

# **Evaluating weather predictions using glider flights, fall 2006 and spring 2007, Pennsylvania USA**

Edward (Ward) Hindman  
Earth and Atmospheric Sciences Department  
The City College of The City University of New York, NYC, NY USA 10031  
[hindman@sci.ccny.cuny.edu](mailto:hindman@sci.ccny.cuny.edu)

With assistance from Stephen Saleeby (CSU) and Olivier Liechti (AuK)

*Presented to OSTIV Meteorology Panel, September 2007  
In preparation for American Meteorological Society, Aviation Meteorology meeting January 2008  
and OSTIV Congress, August 2008 with ultimate destination Technical Soaring*

## Summary

Numerical weather prediction model (Regional Atmospheric Modeling System, RAMS)

Glider flight algorithm (TopTask Competition, TTC)

RAMS-TTC was evaluated using meteorological and glider flight data from glider contests in Pennsylvania

The predictions for contest days with winds  $< 20$  knots were found to be accurate and, therefore, can help plan and evaluate flights for future contests at these sites and contests elsewhere on the east coast USA.

The system requires additional development for winds  $> 20$  knots.

## **Procedures**

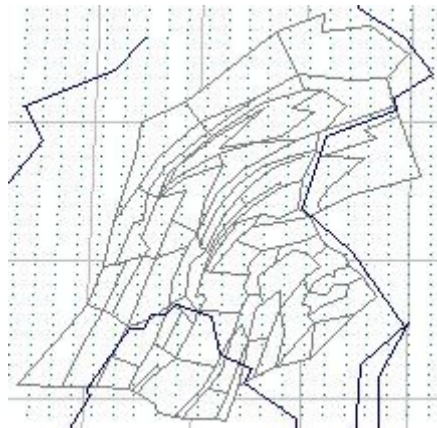
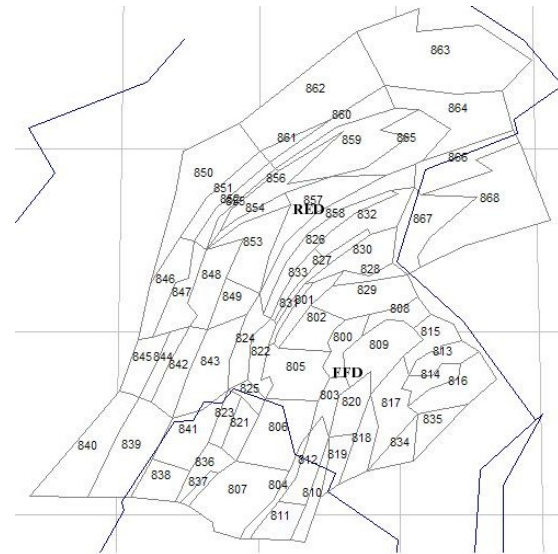
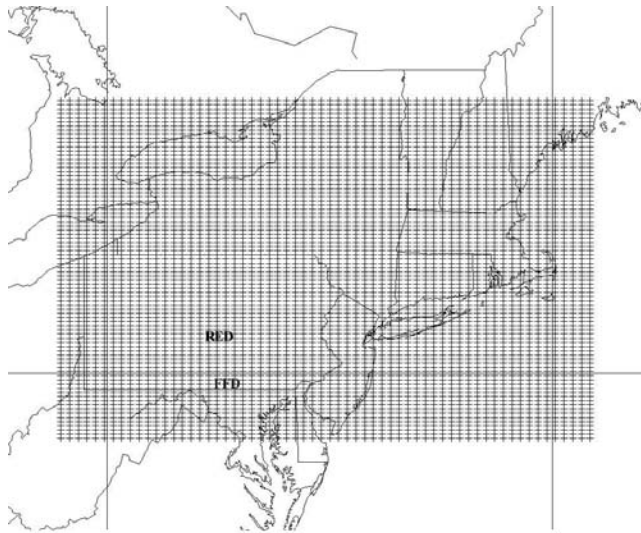
**Collect the flight recorder files**

