevalent.

Diurnal Variation

Afternoon (18–22 UT) winds at Chajnantor are substantially stronger than at any other time of day (Figure 3). During the night and the morning (2–14 UT), northwesterlies prevail. The wind shifts to the west during the afternoon (16–20 UT) and develops a southwest component in the evening (22–24 UT).

Conclusions

Windroses present the joint distribution of the wind speed and direction. For Chajnantor, these reaffirm previous characterizations of the wind patterns: westerly winds predominate and the wind is stronger in the winter and in the afternoon. Windroses for individual months, years, etc., are available at the web site, <http://www.tuc.nrao.edu/alma/site>.

Reference

Radford, S. J. E., & Holdaway, M. A., 1998, Proc. SPIE 3357, 486

Chajnantor Winds 1995–2003

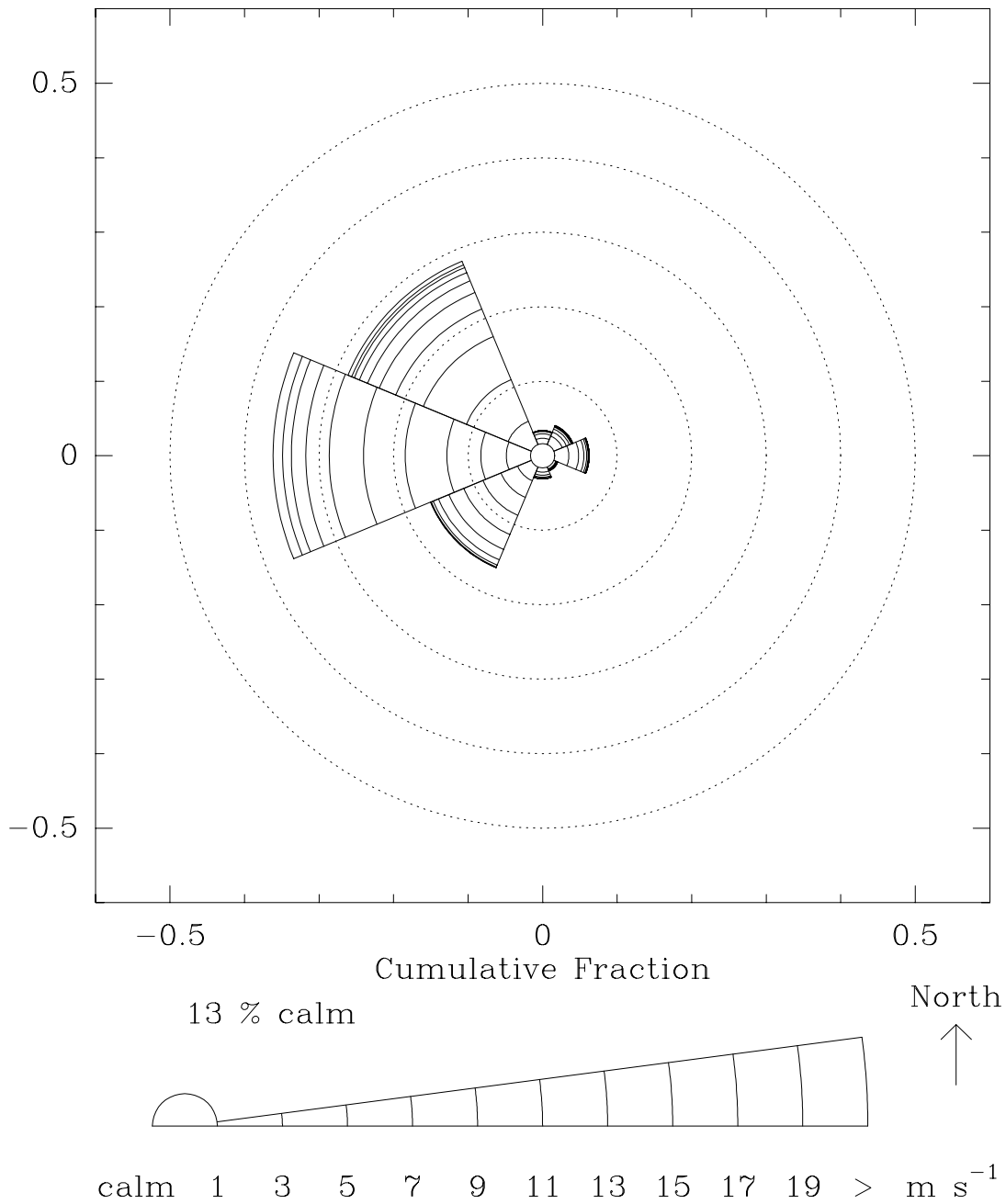


Figure 1: Chajnantor windrose for 1995 April through 2003 December. The central circle represents calm winds, $< 1 \text{ m s}^{-1}$, regardless of direction. Each pie slice shows the fraction of winds blowing from that octant. Within each pie slice, the arcs indicate the cumulative fraction of winds $< 3 \text{ m s}^{-1}$, $< 5 \text{ m s}^{-1}$, $\dots < 19 \text{ m s}^{-1}$, and $> 19 \text{ m s}^{-1}$. Because calm winds are apportioned equally to each octant, the radius of the center circle is one eighth the total fraction of calm winds.

Chajnantor Winds 1995–2003

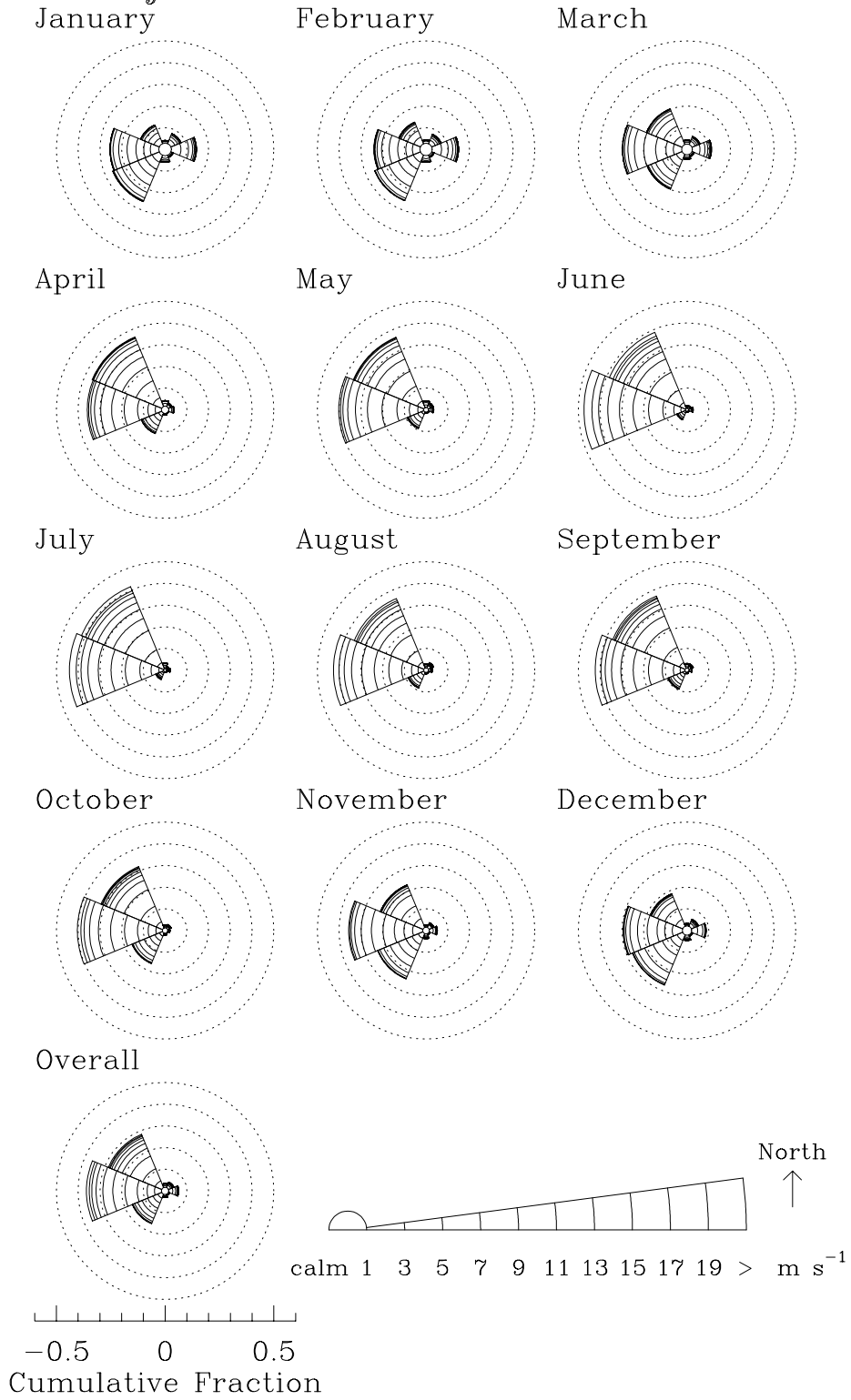


Figure 2: Seasonal wind variation at Chajnantor, 1995 April through 2003 December.

