The Implementation of WRF
at the
Air Force Weather Agency

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Pre-IOC Accomplishments

- **What we've overcome in order to reach Initial Operating Capability (IOC)**

  - **Numerical instability in regions of significant convection**
  - **A discontinuity in upper-level moisture fields**
  - **Dynamical "shocks" along the boundaries of inner nested grids**
  - **Inability to process single-level upper-air observations**
  - **An instability in the YSU PBL scheme**
  - **Incorrect initialization of frozen sea ice**

WRF Optimizations

- **What has been optimized along the way**

  - **w-damping**
  - **WRF single moment 5**
  - **Optimal background error covariance statistics**
  - **Noah LSM**
  - **2x speed-up in running WRF utilizing different compiler flags on certain platforms**

WRF Verification

- **Subjective evaluations**
  - **Lead forecasters**
  - **Warfighter Support Development Team**

- **Objective evaluations**
  - **Model Analysis Team**
  - **Generalized Operations (GO) Index**

Subjective Verification

27 Mar – 31 Mar 06

Scale
1= Much Worse   2 = Worse   3 = About the same   4 = Better   5 = Much better

Category	Overall Average		# of responses	High	Low
Severe	3.3	G	31	5.0	2.0
Icing	3.4	G	9	4.0	2.0
Turbulence	0.0	N/A	0	0.0	0.0
Winds	3.5	G	18	4.0	2.0
Clouds	3.2	G	5	4.0	2.0
Precip	3.1	G	17	5.0	2.0
Temp	3.4	G	9	4.0	3.0
SLP	3.0	G	3	4.0	2.0
Visibility	2.5	R	2	3.0	2.0

Objective Verification via the GO Index

- **Modeled after the UKMO's program**

- **Represents a model's forecast skill over another forecast reference (e.g., climatology, persistence, different model)**

- **Derived from forecast and persistence RMS errors against surface and upper-air observations**

- **Key parameters examined:**
  - **Wind Speed at the surface, 850 mb, 400 mb and 250 mb**
  - **Dewpoint at the surface, 850 mb, 700 mb and 400 mb**
  - **Temperature at the surface and 400 mb**
  - **Geopotential height at 400 mb**
  - **Sea Level Pressure**

GO Index

■ **Weighted average of RMSEs of multiple parameters, levels and forecast lead times:**