**Collect weather data**

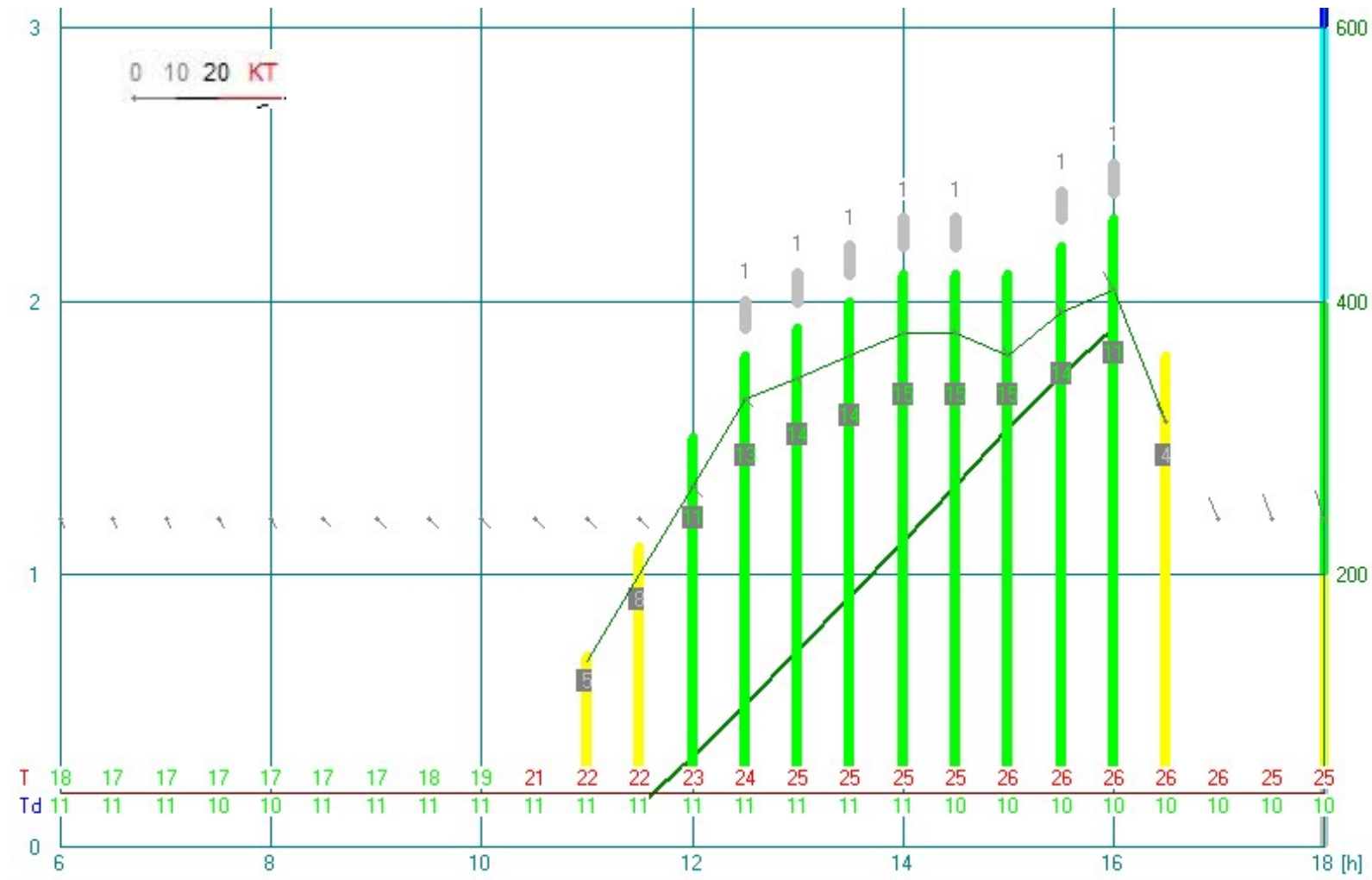
## Procedures (contd.)