Chajnantor Winds 1995–2003

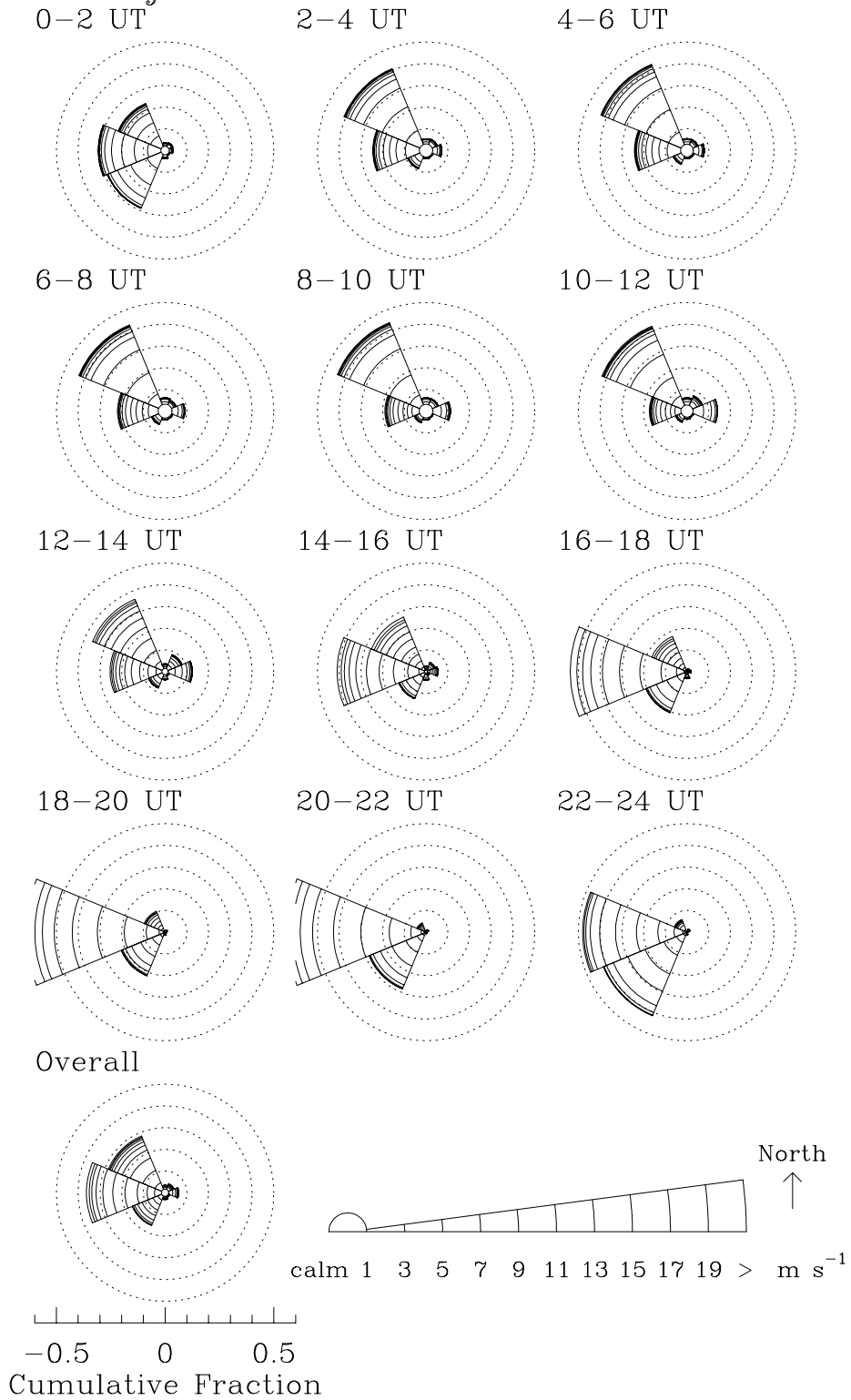


Figure 3: Diurnal wind variation at Chajnantor, 1995 April through 2003 December. Local solar time is UT – 4^h 31^m, so local noon is 16^h 31^m UT.