Analysis of Land Versus Ocean Radar-Derived South Florida Rainfall Data During CRYSTAL-FACE

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1. INTRODUCTION

One of the goals of NASA's Cirrus Regional Study of Tropical Anvils and Cirrus Layers-Florida Area Cirrus Experiment (CRYSTAL-FACE) was to study the evolution of tropical anvil clouds generated by deep convection. We utilized a network of NOAA/NWS WSR 88-D (NEXRAD) and the NASA NPOL radar to investigate precipitation processes in the convective cell and anvil portion of raining systems. The radar network provided continuous coverage, in ten minute intervals, over a large portion of South Florida for July, 2002. The project goal was to study the evolution of precipitation systems by examining the diurnal variability of precipitation over the land and ocean portions of the radar's coverage. In this analysis we distinguish between rain from convective cells & the stratiform anvil portion of systems over South Florida and the surrounding oceans.

2. DATA

NPOL polarimetric radar data were used to adjust the conversion from reflectivity to rainfall rate for the NEXRAD network, to construct a self-consistent 10-minute rainfall maps (2 km grid spacing) covering South Florida. A global Moderate Resolution Imaging Spectrometer (MODIS) derived land/sea mask with 1-km resolution was used to differentiate land/sea precipitation. We applied an automated convective-stratiform separation algorithm on each rainmap before constructing rain time series and diurnal composites.