### Construct the RAMS-TTC interface files

#### Reedsville PA (RED), Fairfield PA (FFD)



# RAMS-TTC predictions



## **Procedures (contd.)**

**Determine the convective boundary layer (CBL) depth**

**Determine actual and predicted glider climb rates**

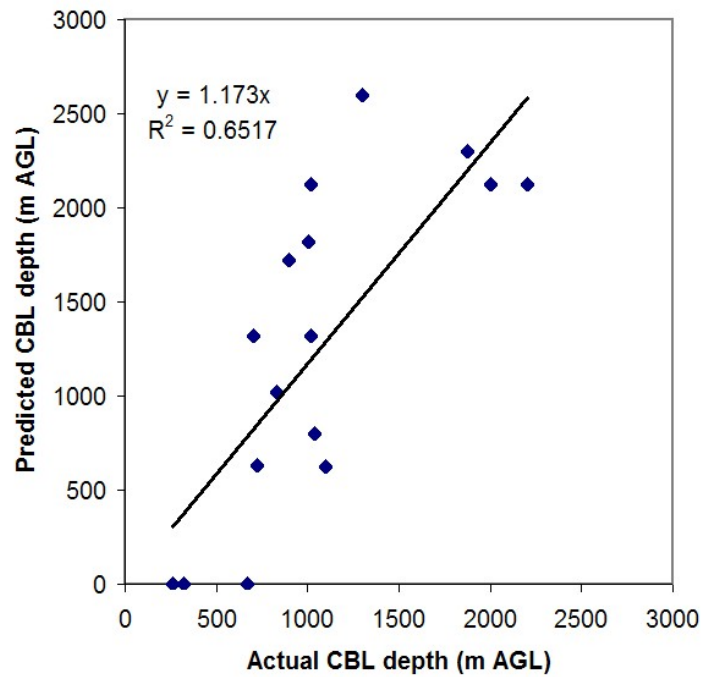
**Determine the 1000m AGL winds**

**Determine actual and predicted task speeds**

**Determine the onset of convective clouds**

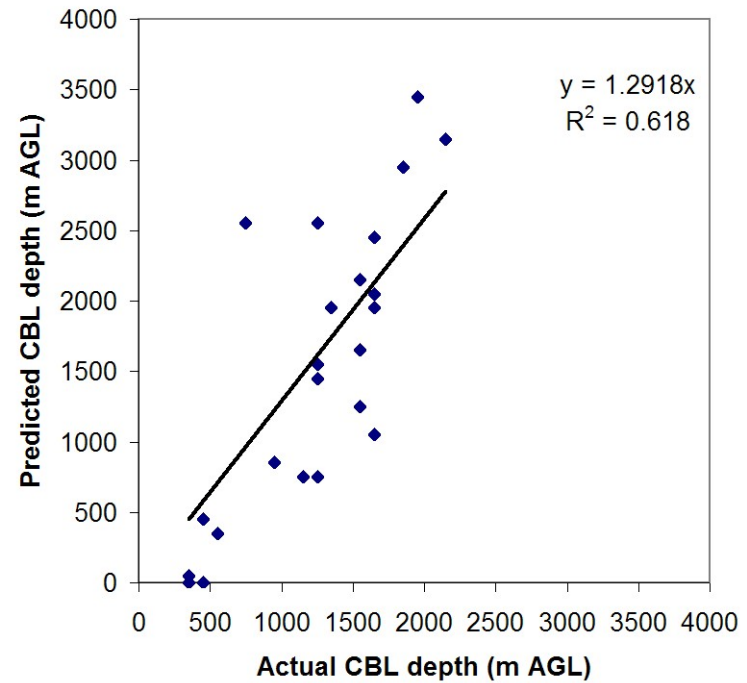
# Predicted and actual convective boundary layer (CBL) depths

