



**Barcelona  
Supercomputing  
Center**  
*Centro Nacional de Supercomputación*



# Applications of remote sensing for improvement of air quality forecasts over Europe

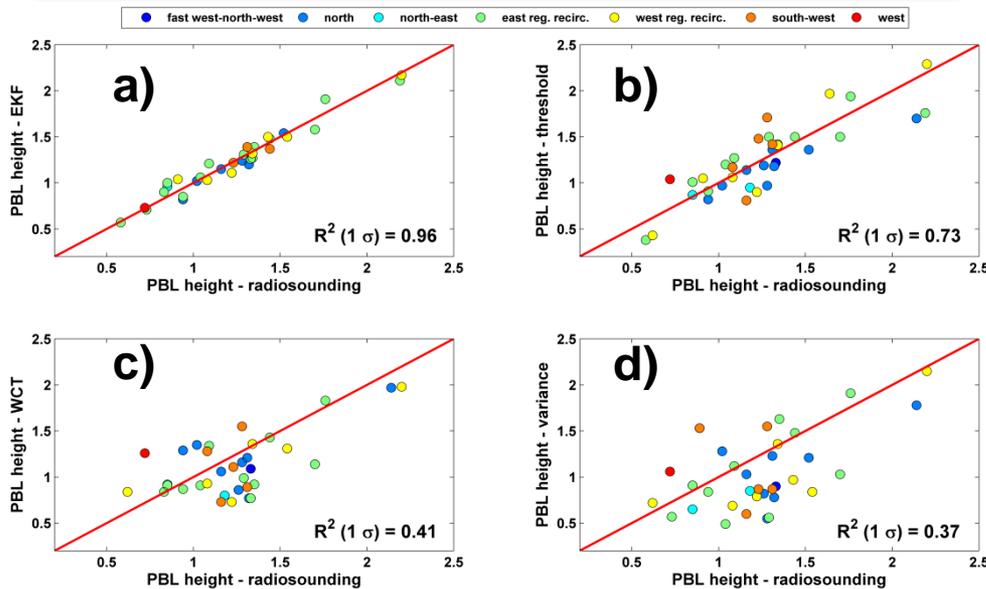
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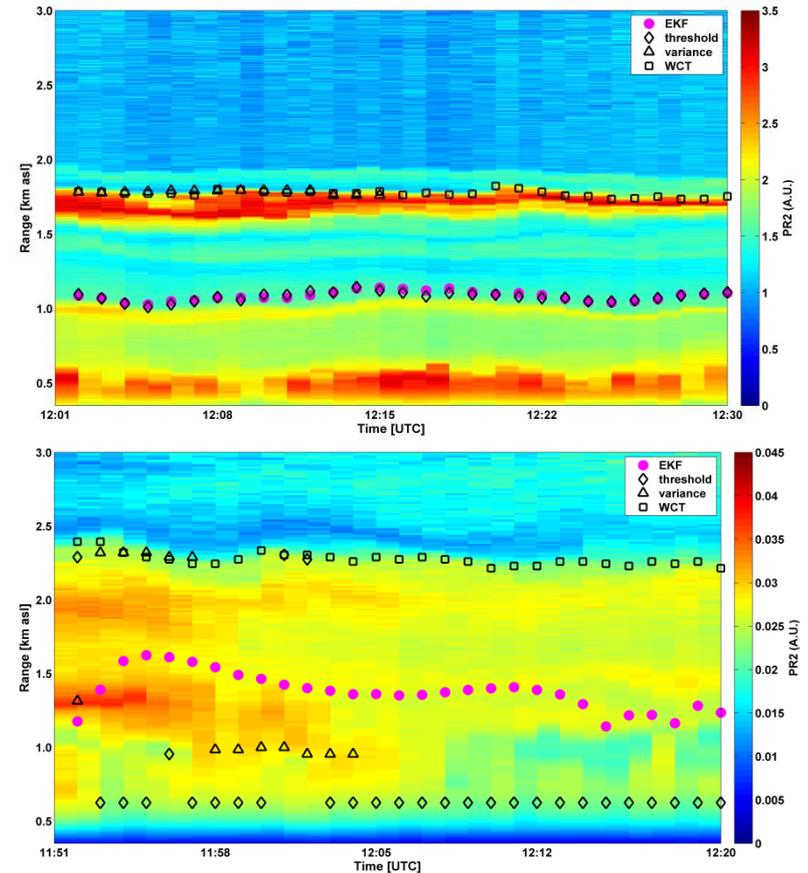
Barcelona Supercomputing Center, Earth Sciences Dept.



