Supplemental Material

1. Vertical structure of clouds

To study vertical structure of cloud layer and the wind field at seeding altitude, radiosonde data including Shanghai (121.44°E, 31.40°N ; ~150 km north of the experiment area), Hangzhou (120.16°E, 30.25°N; ~150 km west of the experiment area), and Taizhou (121.41°E, 28.62°N; ~150 km south of the experiment area) were analyzed at 0600 UTC. The cloud showed apparently double-layer structure over experimental region. The upper-layer cloud of 8~12 km height was dominated by west wind, however, the easterly wave cloud, which mainly blow ~4 km height, was dominated by east wind.

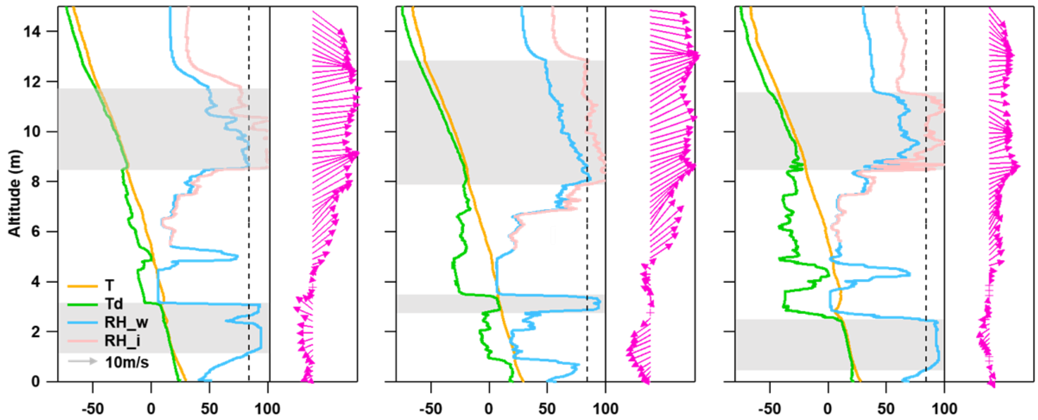

Figure S1. Vertical profiles of temperature (*T*), dew-point temperature (T_d), relative humidity (*RH*), wind speed and direction from radiosonde measurements over Hangzhou (120.16°E, 30.25°N; ~150 km west of the experiment area), Shanghai (121.44°E, 31.40°N ; ~150 km north of the experiment area), and Taizhou (121.41°E, 28.62°N; ~150 km south of the experiment area) at 0600 UTC on 4 September. Dot lines defined a threshold of 84% given by Wang and Rossow (1995), and the gray shaded area indicate cloud region which identified by RH threshold.

2. TREC technique description

The TREC method begins by subdividing the radar scan of Domain C into equal boxes with each box spaced some distance apart. The initial boxes are then correlated with all possible arrays of the same size in the second scan to find the best matching second box. The motion vector over a box is assumed to be uniform and is determined by calculating the maximum correlation coefficient (R_{max}) between two consecutive reflectivity boxes (Tuttle and Foote, 1990). The correlation coefficient (*R*) is then calculated using the following formula:

$$R = \frac{\sum_{x,y} Z_1(x,y) Z_2(x,y) - \frac{1}{N}\sum_{x,y} Z_1(x,y) \sum_{x,y} Z_2(x,y)}{\left\{\left[\sum_{x,y} Z_1^2(x,y) - N\,\overline{Z_1^2}\right] \times \left[\sum_{x,y} Z_2^2(x,y) - N\,\overline{Z_2^2}\right]\right\}^{\frac{1}{2}}} \quad , \tag{1}$$

where $Z_1(x,y)$ and $Z_2(x,y)$ represent the reflectivity arrays at times t_0 and t_1, $\bar{Z}_1$ and $\bar{Z}_2$ represent the mean reflectivity values of the box, and *N* indicates the number of data points within a box. A search radius $R = v_{max} \times t$, where v_{max} is the maximum velocity of the target echo, is used to limit the greatest displacement. According to the continuity of the echo development, the TREC method uses a correlation analysis to calculate the relative movement between successive boxes. The mean direction of the seeded echoes (Domain C) is estimated by averaging all TREC vectors of each box with in the domain identified by threshold reflectivity.

