DEEPWAVE Dry Run
5 to 14 August 2013

Ron Smith, Dave Fritts,
Steve Eckermann, Jim Doyle,
Jim Moore

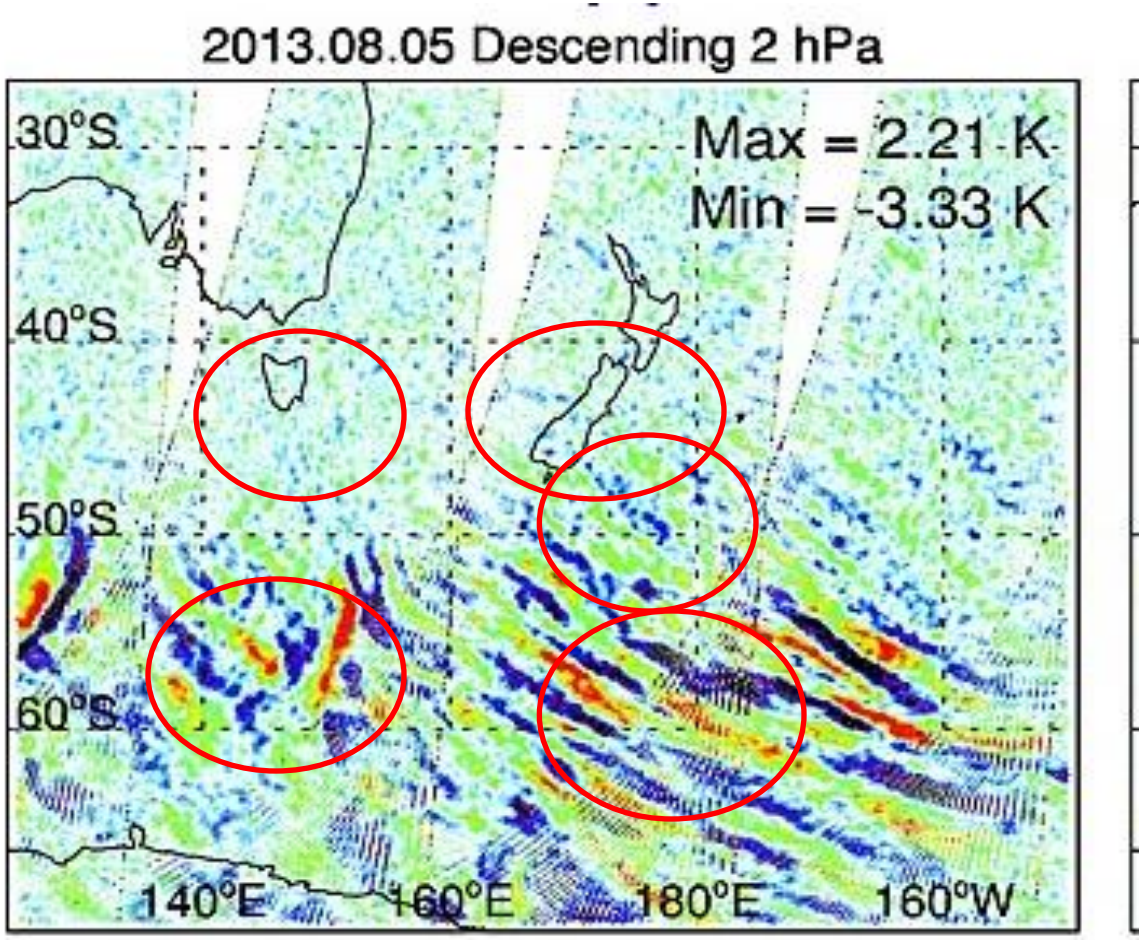
“dry run” = fire drill with no water or military operation with no ammunition

Objective of the Dry Run

- Gain experience using forecasts to allocate aircraft and sounding resources
- Judge the quality and format of model forecasts
- Develop a measure of quality in flight planning
- Team building

DEEPWAVE Dry Run Summary

- 5 to 14 August 2013
- 10 days; 5 virtual flights
- Rotating Chairman
- Forecasts: EC, COAMPS, GFS
- EOL Data Catalog Active
- 5 aircraft operating areas
- Post-event evaluation