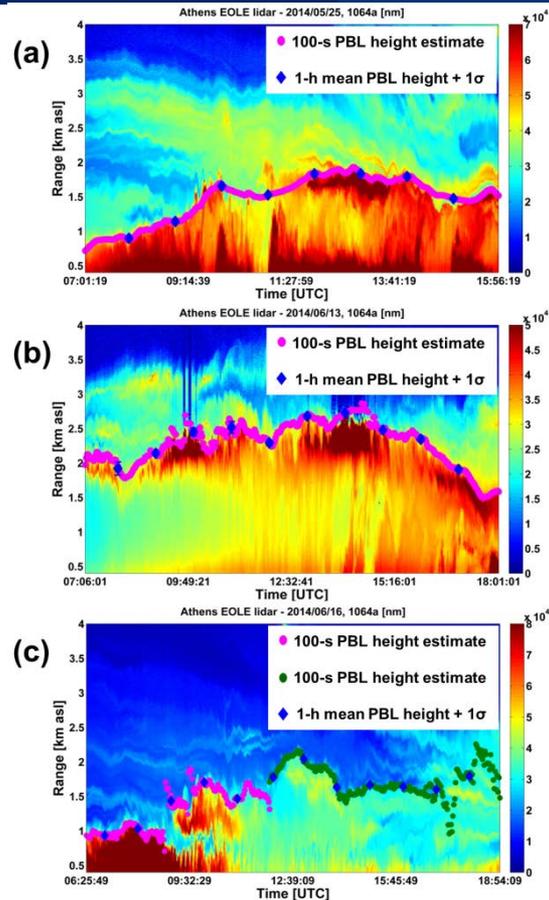
*Banks et al. (2014, Proc. of SPIE)* → It was found that a time-adaptive extended Kalman filter technique provided lidar estimates closest to the observed values



PBL heights estimated from lidar-based methods against radiosounding for a) extended Kalman filter, b) threshold, c) wavelet covariance transform, and d) variance methods. Data are colour-coded according to synoptic cluster type arriving at 1.5 km altitude over Barcelona, Spain using 16-yr back-trajectory data.

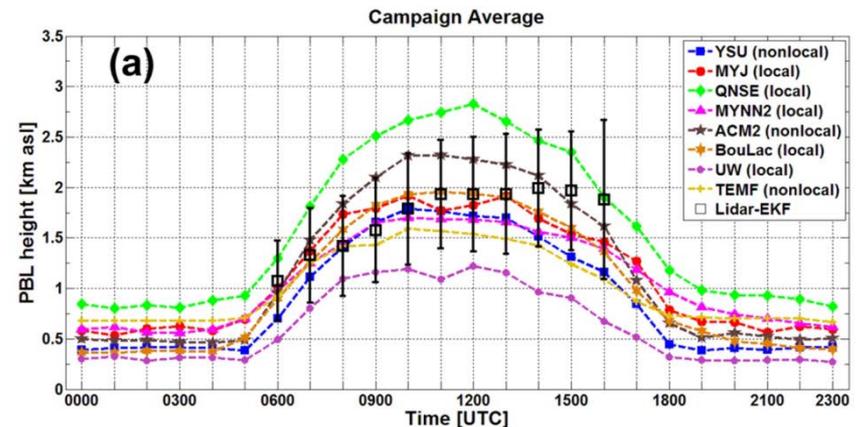


Lidar time-height series for the 2 most frequent synoptic types in Barcelona; regional recirculations (top) and southwest Saharan dust episodes (bottom). Overlaid are 1-min PBL height estimates from the extended Kalman filter and 3 classic methods.