Fairfield PA



Average actual: 1026 $\pm$ 215 m  
Average predicted: 921 $\pm$ 132 m

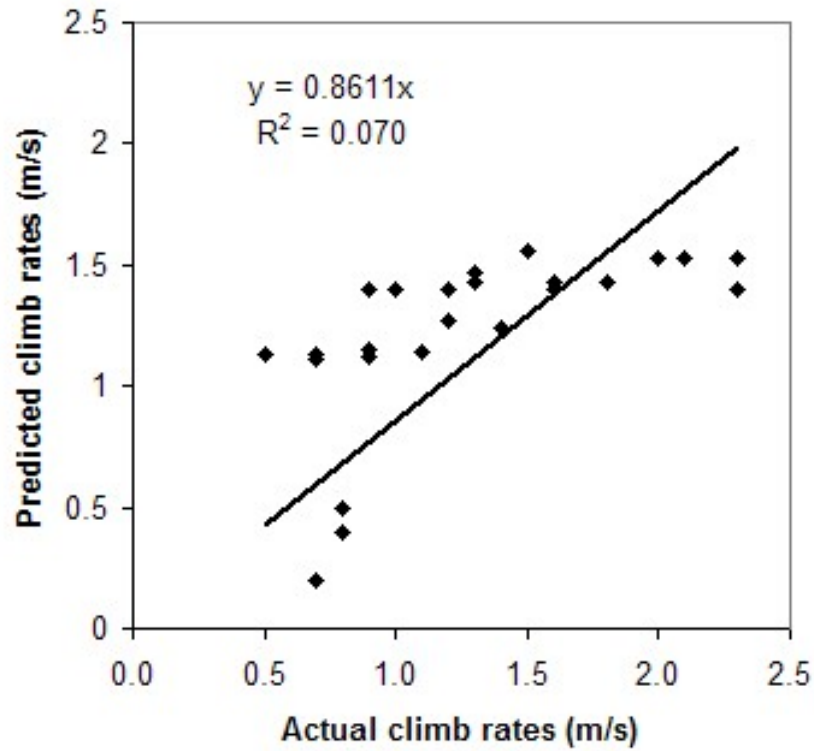
Reedsville PA



Average actual: 1160 $\pm$ 101 m  
Average predicted: 1559 $\pm$ 156 m

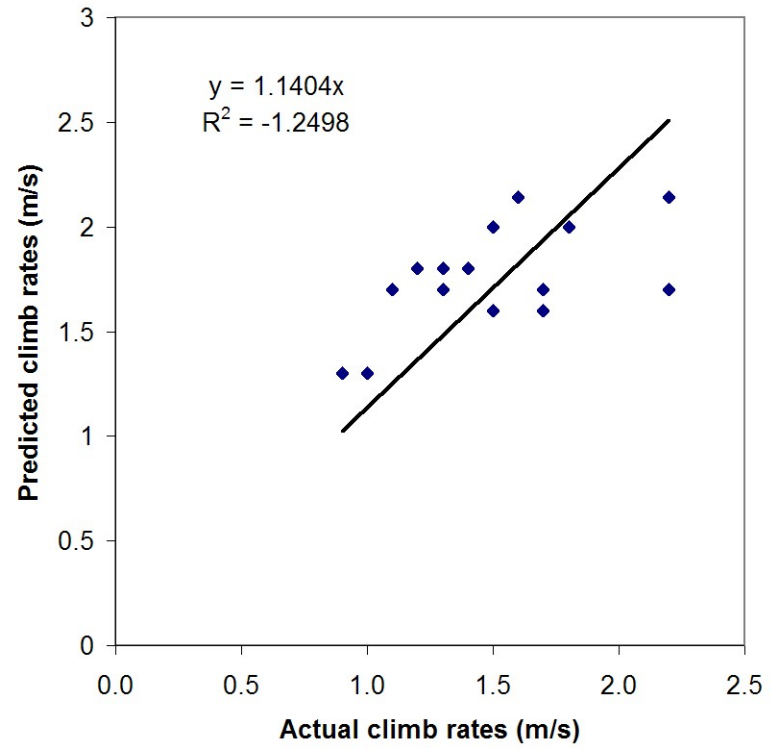
# Predicted and actual climb rates

Fairfield PA