Over the south island of NZ (Table 2) [mountain waves]
SE of the south island in trailing waves (Table 3) [trailing waves]
Over and south of Tasmania (Table 4) mountain and trailing waves]
Southern Ocean southeast of NZ (Table 5) [non-orographic waves]
Southern Ocean southwest of NZ (Table 6) [non-orographic waves]

Scoring

- Was the aircraft sent to the chosen region on the best day for waves in that region?
- Score (1-10) is based on the day's ranking for waves in the chosen operating region.
- Example, if the NGV was sent to Tasmania on the best day of the dry run for waves over Tasmania; the score is 1.
- Scoring is based on a later model run; not real data. Both a high (e.g. 2hPa) and a low (e.g. 200hPa) score is made.

Date; August	chair	critic	Forecast	Take Off 06Z On Aug.	NGV flight	DWS NGV	Falcon	Soundings	Goal	Score high	Score Low 200 hPa
5 Mon	D	E	AR	6	no		no	no			
6 Tues	D	E	AR	7*	NZ (6hr)	12	NZ	ISS	OroWave	1	1
7 Wed	E	D	AR	8*	NZ (6hr)	12	NZ	ISS	OroWave	3	4
8 Thurs	E	D	AR	9	no		no	no			
9 Fri	F		JD	10*	Tasmania (9hr)	12	no	Hobart	OroWave	1	3
10 Sat	D		CR	11	no		no	no			
11 Sun	D	K	CR	12	no		no	no			
12 Mon	F		AR	13*	Southern Ocean (8hr)	12	no	Macquarie	Non-OroWave	2	-
13 Tues	S		AR	14	no		no	no			
14 Wed	S		QJ	15*	NZ & SO (9)	20	NZ	ISS, Macquarie	OroWave&(Non-Orowave)	9 (3)	2-7 (1)

Table 1: DEEPWAVE Dry Run Summary (* flight day)
(Chairs: Jim Doyle, Steve Eckermann, Dave Fritts, Ron Smith),(Critics: Steve Eckermann, Chris Kruse, Jim Doyle), (Forecasters: Alex Reinecke, Carolyn Reynolds, Qingfang Jiang, Jim Doyle)

Lessons learned (1)

1. The four general objectives (NZ waves, Tasmania waves, Southern Ocean waves and predictability) provide enough variety and occur often enough that the NGV can be utilized about half of the days during the deployment period. There is the lurking danger (seen at the end of the dry-run) of an extended period with blocked flow at mid and upper levels resulting in no deep wave propagation over NZ and Tasmania. The good science days come in bursts.
2. The Data Catalog is a useful way to provide all decision makers with a consistent set of information. It needs to load more quickly. Several more data sets must be added before the project begins:
   - NZ coastal radar showing the convection and motion of the cells.
   - Surface meteorological stations on the NZ west coast.
   - ISS data and products
   - Satellite overpass times and various specialized products
   - Australian BOM high resolution sounding data (eastern and SE locations)
   - NZ Meteorological Service high resolution soundings from all locations (4)

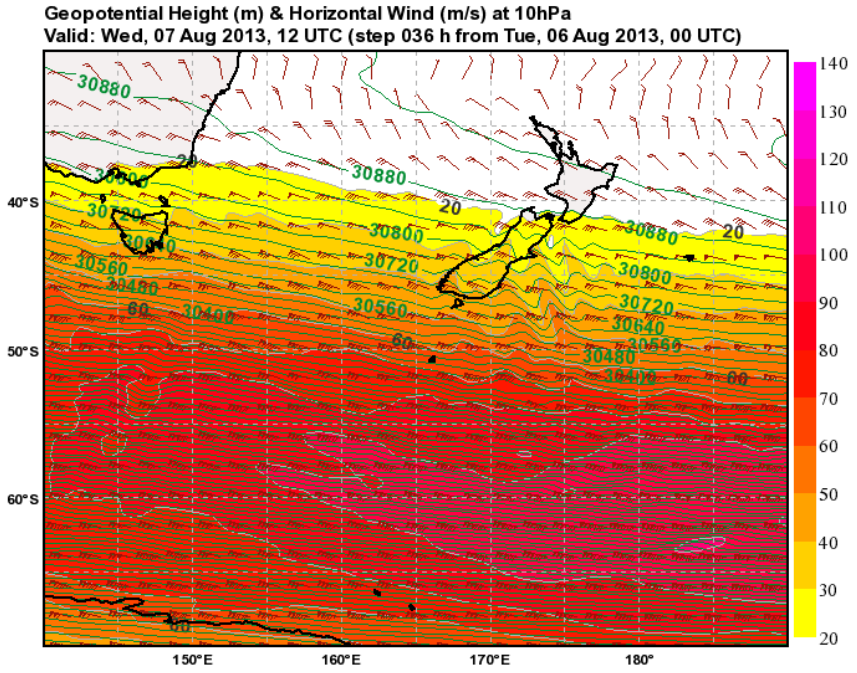
Lesson Learned (2)