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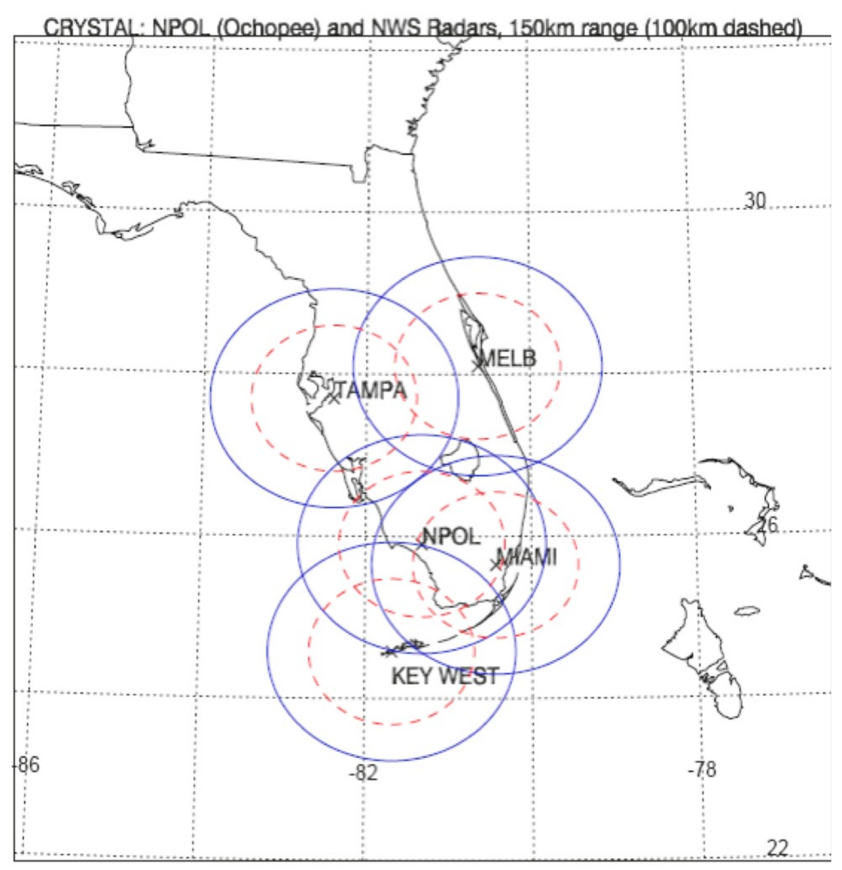
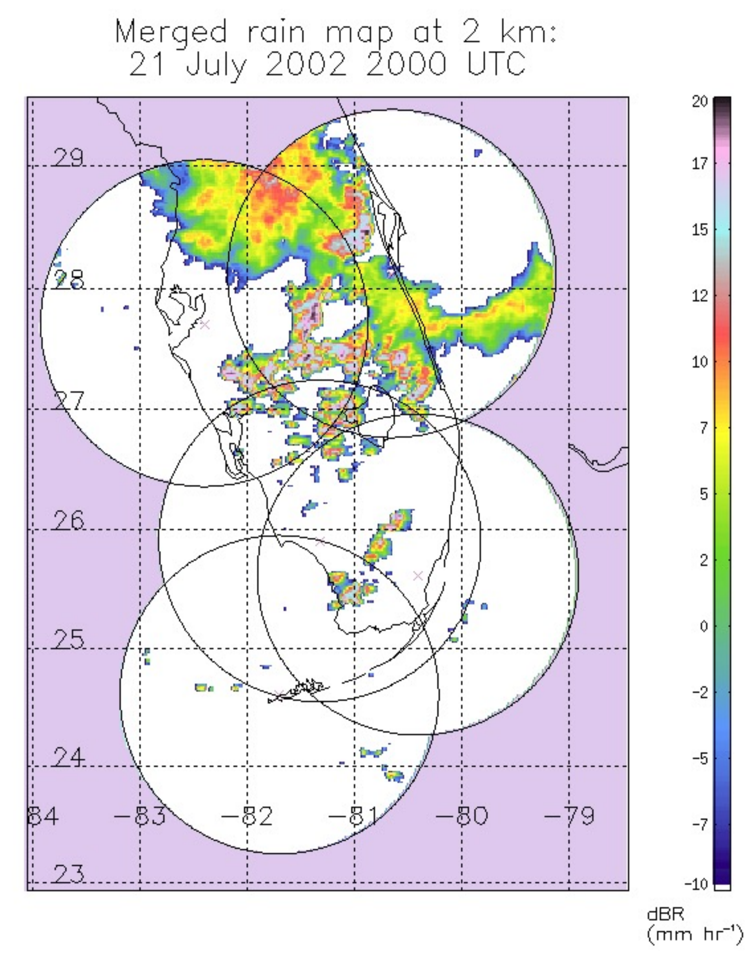
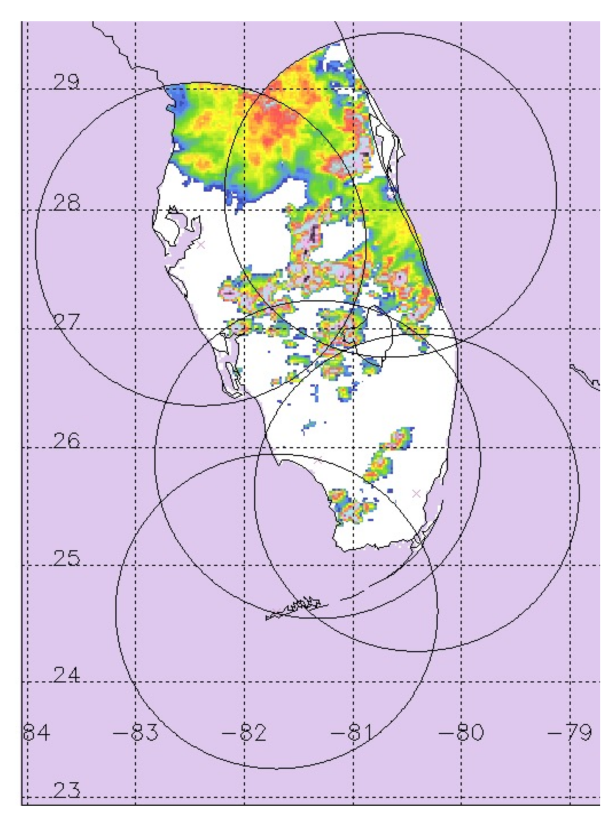
Radars