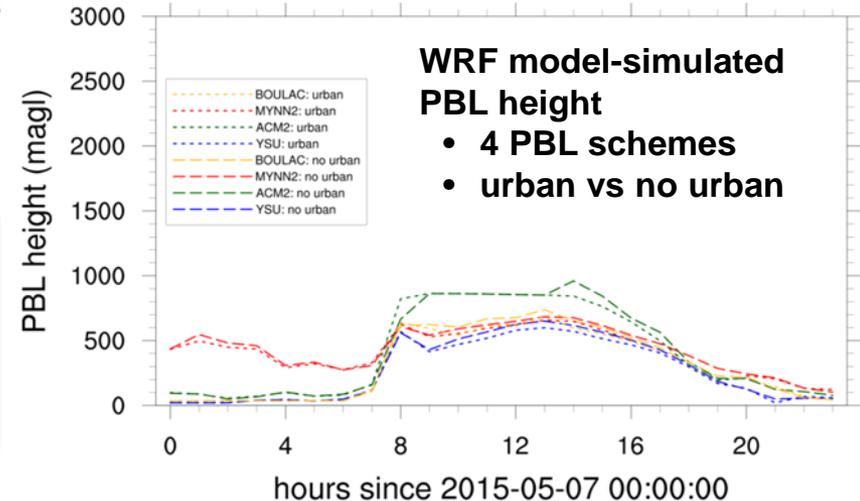
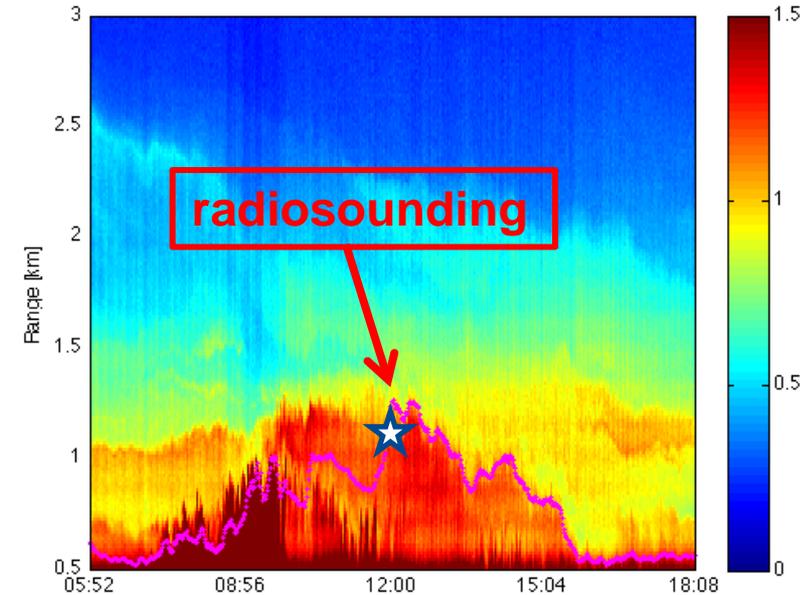
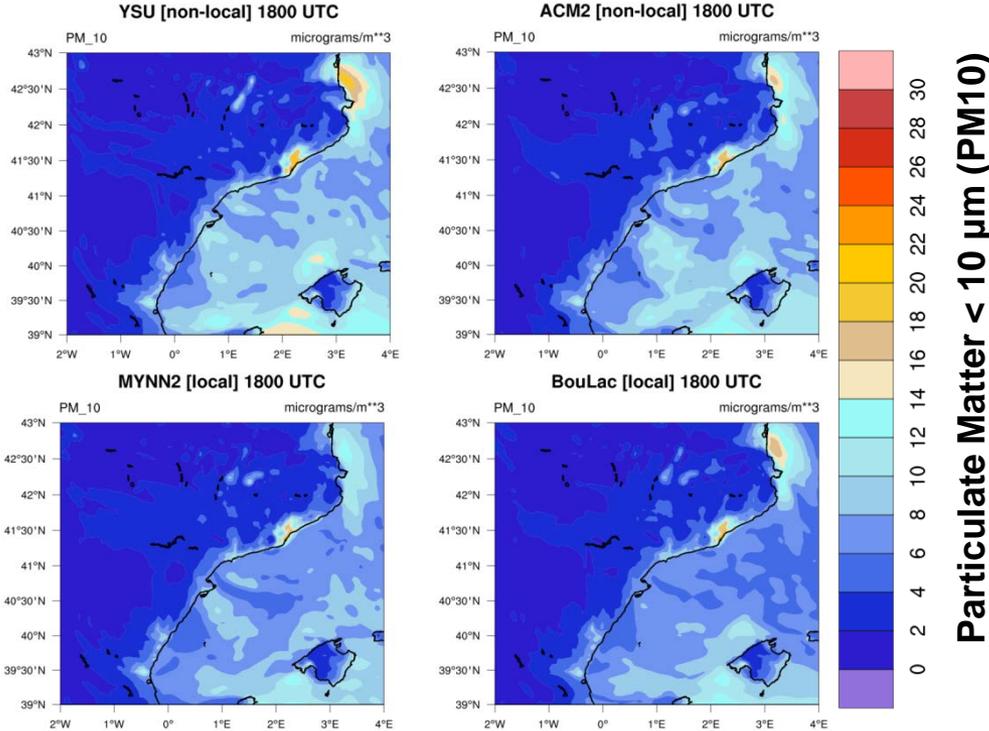
*Banks et al. (2015, Bound.-Lay. Meteol.)* → Eight PBL schemes from the WRF model were evaluated as compared to observations over Barcelona

*Banks et al. (2015, Atmos. Research)* → Continued test with observations from HygrA-CD field campaign over Athens



Athens lidar time-height color plots at 1064 nm wavelength for a) Continental, b) Etesians, and c) Saharan synoptic flow types, overlaid with PBL height estimates (circles, 100-s resolution) using the extended Kalman filter technique. Also shown are the 1-h mean PBL height (blue diamonds) calculated with nine 100-s estimates, along with  $1\sigma$  standard deviation.

Hourly-mean PBL height comparison between Athens lidar (open black squares) and WRF PBL schemes (colored lines) for HygrA-CD campaign average. PBL heights estimated by lidar with extended Kalman filter technique.



*Banks et al. (2015, MAC-MAQ conference) → 4 WRF PBL schemes sensitivity-tested with air quality forecast simulations, as compared with surface observations from monitoring stations and lidar data from the Barcelona micropulse lidar (MPL), a new station in the NASA MPLNET, along with the extended Kalman filter*