



Assimilation and simulation of Cyclone Gonu (2007) using the UAE WRFVAR system

INTRODUCTION

On early June 2007, a severe cyclone "Gonu", formed over the south western Indian coast, succeeded in reaching the north eastern coast of the Arabian Peninsula. Using the recently developed Weather Research and Forecasting system, implemented in both assimilation and prediction modes at the United Arab Emirates Air Force and Air Defense, and operational over the Arabian Peninsula and a large part of the Indian Ocean, numerical experiments consisting in different warm cycling assimilations followed by short to medium range forecasts are conducted for the initialization and simulation of this cyclone.

The assimilation is using in addition to the available common GTS observational data, Global Positioning System Radio Occultation (GPS RO) Reflectivity soundings provided by COSMIC/DAAC, and Quick Scatterometer (QuikSCAT) near-surface wind observations, with their experimental high spatial resolution of 25 km, provided by the "Koninklijk Nederlands Meteorologisch Instituut" (KNMI).

The prediction part of WRF model takes benefit of the high resolution two-way nesting technique and the use of adequate physical parameterization dealing reasonably with such super active phenomena (Kain-Fritsch cumulus, Lin et al. microphysics schemes, Yonsei University planetary boundary layer).

The results of the experiments suggest that the subsequent WRF model forecasts of Gonu cyclone track and accompanying precipitation are significantly impacted upon the initial analyses fields. QuikSCAT and GPS RO, when assimilated using tuned background and observation error statistics, especially have a very significant impact on the quality of these forecasts in term of the storm position and intensity.

Experimental Design

U.A.E. WRF model characteristics

WRF 3.2	Domain "W1"	Domain "W2"	Domain "W3"	Resolution	Physics	Domain "W1"	Domain "W2"	Domain "W3"
Grid Coordinates	40 km 1680 x 1360 ± 80	15.60 km 580 x 550 ± 80	4.44 km 172 x 150 ± 80	Realistic	RTTO Duchon scheme	RTTO Duchon scheme	RTTO Duchon scheme	RTTO Duchon scheme
Time step	200 s	70 s	20 s	Realistic	YSU scheme	YSU scheme	YSU scheme	YSU scheme
Vertical	Parrier	Parrier	Parrier	Realistic	Moist LSR	Moist LSR	Moist LSR	Moist LSR
Horizontal	Kaln-Philips scheme	Kaln-Philips scheme	Eguchi	Initial and Secondary radiation	SW-Var	SW-Var	SW-Var	SW-Var
Vertical					SW-Var	SW-Var	SW-Var	SW-Var
Horizontal					Two-way nest	Two-way nest	Two-way nest	Two-way nest
					GP1	Multi-Beam		
					GP2	Arabic Peninsula		
					GP3	United Arab Emirates		
					WRF-VAR with version 3.2			
					LAWRIFF is operational at Dubai from August 2006			