Average actual: 1.3 $\pm$ 0.1 m/s  
Average predicted: 1.2 $\pm$ 0.1 m/s

Reedsville PA

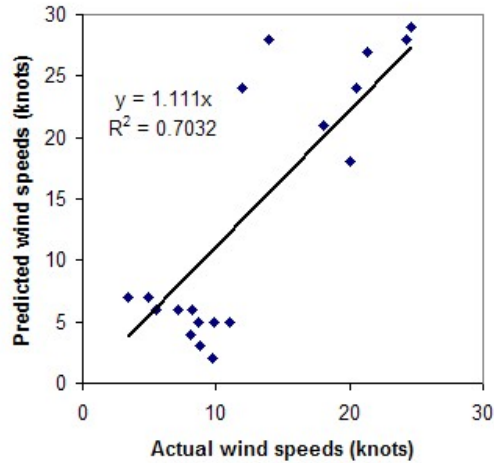


Average actual: 1.5 $\pm$ 0.1 m/s  
Average predicted: 1.7 $\pm$ 0.1 m/s

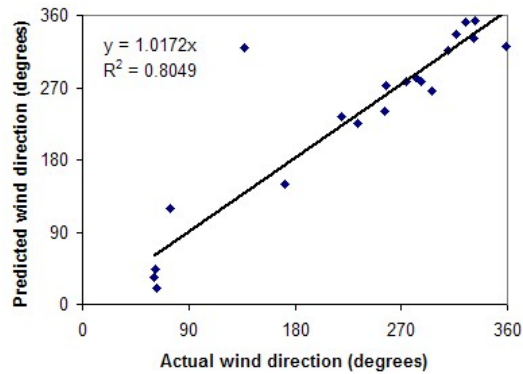


# Predicted and actual 1000m AGL winds

Fairfield PA