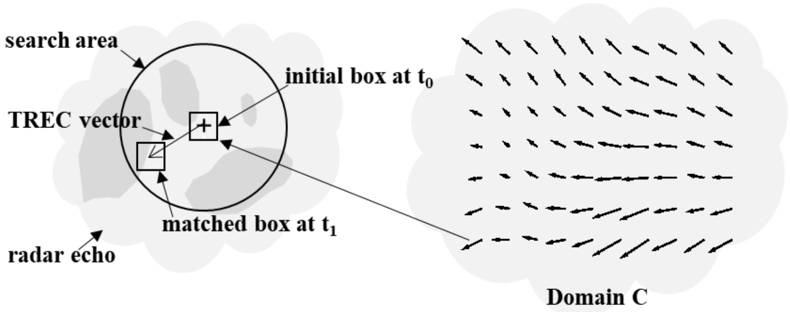

Figure S2. Schematic illustration shows the computation of a TREC vector to determine the motion of the Domain C which identified by threshold reflectivity. The box at time t_0 is compared to all boxes of the same size at a later time t_1 that appear within a circular search area. The position of the matched box for which the correlation coefficient reaches a maximum determines the end point of the motion vector.

3. Motion of the seeding echo

We tracked the seeding echoes frame by frame to analysis the variation caused by cloud seeding. As the seeding operation continued, radar parameters including *CR* and *VIL* gradually decreased. About 12 min after seeding ended (0418 UTC), *CR* decreased to a minimum (~10 dBz) and *VIL* was ~0.2 kg m^{-3}.

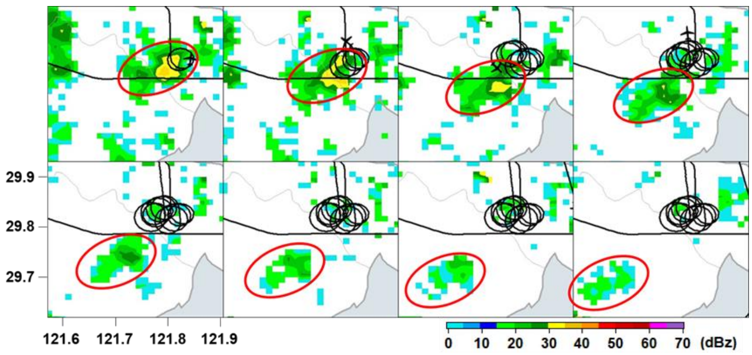

Figure S3. Composite reflectivity (5 layers grids data at 1000~3000m intervals of 500m) of seeding echo at 0336 ~ 0418 UTC (6 min intervals), The red oval outlines the seeding clouds. The red oval outlines the seeding cloud and the black lines represent flight track. To clearly show seeding cloud, weak echoes (<10dBz) are rejected.

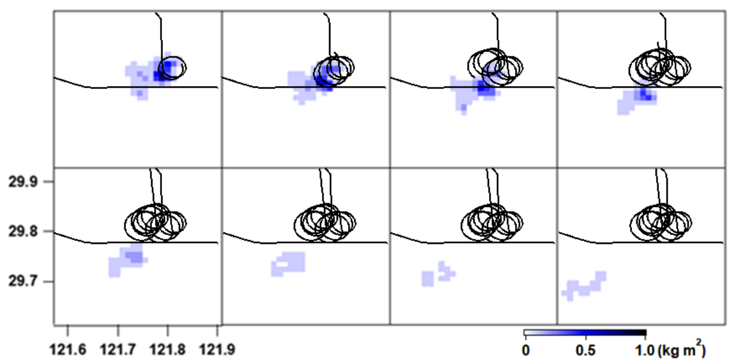

Figure S4. Vertical integration liquid water content (VIL, consider 5 layers grids data at 1000~3000m intervals of 500m) of seeding echo at 0336~0418 UTC (6 min intervals).

4. Reference

Tuttle, J. D., and Foote, G. B.: Determination of the boundary layer airflow from a single Doppler radar, Journal of Atmospheric and oceanic Technology, 7, 218-232, 1990.

Wang, J., and Rossow, W. B.: Determination of cloud vertical structure from upper-air observations, Journal of Applied Meteorology, 34, 2243-2258, 1995.