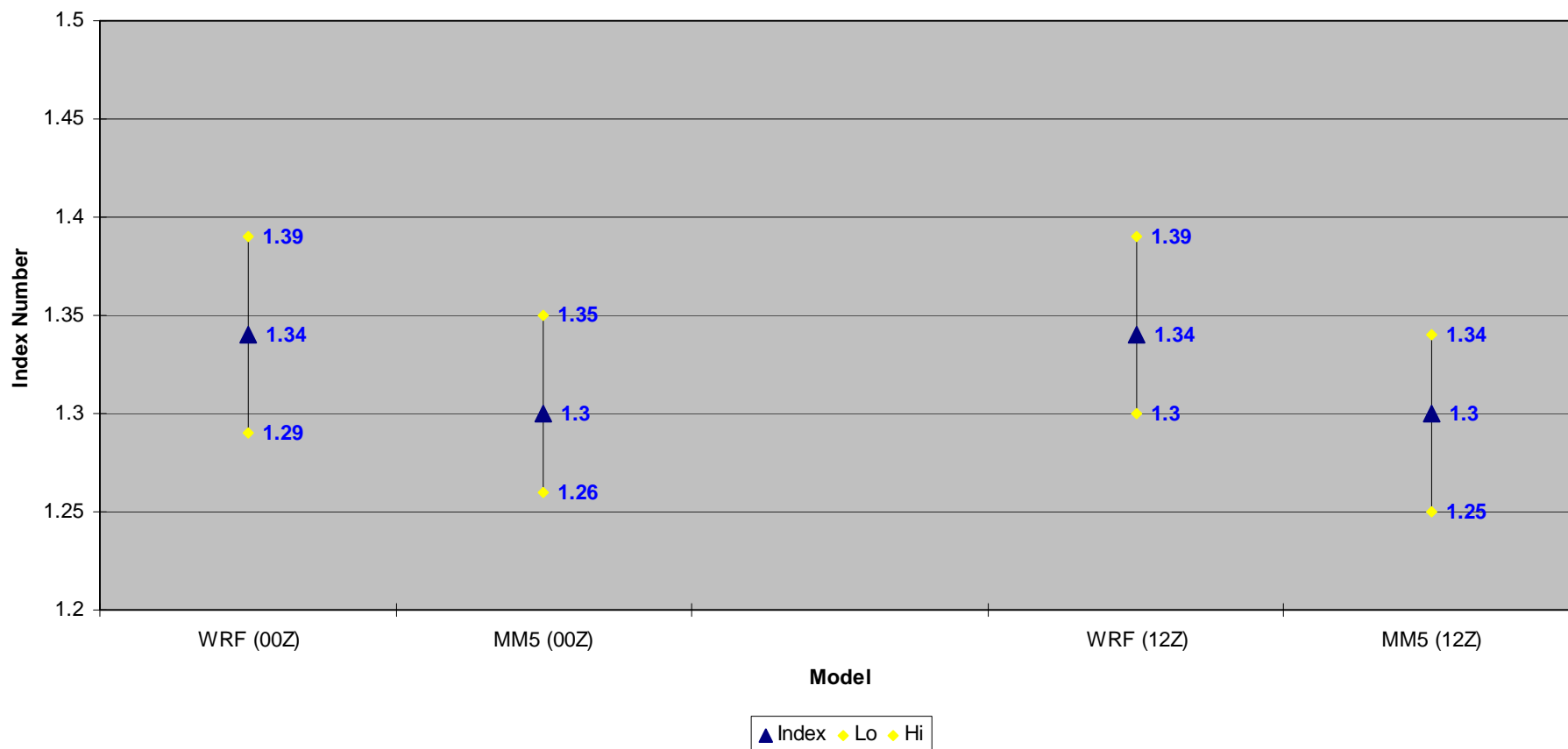|	12 hr		24 hr		36 hr		48 hr	
400WS	4		3		2		1	
250WS	4		3		2		1	
850WS	4		3		2		1	
700TD	8		6		4		2	
400TD	8		6		4		2	
400TT	4		3		2		1	
400HT	4		3		2		1	
SLP	8		6		4		2	
SFCTT	8		6		4		2	
850TD	8		6		4		2	
SFCTD	8		6		4		2	
SFCWS	8		6		4		2	
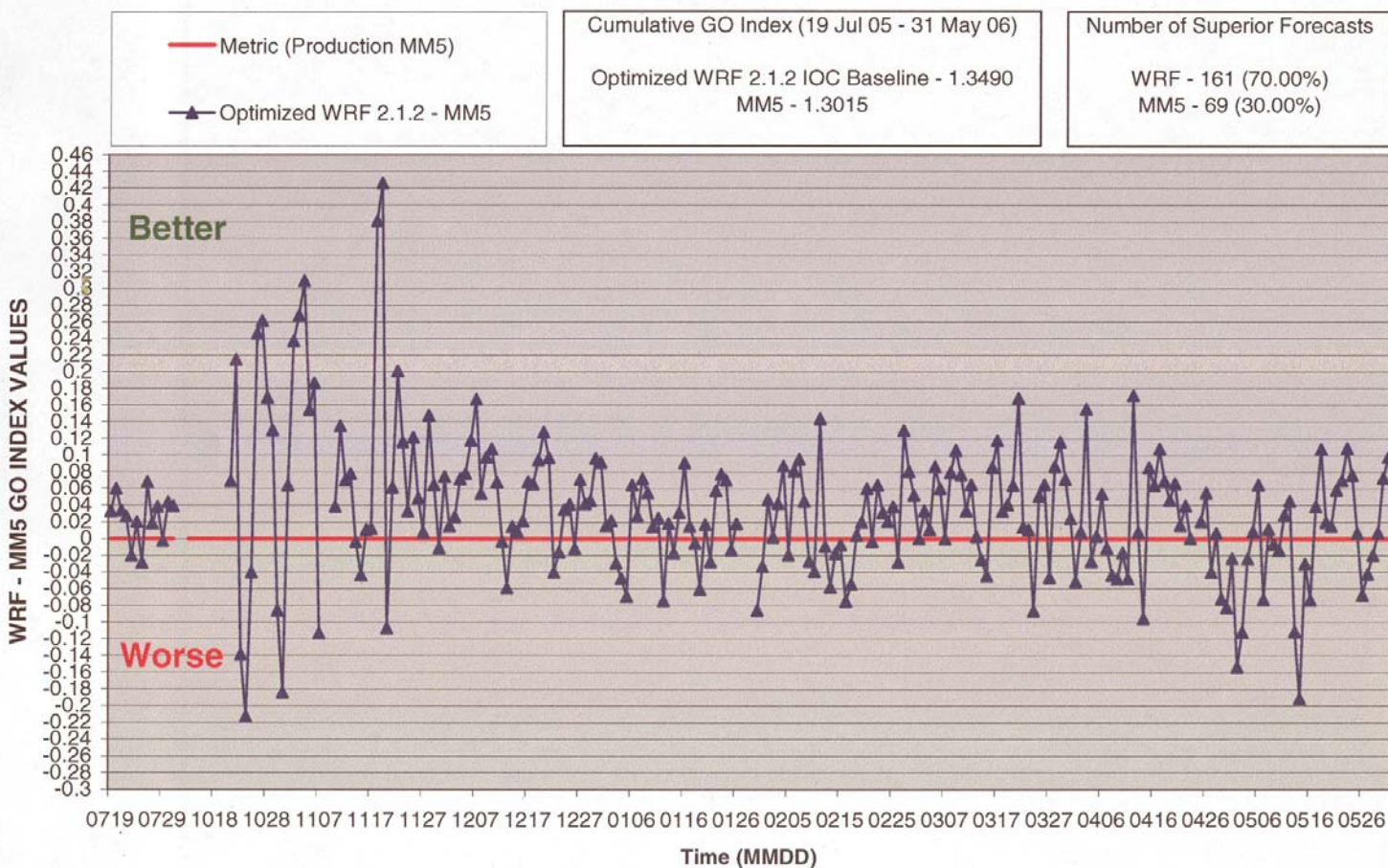
GO Index

GO Index

WRF- MM5 GO Index Comparison

WRF IOC at AFWA

- **The AFWA Commander approved initial implementation of WRF on 6 Jun 06**

    - **Target IOC Date: 18 Jul 06, 12Z cycle**
    - **Initially, WRF will run only on our classified weather information network (JAAWIN-S)**
    - **This will be followed by a prioritized spiral approach, which will phase out all remaining MM5 windows**
    - **Full Operational Capability (FOC) is expected in late 2007**