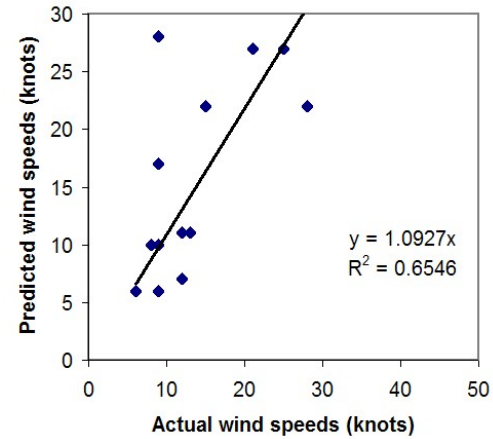


Average actual: 12+/-2 m/s  
Average predicted: 13+/-3 m/s

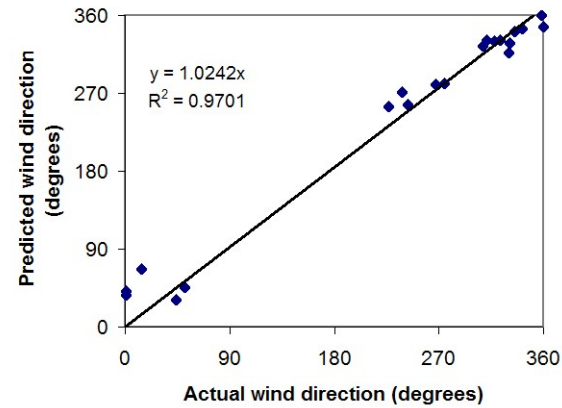


Average actual: 214+/-28 degrees  
Average predicted: 239+/-28 degrees

Reedsville PA

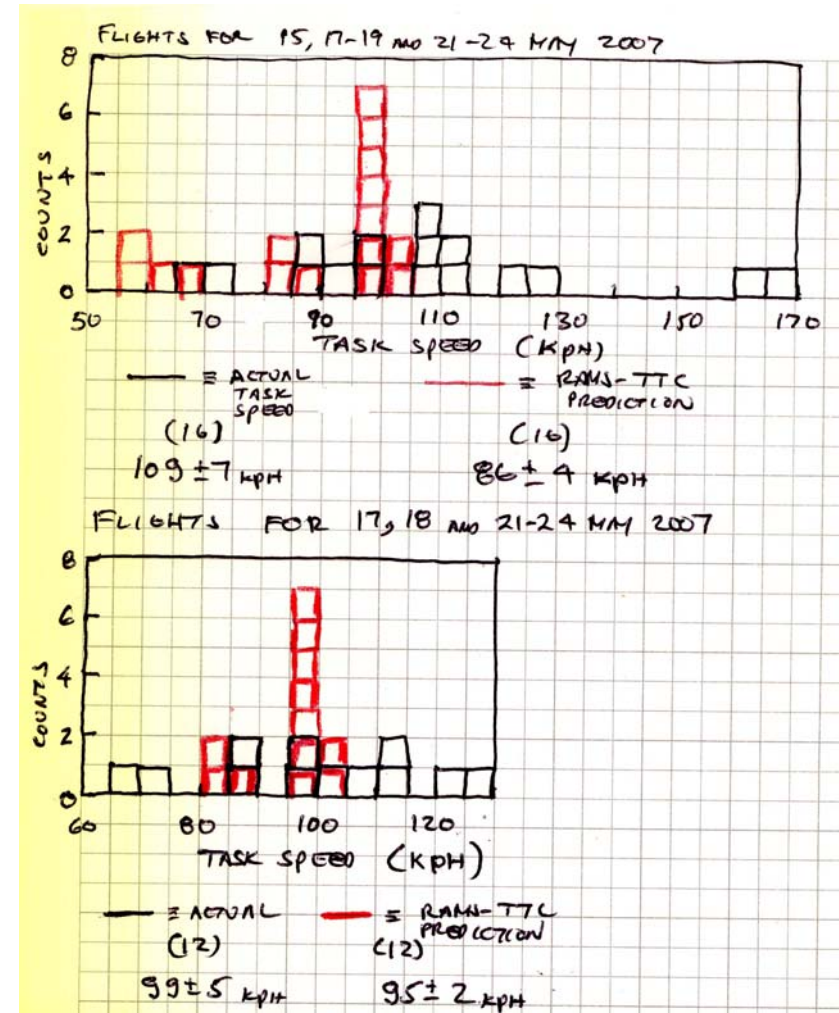
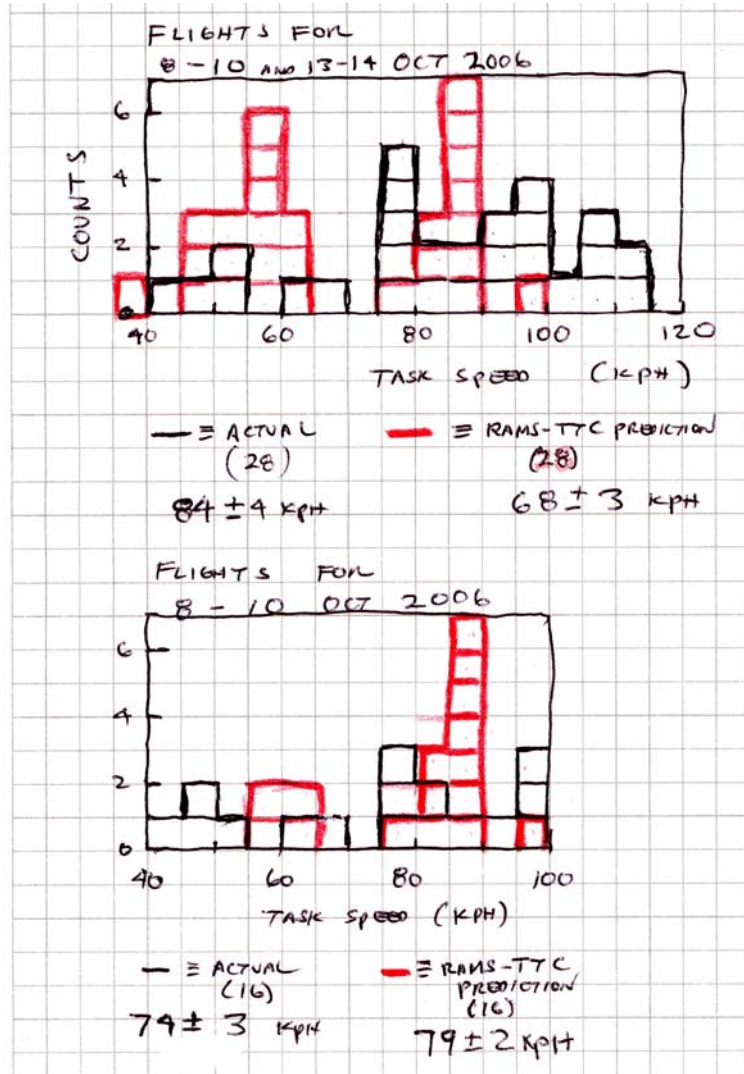