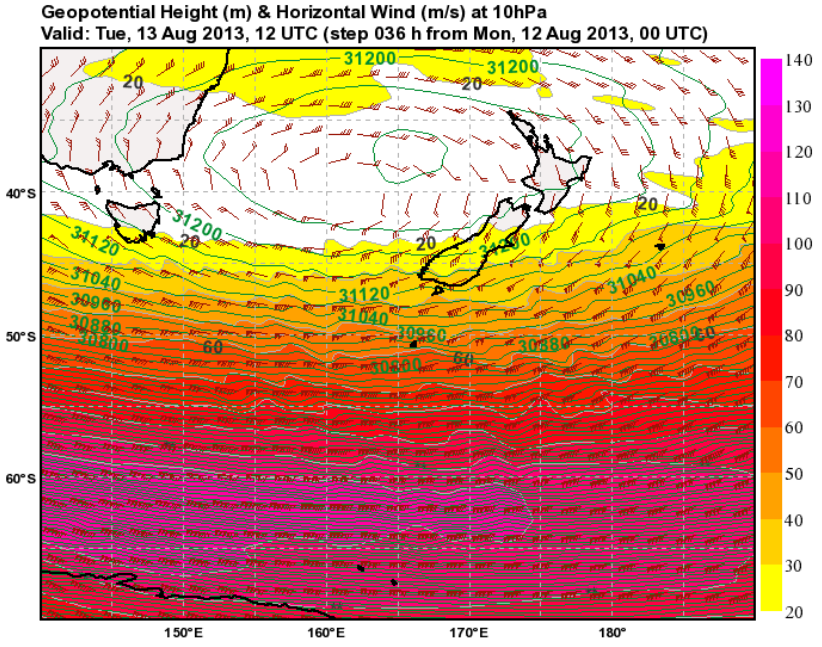
1. The EC, NRL and other forecasts are pretty consistent from run to run, once we are inside 60 hours. This will help in two-day planning. The accuracy, inter-model consistency and physical nature of these forecasts are unknown and problematic.
2. Additional diagnostics from the models are needed in the Catalog:
   - Time series of several indices from forecast products.
   - Wave diagnostics from forecast products: EF and ray paths.
   - More Cross sections.
   - Aircraft fly-throughs (Allow passes through the model grid from an aircraft frame of reference)
   - GoogleEarth based flight tracks, model products, satellite verification
   - The weather forecasts should include a turbulence forecast or discussion to support the G-V and Falcon operations. Additional diagnostics (e.g., TKE, CAT parameters) from the operational and DeepWave real time models will be needed
   - Airport terminal weather forecasts (primary and alternate locations)

Lessons Learned (3)

1. The Dry Run did not sufficiently exercise
   - Falcon Operations
   - ISS operations
   - Predictability flights
   - Other observing systems
2. When possible, we should maintain a priority on repeat flight legs to optimize the information from each pass in a time-changing gravity wave environment. Some dry run flights did not have sufficient repeat legs to judge wave transience. This is likely to happen over the ocean where we do not trust the forecasted location of the waves. The “lawn-mower pattern” with no repeat legs may be needed to find waves but it gives only a complex mix of time and space observations.
3. A good flight plan over New Zealand includes two long legs (e.g. 300km) in an open V-shape.

