

# T-REX Valley Winds Intercomparison Study

Juerg Schmidli  
presented by Peter Sheridan

T-REX Workshop, Yale University, March 2008



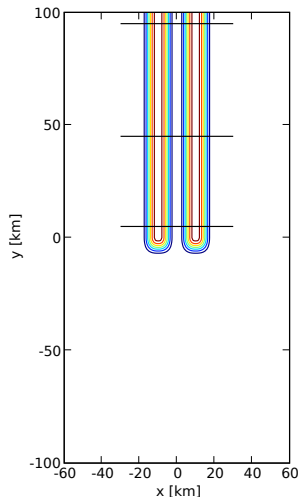
# Objectives of Intercomparison Study

## Analyze sensitivity of model-simulated valley winds to

- ▶ Dynamical core and computational mixing
- ▶ Parameterization of turbulence (1d PBL scheme)
- ▶ Parameterization of surface-atmosphere interactions and radiation transfer

# Experimental Setup

- ▶ Atmosphere at rest with surface inversion ( $\Delta\theta = 5\text{ K}$ )
- ▶ Integration:  $36^\circ\text{ N}$ ; 21 March; 6–18 LT
- ▶ 1d PBL parameterization; horizontal mixing
- ▶ Domain:  $120 \times 400 \times 12.2\text{ km}$
- ▶ Grid:  $\Delta x = \Delta y = 1\text{ km}$ ;  $\Delta z = 20 \dots 200\text{ m}$
- ▶ uncoupled and fully coupled simulations
- ▶ 2d and 3d setup (and 1d)



Terrain (southern half of domain)



# Experimental Setup

## Uncoupled simulations

- ▶ free-slip lower boundary
- ▶ surface heating determined by specified surface sensible heat flux
- ▶ zero momentum and latent heat flux

## Coupled simulations

- ▶ no-slip lower boundary
- ▶ surface heating determined by physics (land surface; radiation transfer)
- ▶ land surface as in Owens Valley (semidesert;  $sr = 0.2$ ,  $z_0 = 0.1$  m)

Problem: Setup is difficult to implement in some models



## Participating Institutions

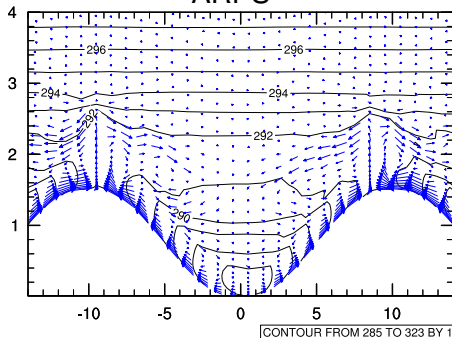
Institution	Model	1d	2d-unc	2d-cpl	3d-unc	3d-cpl
NCAR	ARPS	✓	✓	✓	✓	✓
University of Leeds	BLASIU5	-	✓	✓	-	-
NRL	COAMPS	✓	✓	✓	✓	✓
DRI	COAMPS	✓	✓	✓	✓	✓
Univ of München	MM5	-	(3D)	(3D)	✓	✓
Univ of Virginia	RAMS	-	-	✓	✓	✓
UK MetOffice	UM	✓	✓	-	✓	-
Univ of California	WRF	✓	✓	✓	✓	✓
NCAR	EULAG	-	-	-	-	-
Michigan State Univ	RAMS	-	-	-	-	-

(<http://wiki.eol.ucar.edu/trex-modeling/ValleyWinds/FirstRoundIntercomparison>)

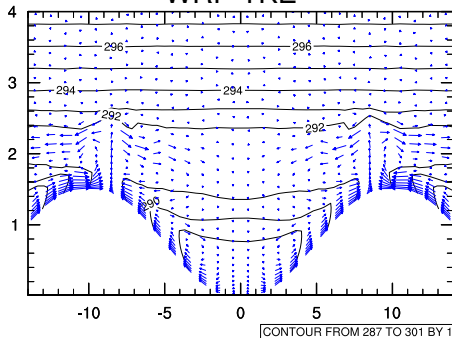
Re-open submission?

