



Characteristics of vertical air motion during monsoon over central Himalayan region using 206.5 MHz Stratosphere-Troposphere Radar

Nabarun Poddar* ^{(1),(2)}, Siddarth Shankar Das ⁽¹⁾, Manish Naja ⁽³⁾, Samaresh Bhattacharjee ⁽³⁾

(1) Space Physics Laboratory, Vikram Sarabhai Space Centre, ISRO, Thiruvananthapuram

(2) University of Kerala, Thiruvananthapuram

(3) Aryabhata Research Institute of Observational Sciences, DST, Nainital

email: nabarunpoddar1998@gmail.com

Abstract: Vertical motion (w) of air is an important dynamical variable as it facilitates the study of different atmospheric processes across different scales. This w has embedded the signatures of the prevailing atmospheric dynamics starting from local mesoscale processes right up to planetary scale circulations, all of which can be quantified with appropriate precision and period of observation of w . The upward and downward motion of air parcels are set in place to attain radiative-convective equilibrium in the troposphere. This indirectly controls the weather phenomena over a region in the lower troposphere. And has direct control over the dynamical, radiative, and chemical interactions between the well-mixed troposphere and the stably stratified stratosphere in the upper troposphere and lower stratosphere (UTLS) region through the transition inversion layer—the tropopause, whose vertical structure and temporal variability manifests the vertical exchange of mass and momentum between the lowest two layers of the atmosphere. These processes, termed as “Stratosphere-Troposphere Exchange” (STE) by the atmospheric science community, play a vital role in determining the climatological features of a region. To quantify all these processes precision in measured w becomes very important, but like any region of interest, having accurate measure of vertical motion of air is very difficult owing to its relatively small magnitude compared to the horizontal components of wind. In this aspect, a state-of-the-art, indigenously developed stratosphere–troposphere (ST) radar operating at 206.5 MHz, which is a pulse-Doppler radar at Aryabhata Research Institute of Observational Sciences (ARIES) Nainital (29.35°N; 79.45°E) – the region of interest in the central Himalayas, gives direct measurements w which has been used to study the long-term characteristics of vertical air motion and its role in the dynamical processes. Long term w measured from the radar vertical Doppler have been characterized. The study focusses on the characterisation of w during the Asian Summer Monsoon (ASM) season when the Asian Summer Monsoon Anticyclone (ASMA) is active over these regions. The profile-by-profile w observed are averaged for specific time periods of a day for all the monsoon months and for each month all together to understand the evolution and variation of the same during. Composite means with respect to months and times of a day both show the presence of downdrafts in the lower troposphere below 6 km in general, whereas in the middle to upper troposphere it is the mixture of both updrafts and downdrafts with generally updrafts occurring above 12 km. The transfer of air parcel from ground to UTLS region can be quantified as a two-step process similar in many ways to what was observed in tropical region in previous studies. This gives us an insight into the long-term characteristics of w over the region with seasonal variations associated with the various local climatological features. Details of results shall be presented at the upcoming conference.