Upper level anti-cyclones





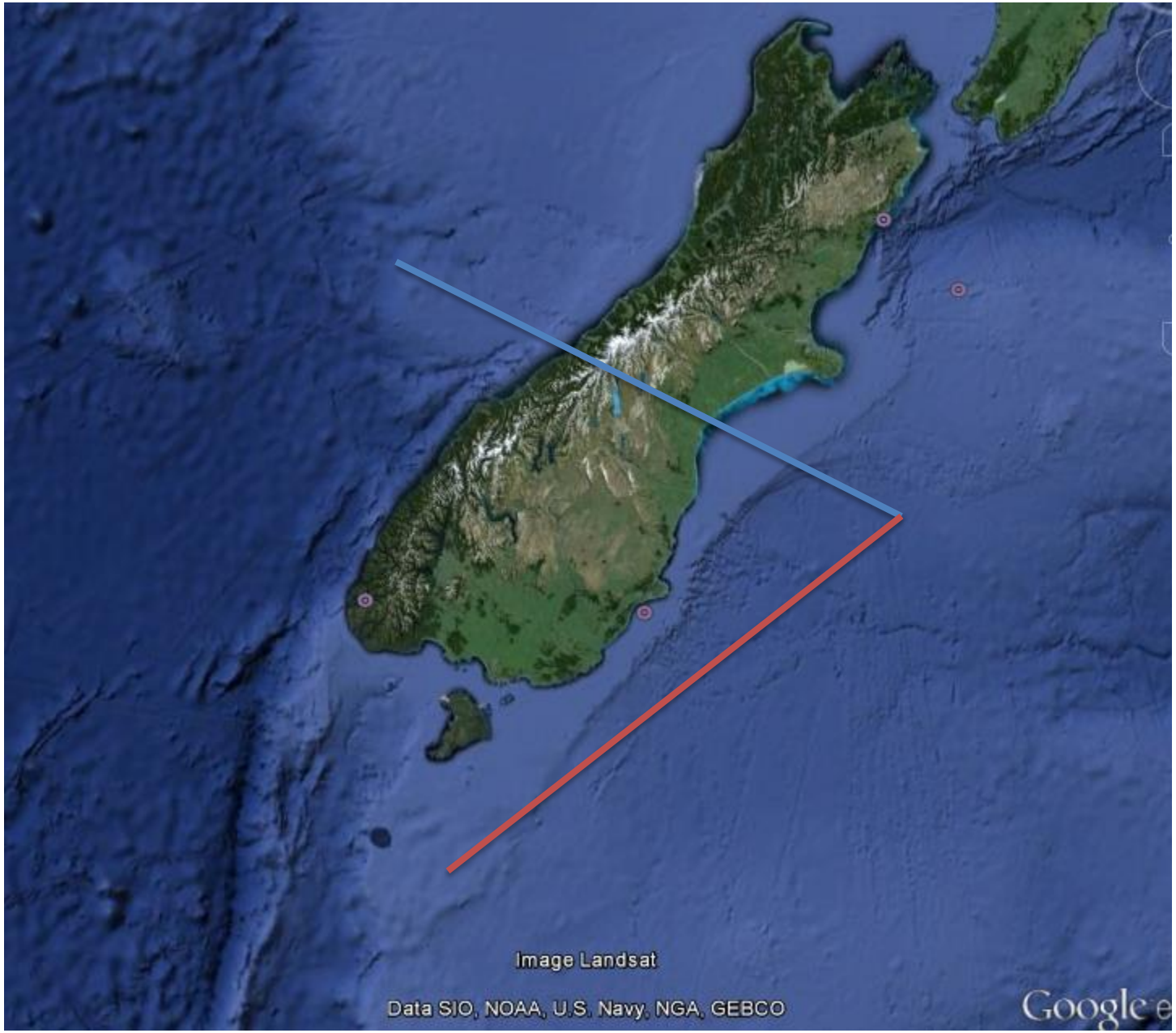


Image Landsat
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Google

Region A: South Island

Plan Day	Flight day	AIRS 3hPa	AIRS 40	EC 3hPa	EC 50	EC 200	COAMPS 2hPa	COAMPS 50	COAMPS 200
5 Mon	6	0	0	8	8	0	X	X	10
6 Tues	7*	0	0	20	16	16	X	X	4
7 Wed	8*	0	0	4	8	4	X	X	12
8 Thurs	9	0	0	0	0	4	X	X	8
9 Fri	10	1.5	0	12	8	0	12	8	8
10 Sat	11	0	0	0	0	0	16	4	4
11 Sun	12	0	0	0	4	4	0	4	8
12 Mon	13	0	0	4	12	8	4	12	16
13 Tues	14	0	0	0	4	12	0	12	4
14 Wed	15*	0	0	0	12	8	0	0	4

