

Nowcasts and forecasts for the Olympics & Paralympics 2012

Clive Wilson with thanks to Mike Bush, Mark Weeks, Paul Agnew, Jim Trice

34th EWGLAM and 19th SRNWP Annual Meeting 2012

08th – 11th October 2012 Helsinki, Finland



- Operational context
- Met Office Showcase
 - MOGREPS-UK 2.2km ensemble Nigel Roberts' talk
 - Hourly rapid-update NWP nowcast Zihong Li's talk
 - Air Quality model
 - Weymouth Bay very hi-res models

Olympics & Paralympics forecasts 2012



Met Office









Olympic Park Forecasting team

- Events: Opening and Closing ceremonies, Athletics, Hockey, BMX, Tennis and many other outdoor events in and around London
- Forecasters: Team leader +4





Olympic Park Forecasting team -LOCOG support

- Deployed to London on 16 July (ahead of opening ceremony 28 July)
 - worked alongside LOCOG within their Main Operations Centre at Canary Wharf.
- Forecasts, warnings and advice to LOCOG
 - to help them with the organisation and safe running of the Olympics.
- London operation was 24x7 with 12-hour shifts
- Daily Incident Management Team meetings.
- Team provided 'start-up' guidance each morning
 - for the forecasters at Eton Dorney and Weymouth.



Olympic Park Forecasting team

- 2008 Paralympics, Beijing
 - Forecasters Andy Page and Jon Millard guests of the Chinese Met Administration
- Main issue to get right (apart from the forecast of course)
 - consistency in the forecasts coming out from a number of sources both internal and external to the Met Office
- Looking ahead:
 - Marcia dos Santos Seabra from Instituto Nacional de Meteorologia (INMET) visited team and Exeter during Olympics for 2016 Rio planning



Olympics showcase capabilities

- Improving UK km-scale forecasts
 - 2.2km 6-hourly UK ensemble
 - 1.5km hourly southern-UK NWP-nowcast
- Integrating coupled impact forecasts
 - 12km Air Quality
 - 333m atmosphere & 250m wave models for Weymouth Bay





Olympics opening ceremony 19:00-23:00UTC 27/07/12

- Ops Centre guidance for precipitation :
- 25% probability (any amount) and 10% for heavy precipitation, sufficient to wet spectators.
- Thunder risk ≤10%.
- Prediction of generally dry weather with a small risk of showers was proved correct
 - A shower in the hour before the ceremony but the event itself stayed dry
- Wind forecast was important for "Queen's skydive"



MOGREPS-UK prob of 5mm or more in 6 hours to 00Z Sat.



Note the 5 to 10% prob near London



Rain rate [mm/hr]





Deterministic models - UK4 and UKV(1.5km)

- Operational Power 6
- Parallel Power 7
- Lift-and-shift suite
 - But running for several months independently
- Significant differences in initial and lateral boundaries







0.25

0.5





16

32

>32

T+17







T+29 T+35 Operational(P6) UKV (1.5km)



0.1

0.25

0.5

16

32

>32



>32

T+35



T+23

T+29

Operational(P6) UK4



>32



>32

T+27

T+9











T+15



T+27

T+21

Mogreps-UK Prob >0.2mm in hour



Mogreps-UK Prob >0.2mm in hour

27/07/12 20:00 - 21:00 BST



Mogreps-UK Prob >4mm in hour



27/07/12 20:00 - 21:00 BST



Mogreps-UK Prob >4mm in hour





NDP hourly nowcast

NDP - Rain Rate At 09:00Z on 28/ 6/2012, from 06:00Z on 28/ 6/2012



NWP-based nowcasting: June 28th storms 0900UTC



NDP - Rain Rate At 09:00Z on 28/ 6/2012, from 08:00Z on 28/ 6/2012



Radar Rainfall Rate (composite:1km) For 0900Z on 28/06/2012



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NWP-based nowcasting: June 28th storms 1200UTC