## Selected Results: 2D coupled (12pm)

ARPS



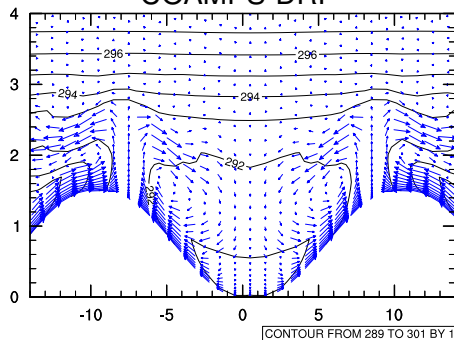
WRF-TKE



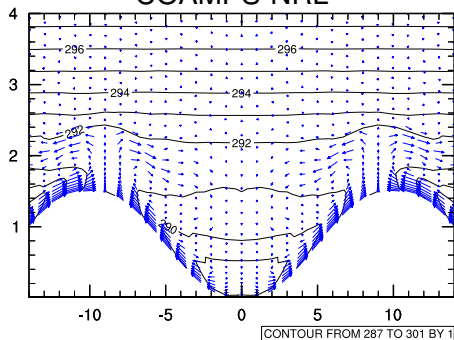
⇒ Different models, but similar results

## Selected Results: 2D coupled (12pm)

COAMPS-DRI

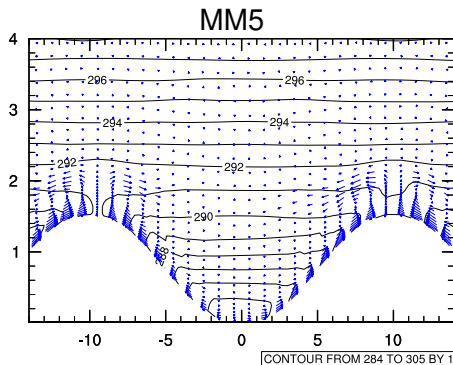
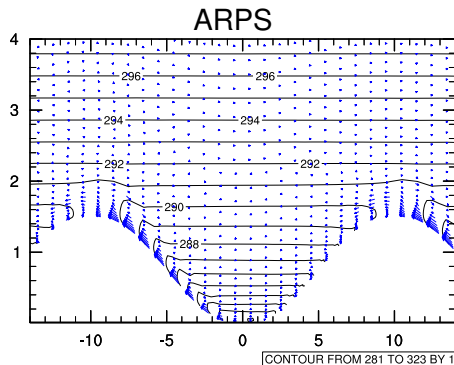


COAMPS-NRL



⇒ Same model, but quite different results!

## Selected Results: 2D coupled (9am)

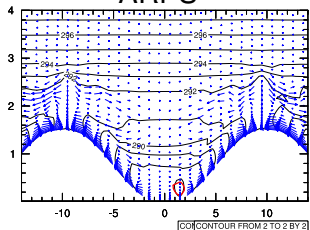


- ⇒ ARPS and RAMS show non-symmetric evolution of slope winds
- ⇒ All other models exhibit a symmetric evolution

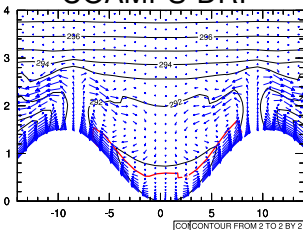


# Selected Results: 3D coupled ( $y = 50$ km; 12pm)

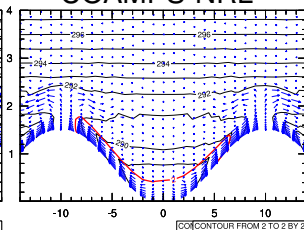
ARPS



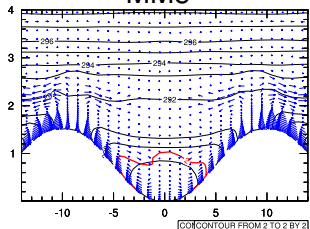
COAMPS-DRI



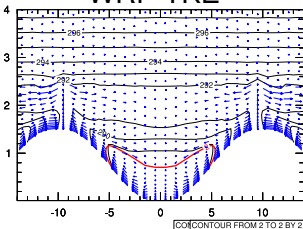
COAMPS-NRL



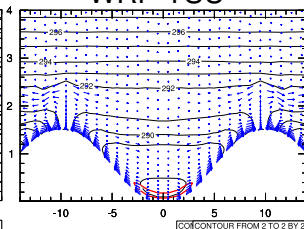
MM5



WRF-TKE

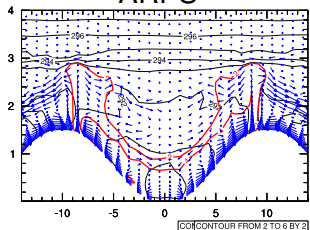


WRF-YSU

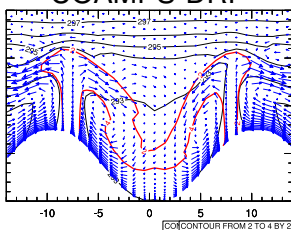


# Selected Results: 3D coupled ( $y = 50$ km; 3pm)

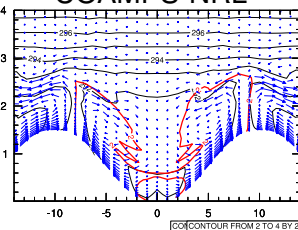
ARPS



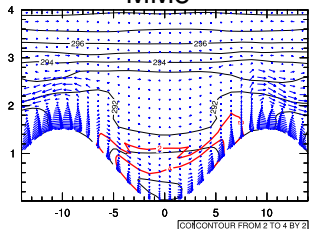
COAMPS-DRI



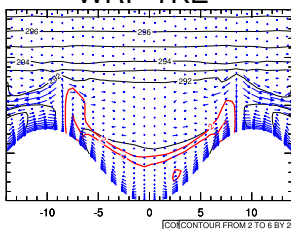
COAMPS-NRL



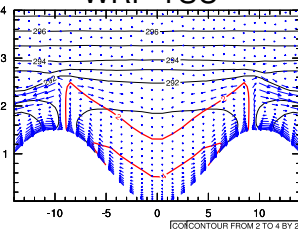
MM5



WRF-TKE



WRF-YSU





# Discussion

## Suggested Analysis

- ▶ In comparing the models, focus on the mean up-valley mass flux and vertical mass exchange (i.e. bulk diagnostics; influence of the valley flow on the larger scale)
- ▶ Along-valley variation of up-valley mass flux and vertical mass flux
- ▶ Evolution of cross-valley averaged potential temperature profile and plain-valley temperature differences  
⇒ Valley wind dynamics

## Intercomparison Paper

- ▶ Based on results of above analysis
- ▶ Further ideas and suggestions?