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MMM SEMINAR *NCAR*

The Source/Sink Distribution of Scalars in Vegetation Canopies: Key to the Understanding of Covariances of Passive and Reactive Compounds

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About 30% of the Earth's land surface is covered with tall vegetation. Tall vegetation acts to spatially distribute sources and sinks of scalars such as heat, water vapour, CO_2 and volatile organic compounds. From the atmospheric modelling perspective, vegetated surfaces are frequently considered as an unresolved single big leaf. However, if one is interested in the interaction among different scalars (in particular reactive compounds) in and above canopies, the vegetation should essentially be viewed as three-dimensional. Within such a three-dimensional control volume, each scalar can have various source/sink distributions which typically differ across scalar types. The spatially varying source/sink distributions can lead to de-correlation between the scalars; a particularly relevant feature for chemical reactivity. Furthermore, canopy-induced flow characteristics (e.g. organization in the flow, atmospheric stability variations within and above the canopy, etc.) can also affect the degree of scalar-scalar correlation.

Although modelling techniques exist to investigate the influence of scalar source distribution on scalar correlation within and above canopies, limited observational studies offer sufficient information to guide interpretation. The 2007 Canopy Horizontal Array Turbulence Study (CHATS) field campaign attempts to fill this gap, where detailed turbulence data were collected in a deciduous walnut orchard outside Dixon, California.

During the presentation, CHATS data analysis will be discussed focusing on temperature and humidity as the scalars of interest. The spatial distribution of temperature and humidity sources is found to depend both on the canopy's leaf state and on atmospheric stability. We will show how source distribution dissimilarity between the two scalars directly influences their scalar-scalar correlation, both within the canopy air space and above. Furthermore, the impact of source distribution and stability on the residence time of scalars within the canopy will be illustrated. Finally, we show how scalar transport efficiency (correlation between vertical wind and scalar concentration) reveals clear influence resulting from both the scalar source distribution and stability. The presentation will emphasize the importance of these results for modelling the influence of canopy-induced source/sink distributions on scalar exchange in weather forecasting and climate projection models that are unable to resolve these micro-scale processes.

This seminar will be recorded and available to view via webcast at:
http://www.fin.ucar.edu/it/mms/fl-live.htm

Thursday, 19 December 2013, 3:30 PM
Refreshments 3:15 PM
NCAR-Foothills Laboratory
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