NDP - Rain Rate At 12:00Z on 28/ 6/2012, from 11:00Z on 28/ 6/2012



Radar Rainfall Rate (composite:1km) For 1200Z on 28/06/2012



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Nowcasting Demonstration Project

- Experimental convective-scale hourly nowcast to 12 hours ahead
- Enhanced assimilation of observations (especially Doppler radar)
- Southern UK only (HPC limitation)
- Operational UK-wide successor will be implemented following next HPC upgrade in 2014
- Will replace extrapolation nowcast (STEPS



Air Quality Model



Air Quality for the Olympics

- New forecast maps of the 'Daily Air Quality Index' were presented on the **Olympics Showcase**
- Although air quality was generally good during the Olympics, pollution levels increased in the few days prior to the opening ceremony
- In southern England ozone levels rose significantly and were well forecast





 Forecasts were verified in near-real-time by comparison against the UK Automatic Urban and Rural Network of air quality observations



Air Quality for the Olympics

Forecasts were verified in near-real-time by comparison ulletagainst the UK Automatic Urban and Rural Network of air quality observations



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AQUM: Air Quality configuration of the Unified Model

- Uses collaborative aerosol & chemistry developed for Earth System Model use in Climate Change research
- Configured in a 12km NW Europe forecast model, run once daily to 5 days ahead using ECMWF boundary conditions
- Operational in site-specific forecasts on Met Office & BBC web sites - replaced old approach for BBC based on NAME
- DEFRA review group recently judged it the best air quality forecasting model available in UK
- Will ultimately (2020?) be included in all forecasting configurations to capture aerosol-weather interactions



- Events: Sailing and Windsurfing
- Forecasters: Team leader Jim Trice, Gillean Keith, Penny Tranter and Mark Bevan





- Weather integral to sailing
 - competitors seek to use changes in wind speed and direction to gain a competitive advantage.
- Forecasters & LOCOG race management teams aim to provide a safe and fair competition.
- evening/morning roster with the same forecaster briefing in the evening and then again in the morning
 - to ensure a consistent story
 - forecaster highlights any changes which impact on the racing schedule.



- 10 sailing classes with different set of weather limits
 - who should sail where heavily influenced by the forecast.
- wind limits are fairly generous sail if 5KT up to 20 KT (gusting 30 KT
- race management very sensitive to changes in wind direction, particularly in the immediate run up to a race start.
- Forecast wind speed and direction + the variability in the wind direction
- forecasts based on
 - Weymouth Bay Model (333m resolution)
 - Convective Scale Ensembles (2.2km) to give idea of confidence.



- All competitors have access to forecasts online
- The weather is always a hot topic of conversation
 - always a huddle of sailors around the meteorology section of the competitors' notice board.
- fairness
 - the competitors briefed en-masse with no contact with the forecasters allowed after the briefing
- forecasting team at Weymouth highly praised
- 1st Sunday's (29 July) sailing race was postponed on the team's advice - a decision that proved to be correct.
- A trough line came through during the early afternoon. The winds were very variable in direction around a CB cloud and so the decision was taken to delay race starts until the wind direction had settled

Weymouth model domain & orography







Met Office



Weymouth Bay models

Met Office

- Operational very hi-res models to support Weymouth Bay forecasters for duration of Olympics/Paralympics
- 333m UM weather forecast model
 - Used for LOCOG Weymouth Bay wind climatology
 - Captures local wind/weather detail missed by 1.5km UKV: frost/fog hollows, beach vs town, park vs urban, mountain waves
- 250m SWAN wave forecast model
 - Resolves headlands missed by 12km operational wave model including blocking of SW swell by Portland
 - Represents shallow water physics better than Wavewatch III including focussing of swell on Kimmeridge Bay
 - Aim to add physics to WWIII, couple with NEMO-SHELF ocean model & configure to forecast within 1km of UK shoreline by 2020
- Models independently run from UKV initialisation & forcing



