



## Microwave Profiling and Airport Weather

An [Aviation Weather Decision Support System](#)<sup>1</sup> is now in operation at the Dubai International Airport. The AWDSS collects Microwave Profiler, wind profiler, radar, satellite and surface observations. It ingests these data into a Weather Research and Forecast model and uses a suite of detection and Nowcasting algorithms to evaluate and forecast airport weather risks. Included are thunderstorms, fog, sea breeze fronts and strong temperature inversions with associated wind shear and turbulence. The system detects, Nowcasts, and forecasts these conditions and delivers automated alerts of hazardous conditions to meteorologists and air traffic controllers. This approach ensures that optimum airport weather support is provided by continuous **surveillance** of upper air dynamics.



### *Radiometrics MP-3000A at Dubai International Airport*

Radiometrics advanced Microwave Profiler (MP-3000A) technology provides continuous temperature and humidity profiles from the surface to 10 km height, with accuracy equivalent to representativeness error of radiosonde soundings at the same site and time. During typical 12-hr radiosonde launch intervals, MP data are up to ten times more accurate than radiosonde data. MP technology also measures liquid water profiles linked to local convection, lightning, downburst, precipitation, fog, visibility and turbulence.

Timely upper air data are crucial for applications requiring accurate Nowcasting and short term forecasting. Continuous MP upper air temperature, humidity and liquid “videos” show short term changes that precede local severe weather. Many of these changes are typically invisible to the eye or radar because of lack of sensitivity, and to radiosondes because of infrequent sampling intervals.

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<sup>1</sup>AWDSS is a Weather Decision Technologies <<http://www.wdtinc.com>> product.



Well established forecast indices based on radiosonde data are useful for short term local forecasting. Included are K-Index (KI), Convective Available Potential Energy (CAPE), Lifting Index (LI), Convective Inhibition (CINH), Total Totals Index (TTI), Showalter Index (SI), etc. These indices can be generated continuously from MP data (and also from wind profiler data) and are very useful for short time local forecasting. New forecast indices are likely to emerge based on continuous MP liquid profiles.

Traditional (virtual) temperature profiling capability has been provided by Radio Acoustic Sounding Systems (RASS) used in conjunction with wind radar profilers. On a daily basis, the largest temperature profile variations typically occur in the lowest 50 m air layer. This layer, which is important for aviation, air quality and homeland security applications, is accurately monitored with MP technology, but is not seen by RASS measurements that start at 100 m (or more) height.

MP technology is passive and fully functional in high winds whereas RASS generates loud acoustic noise (a common source of complaints in populated areas), and does non-functional in high winds. Further, the MP provides temperature and virtual temperature whereas RASS provides only virtual temperature. However, if required, virtual temperature can be calculated from MP temperature and humidity measurements.

MP profile time resolution is less than 1 minute. Vertical resolution is 50 m from the surface to 500 m height, 100 m from 500 m to 2 km height, and 250 m above 2 km height.

## References

- Barrere, C., M. Eilts, J. Johnson, R. Fritchie, P. Spencer, B. Shaw, Y. Li, W. Ladwig, R. Schudalia and D. Mitchell, 2008: [An Aviation Weather Decision Support System \(AWDSS\) for the Dubai International Airport](#), **13th Conf. Aviation, Range, and Aerospace Met., AMS.**
- Chan, P.W., 2005: [Monitoring and Observation of Föhn Wind in Hong Kong using a Multi-Channel, Ground-Based Microwave Radiometer](#), **28th Int. Conf. Alpine Meteor. (ICAM) & Ann. Sci. Meet. Mesoscale Alpine Prog. (MAP).**
- Guedner, J., and D. Spaenkuch, 2001: [Remote sensing of the thermodynamic state of the atmospheric boundary layer by ground-based microwave radiometry](#), **JAOT.**
- Hewison, T., 2006: [1D-VAR Retrieval of Temperature and Humidity Profiles from Ground-based Microwave Radiometers](#), **IEEE TGARS.**
- Knupp, K., Ware, R., D. Cimini, F. Vandenberghe, J. Vivekanandan, and E. Westwater, 2008: [Ground-Based Radiometric Profiling during Dynamic Weather Conditions](#), **JAOT (in preparation).**
- Shaw, B., P. Spencer, R. Carpenter, and C. Barrere, 2008: [Implementation of the WRF Model for the Dubai International Airport Aviation Weather Decision Support System](#), **13th Conf. Aviation, Range, and Aerospace Met., AMS.**