Average actual: 15+/-2 m/s  
Average predicted: 15+/-2 m/s



Average actual: 227+/-18 degrees  
Average predicted: 254+/-16 degrees

# Predicted and actual task speeds



## Onset of convective clouds

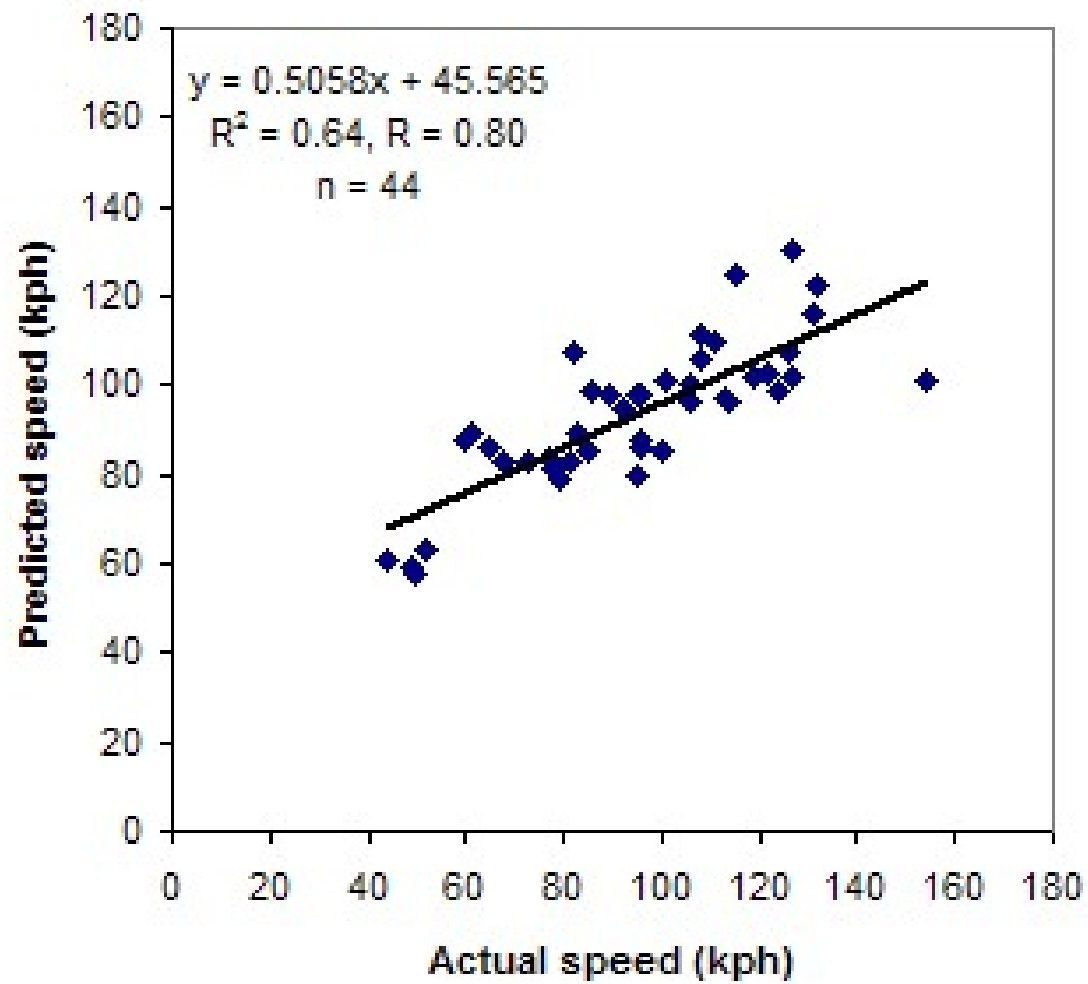
Date	Actual onset (EST)	Predicted onset (EST)	Difference (min)
8-Oct-06	no cumulus	no cumulus	
9-Oct-06	no cumulus	no cumulus	
10-Oct-06	1132	1230	58
13-Oct-06	1145	1300	75
14-Oct-06	no cumulus	no cumulus	

Date	Actual onset (EST)	Predicted onset (EST)	Difference (min)
15-May-07	no cu	no cu	
17-May-07	845	845	0
18-May-07	1145	1100	0
19-May-07	1045	1100	0
21-May-07	no cu	no cu	
22-May-07	no cu	no cu	
23-May-07	1145	1300	90
24-May-07	1145	1230	75

## Comparison of this study and the Colorado study

Parameter	Actual-PA	Predicted-PA	Actual-CO	Predicted-CO
CBL depth (m AGL)	1080*	1381	3700**	3500
Climb rate (m/s)	1.2	1.1	2	2
1000 m AGL wind speed (knts)	13	12	10	15
1000 m AGL wind dir. diff. (deg)	26		22	
(actual dir. - predicted dir.)				
Task speeds (kph)	85	86	112	107
** average elevation 1600m				
* average elevation 180m				

## Predicted and actual task speeds PA and CO



## Conclusions

For the glider contest near Fairfield PA between 8 and 14 October 2006 and the contest near Reedsville PA between 15 and 24 May 2007, the RAMS-TTC system produced:

accurate predictions of CBL depths through the daily convective cycle

accurate predictions of average climb rates, but inconsistent individual rates, for days with 1000 m AGL wind speeds less than 20 knots

accurate predictions of 1000 m AGL wind speeds and directions

accurate predictions of task speeds for days with wind speeds less than 20 knots

accurate predictions of “blue days” and the onset of cumulus, on average, was predicted to be on-time to about 1-hour late

The results achieved in this study are comparable to those achieved in the Colorado study indicating the robustness of the RAMS-TTC system. The system requires additional studies to produce reliable predictions for days with wind speeds > 20 knots.