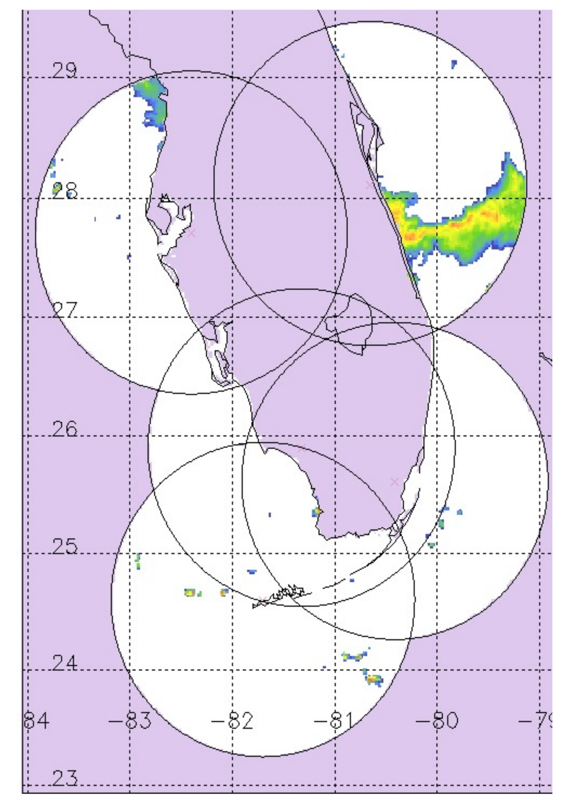
Rainrate



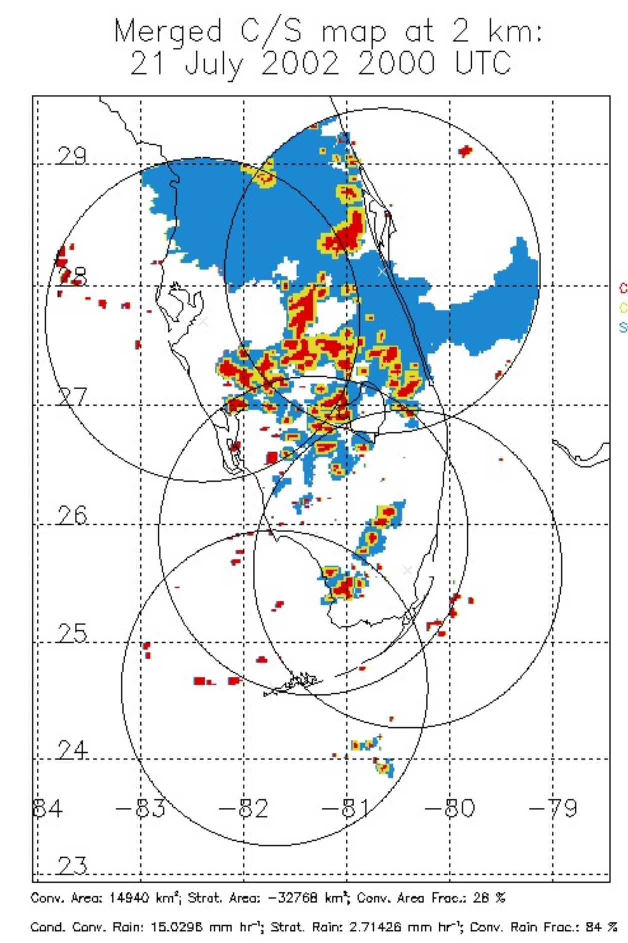
Seamasked



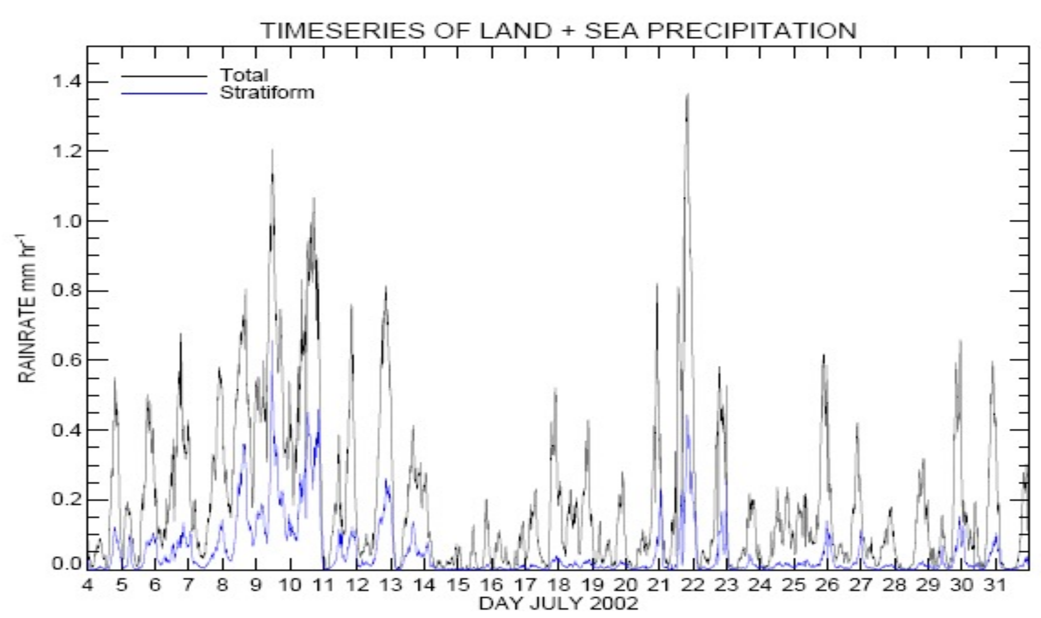
Landmasked



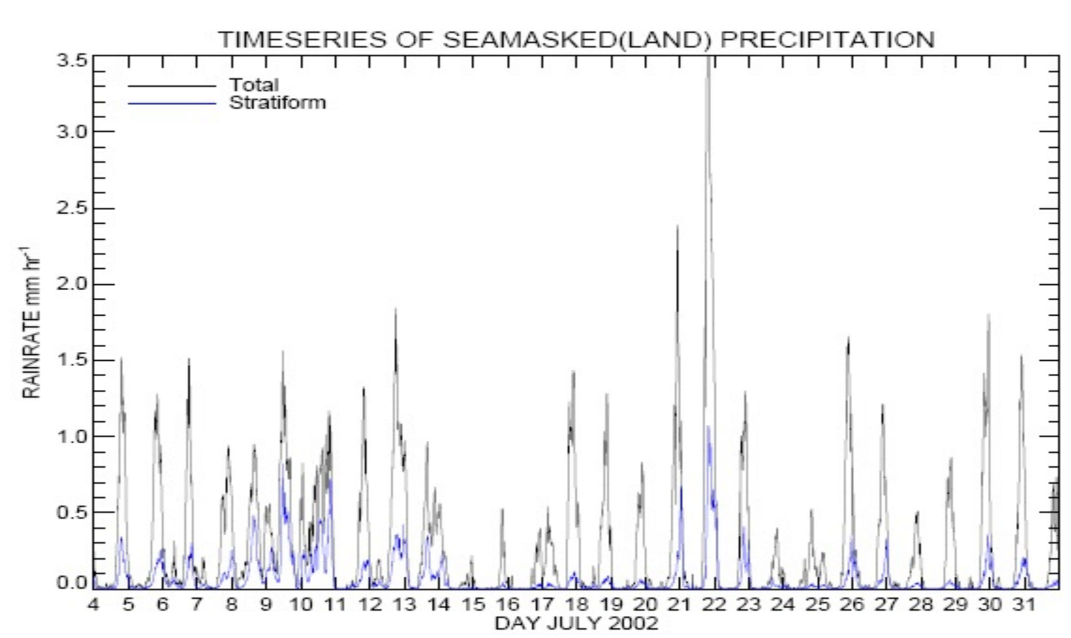
Convective-Stratiform

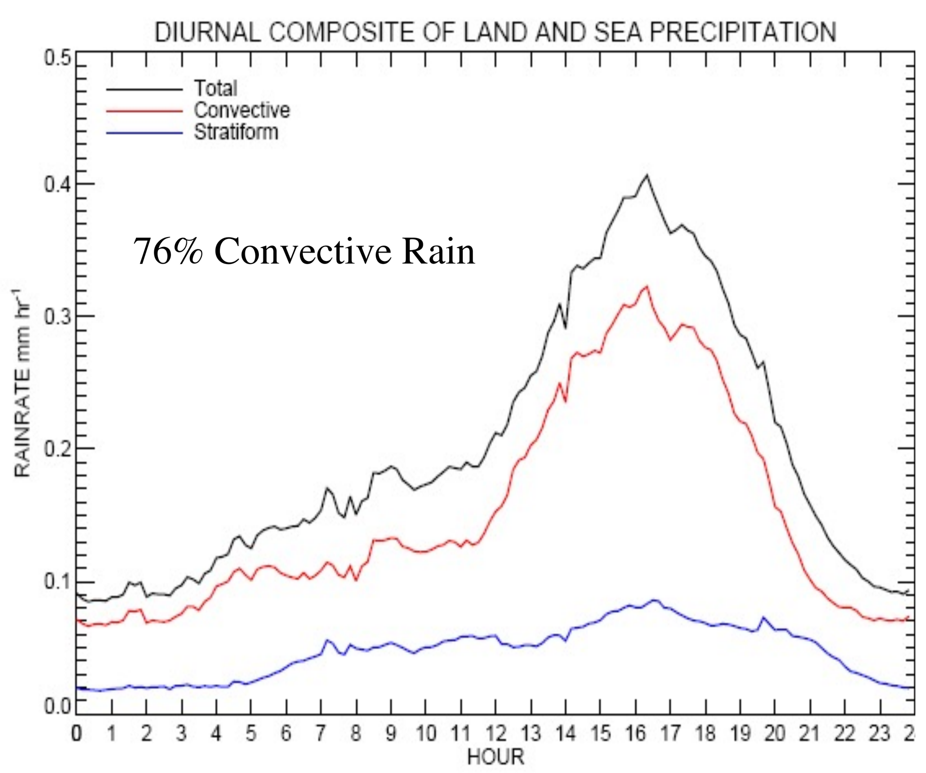


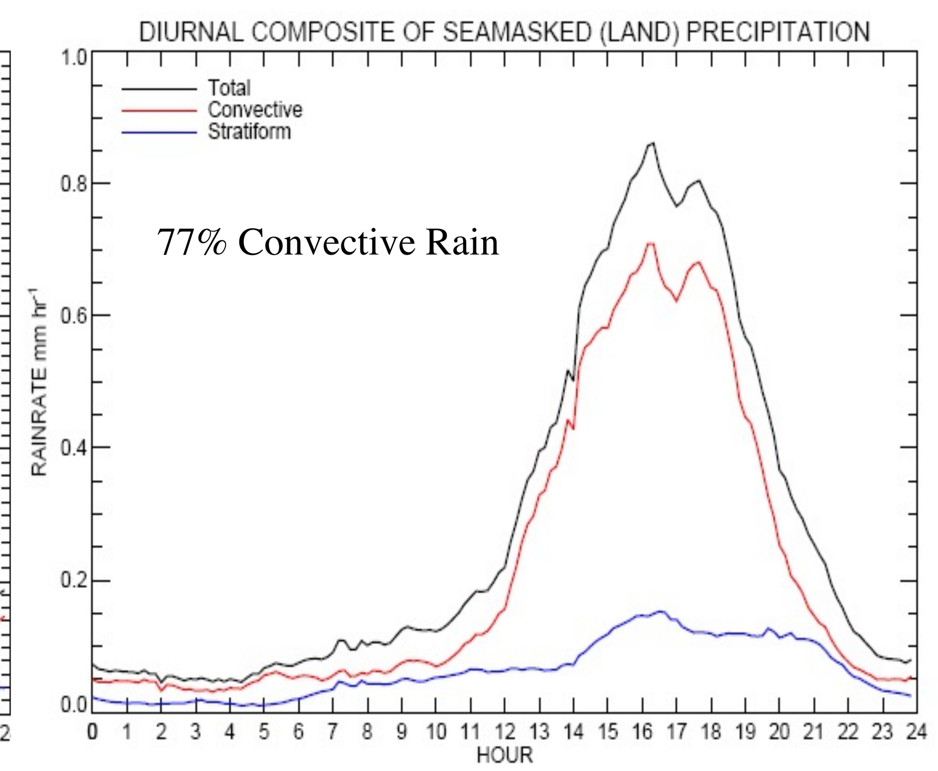
3. TIME SERIES

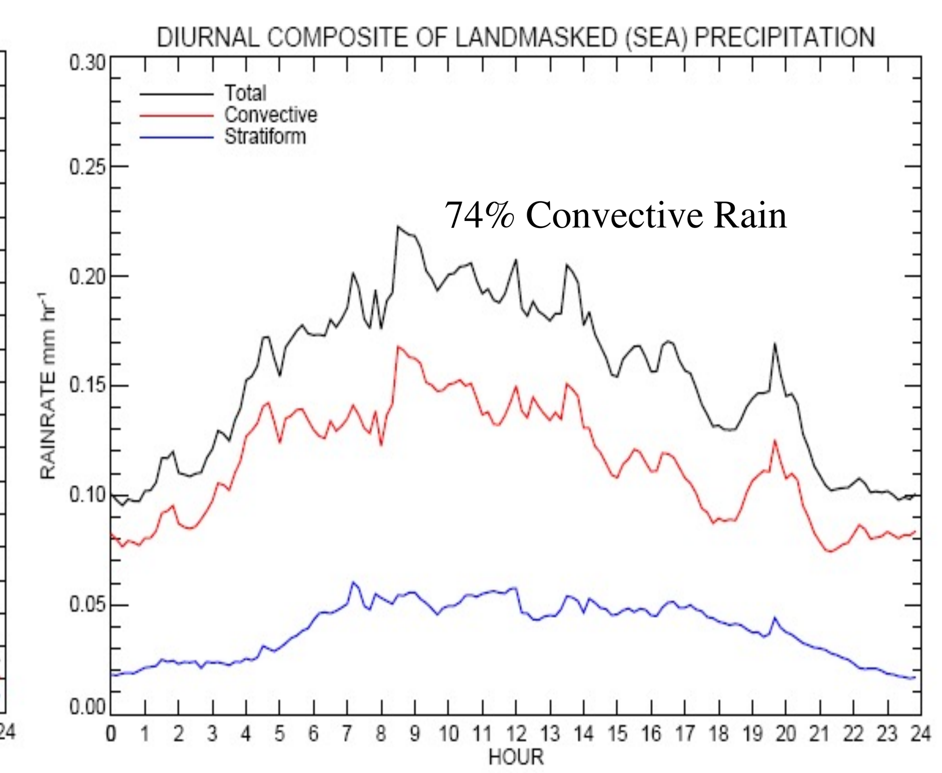


Total (convective + stratiform) & stratiform precipitation timeseries are shown above for land & ocean combined, & below for land only. The dominant mode of variability is diurnal in both time series, though this is clearest over land. However, the rainfall increase in the first ten days was linked to frontal activity in early July.









4. DIURNAL COMPOSITES

The diurnal composite over land revealed a well-defined afternoon maximum, however the ocean diurnal composite reveals a weaker early morning maximum (bottom right). The weak early morning maximum over surrounding oceans does not appear to result from the propagation of land convection, but rather is an independent signal consistent with many previous studies of rainfall over the open ocean. Thus, coastal effects do not contaminate the ocean signal. Furthermore, the oceanic precipitation has a greater fraction of stratiform rain compared to rainfall over land. This analysis suggests that anvil precipitation processes off the coast may evolve independently from land-based convection.