

# DOCTOR OF PHILOSOPHY

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## VARIATIONAL RETRIEVAL OF EASTERN PACIFIC ATMOSPHERIC BOUNDARY LAYER PARAMETERS USING ATOVS WITH THE COAMPS™ MESOSCALE FORECAST SYSTEM

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A one-dimensional variational (1DVAR) retrieval scheme is used to investigate the ability of the Advanced TIROS Operational Vertical Sounder (ATOVS) to contribute information to a mesoscale NWP system within the summertime Eastern Pacific (EPAC) environment. This system is the Coupled Ocean – Atmosphere Mesoscale Prediction System (COAMPS™) and the Naval Research Laboratory (NRL) Atmospheric Variational Data Assimilation System (NAVDAS). Analyses of information content and retrieval performance show that, when treated optimally, significant humidity and temperature information can be derived from ATOVS retrievals within the clear and cloudy sky summertime EPAC environment. A study of retrieval error sensitivity to representative background state vector elements and associated errors was also conducted to establish the *a priori* elements critical for successful 1DVAR retrievals. 1DVAR profile temperature and humidity retrievals were generated using both simulated and actual ATOVS observations constrained by the COAMPS short-term forecasts and a synoptically relevant background error covariance matrix. The time period of interest coincides with the DYCOMS Phase II field study. The 1DVAR retrieval results indicate that ATOVS observations can provide information that, when used in concert with a COAMPS background field, reduce the retrieval error and adjust the retrieval within the shallow boundary layer toward the designated “true” profile.

**KEYWORDS:** Variational Satellite Retrieval, 1DVAR, COAMPS, NAVDAS, ATOVS, HIRS/3, AMSU-A, AMSU-B, DYCOMS II, Information Content, Non-linear Optimal Estimation Theory, Mesoscale Satellite Data Assimilation, Marine Atmospheric Boundary Layer, MABL