The measurements of gravity wave momentum flux using VHF radar winds in thelower atmosphere

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Abstract

The rapid steerability of the MST radar allows us to make three and four beam measurements simultaneously. The estimation of the vertical flux of horizontal momentum flux in the troposphere and lower stratosphere involves two methods: 1) using three beams – one vertical and two oblique, and 2) using four beams – two pairs of oblique beams systematically offset from the vertical. The objective of this study is to compare momentum fluxes computed with three and four beam methods, examine the variations of zonal and meridional momentum fluxes with height, variation of momentum fluxes with wave periods and body forces. The momentum fluxes measured by the two methods are almost the same for wind fluctuations in a fairly long period range (longer than 5 h). We choose frequency bands corresponding to periods of 30 min-8 h and 2-24 h. Zonal fluxes were small at lower levels and increasingly negative (westward) at higher heights. The dominant contributions to the meridional flux occur in the lower-frequency band. Vertical profiles of the zonal and meridional flux in each frequency band were found to be consistent, in general, with the total flux. The large vertical momentum flux values observed around the 16 km altitude on most of the observations are due to the presence of large zonal wind shears at that altitude. The results will be presented in detail in the meeting.

Introduction

Because of the continuous operation of multiple instruments, long term studies have been conducted to quantify the variability and latitudinal difference of gravity wave activity. It has been found from theoretical and observational studies that the high frequency gravity waves with small horizontal scales are the majority carriers of momentum. ~70 % of the momentum and the associated zonal drag are due to gravity waves with observed periods less than one hour **[*Fritts* and *Vincent*, 1987]**. Vertical flux of horizontal momentum in the troposphere and lower stratosphere has been studied by ***Prichard* and *Thomas*, [1993]** and ***Worthington* and *Thomas* [1996]** using MST radar at Aberystwyth (52.4°N, 4.1°W). They found that momentum fluxes for longer period waves show little changes with activity, whereas momentum fluxes of shorter periods are enhanced substantially during active periods. However, less is known about these waves in the lower atmosphere especially in tropics. The method of ***Vincent and Reid* [1983]** is used to estimate the vertical flux of zonal and meridional momentum fluxes from the radial velocities (in two orthogonal beams) measured by the VHF radar and is presented in this paper.

References

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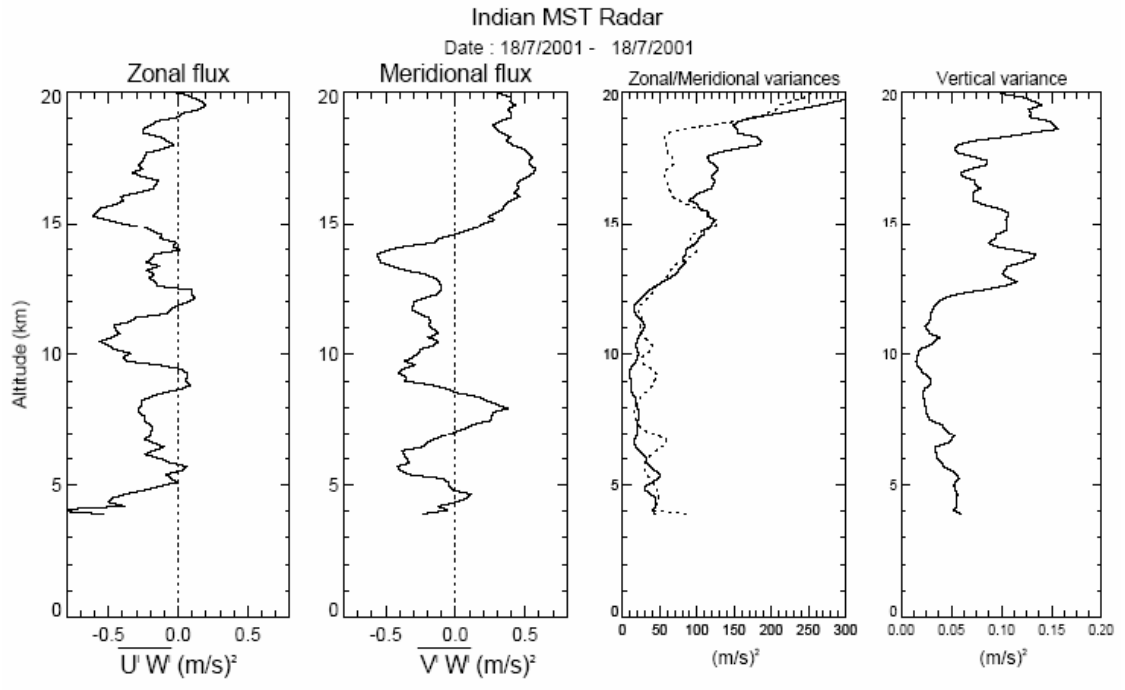

Figure1: Momentum flux and variance of wind fluctuations determined from the MST radar data during 1000-1600 LT on 18 July 2001. For this total 06 hours of observations were averaged. Dotted line represents meridional variance and solid line represents zonal variance.