Weymouth competition courses



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Portland Harbour (central) anemometer: 29th July 2012





Portland Harbour (central) anemometer: 30th July 2012



5 Sept Variable winds

Winds - Uncertainty in wind prediction From convective scale ensembles

Wind Direction (degrees) Key Shoding = uncertainty in wind-direction 75% to max Blue = 25% to 75% Black arrow = median wind direction towords the centre of wind-rose 10m Wind Speed (mph) Beaufort 6 25 (Strong Breeze) Beaufort 5 (Fresh Breeze) 20 Beaufort 4 15 (Moderote Breeze) 10 Beaufort 3 (Gentle Breeze) Beoufort 2 5 (Light Breeze) Beoufort 1 (Light Air) 0 Beoufort 0 00 01 02 03 12 13 14 15 16 17 18 19 20 21 04 05 06 07 08 09 10 11 22 23 (Calm) Wed 05 mox September 2012 75% Median median Note: All times on axis are in BST 25% min

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Warnings Board

Area	Light Winds <=5KT	Strong Wind Mean>=20 KT Gusts >=30 KT	Gale	Wind Angle ∆ >=15 degrees	Visibility <5000 M	Thunderstorm Risk Moderate	Thunderstorm Risk High
Shoreside Portland Harbour				1300-1900			

Eton Dorney Forecasting team

- **Events: Rowing and Canoe Sprint** •
- Forecasters: Alison Eadie, Liz Carlton and Gareth Powell

Eton Dorney Forecasting team

- Morning (5am start), evening shift pattern on site
 - issue the first forecasts by 6.30am.
- hourly wind forecasts
- outlook forecasts to plan ahead
- issue warnings if required •
- Text forecasts displayed on information boards around the site for the athletes
- Not allowed to talk to any of the teams or the athletes, as we working specifically for the organisers.

Eton Dorney Forecasting team

Main forecast concern:

- wind direction
- strong cross winds→ some racing lanes more favourable than others.
- The organisers are extremely concerned about 'fairness', making sure everyone has the same chance.
- thunderstorms, mainly from a crowd safety perspective.
- We worked with the organisers to develop a specific lightning risk warning system to be used at Eton, which gives indications of how long they may have to clear the lake and the spectator stands – and also lets them know when it's safe to start racing again.

Met Office

- Opportunity to showcase key aspects of programme for improving UK NWP
 - 2.2km ensemble
 - Hourly rapid update NWP nowcast
 - Air Quality
 - Weymouth wind & wave
- Short range temporal/spatial variability key aspects
- Much lower cost than hosting a FDP/RDP
- External access layered:
- most public / institutional access stops at the information layer
- only interested scientists are encouraged to visit real-time output
- Most experimental NDP products password protected

Thanks for listening

Extra slides

Bandings for the Daily Air Quality Index										
Band	Index	Ozone	Nitrogen Dioxide	Sulphur Dioxide	PM _{2.5} Particles	PM10 Particles				
		Running 8 hourly mean	Hourly mean	15 minute mean	24 hour mean	24 hour mean				
		μg m ⁻³	μg m ⁻³	µg m ⁻³	μg m ⁻³	μg m ⁻³				
Low		0-33	0-66	0-88	0-11	0-16				
	0	34-65	67-133	89-176	12-23	17-33				
	٩	66-99	134-199	177-265	24-34	34-49				
Moderate	•	100-120	200-267	266-354	35-41	50-58				
	3	121-140	268-334	355-442	42-46	59-66				
		141-159	335-399	443-531	47-52	67-74				
High	0	160-187	400-467	530-708	53-58	75-83				
	•	188-213	468-534	709-886	59-64	84-91				
	•	214-239	535-599	887-1063	65-69	92-99				
Very High	10	240 or more	600 or more	1064 or more	70 or more	100 or more				