Table 2: Region A: Mountain waves over South Island at 12Z (* actual flight day)

Trailing waves south of South island

Plan Day	Flight day	AIRS 3	AIRS 40	EC 3	EC 50	EC 200	COAMPS 2	COAMPS 50	COAMPS 200
5 Mon	6	0	0	16	4	0	X	X	0
6 Tues	7*	0	.3	20	12	0	X	X	0
7 Wed	8*	1	.3	20	8	0	X	X	0
8 Thurs	9	1.1	0	4	4	4	X	X	0
9 Fri	10	2	0	12	0	0	12	0	0
10 Sat	11	1.25	.3	12	0	0	12	12	0
11 Sun	12	3	.3	12	0	0	8	0	0
12 Mon	13	1.5	0.2	4	4	8	12	0	0
13 Tues	14	.5	0	8	0	0	12	0	4
14 Wed	15*	0	0	4	0	0	4	0	0

Table 3: Region B: Trailing waves SE but near South Island at 12Z (* actual flight day)

Over and near Tasmania

Plan Day	Flight day	AIRS 3	AIRS 40	EC 3	EC 50	EC 200	COAMPS 2	COAMPS 50	COAMPS 200
5 Mon	6	0	.5	16	12	8	X	X	5
6 Tues	7	0	0	8	4	0	X	X	4
7 Wed	8	.5	0	4	4	0	X	X	0
8 Thurs	9	3	0	20	16	4	X	X	0
9 Fri	10*	1.8	.3	20	16	4	36	16	8
10 Sat	11	1.5	.5	20	12	4	16	8	0
11 Sun	12	0	.4	16	16	4	12	8	8
12 Mon	13	0	0	12	16	4	16	12	12
13 Tues	14	0	0	12	4	0	12	8	4
14 Wed	15	0	0	4	12	4	0	0	0

Table 4: Region C: Orographic Waves over and near Tasmania at 12Z (* actual flight day)

Southern ocean southeast of NZ

Plan Day	Flight day	AIRS 3	AIRS 40	EC 3	EC 50	EC 200	COAMPS 2	COAMPS 50	COAMPS 200
5 Mon	6	2	0	20	4	0	X	X	0
6 Tues	7	2	0	16	4	0	X	X	0
7 Wed	8	3	.4	12	0	0	X	X	0
8 Thurs	9	1.75	.4	8	0	0	X	X	0
9 Fri	10	6	0	12	0	0	8	0	0
10 Sat	11	2	.2	12	0	0	0	0	0
11 Sun	12	4	0	16	0	4	20	4	4
12 Mon	13*	2.5	0.6	20	0	4	32	0	4
13 Tues	14	3.5	0.3	12	0	0	16	0	0
14 Wed	15	2.5	0	16	4	0	16	0	0

Table 5: Region D: Non-orographic waves over the Southern Ocean southeast of NZ at 12Z (* actual flight day)

Non-orographic waves over the Southern ocean southwest of NZ

Plan Day	Flight day	AIRS 3	AIRS 40	EC 3	EC 50	EC 200	COAMPS 2	COAMPS 50	COAMPS 200
5 Mon	6	3	0.5	20	0	8	X	X	0
6 Tues	7	5	0.45	8	0	0	X	X	0
7 Wed	8	5.5	.6	16	0	0	X	X	0
8 Thurs	9	4	.7	4	0	0	X	X	0
9 Fri	10	2	.3	4	0	0	0	0	0
10 Sat	11	2.5	.2	8	0	0	4	0	0
11 Sun	12	2	.3	12	12	0	4	0	0
12 Mon	13	2.75	0.5	8	0	0	12	0	0
13 Tues	14	2.5	.4	20	8	0	16	8	0
14 Wed	15*	2	.5	24	16	12	12	0	4

Table 6: Region E: Non-orographic waves over the Southern Ocean southwest of NZ at 12Z (* actual flight day)