NRMC Update

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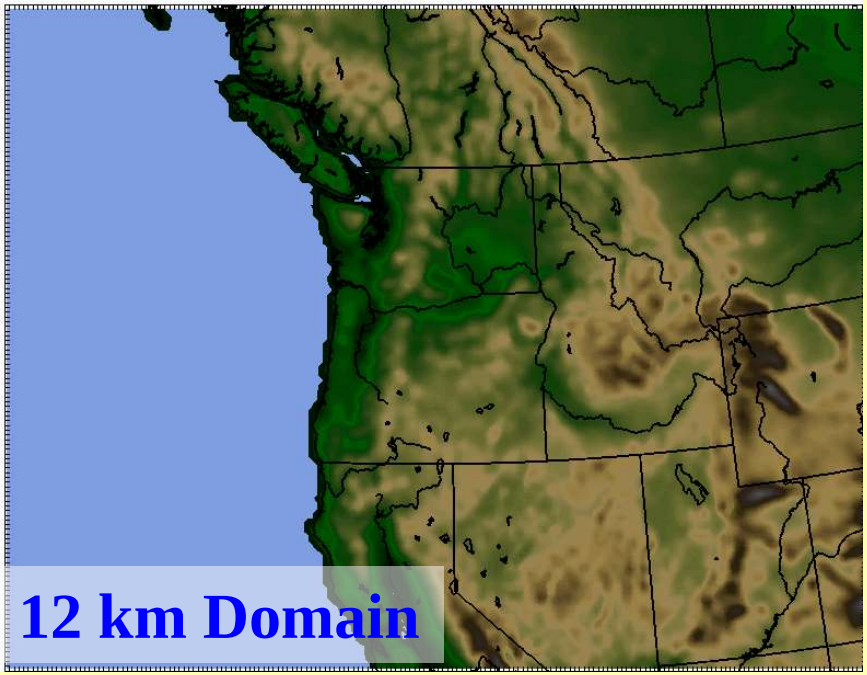
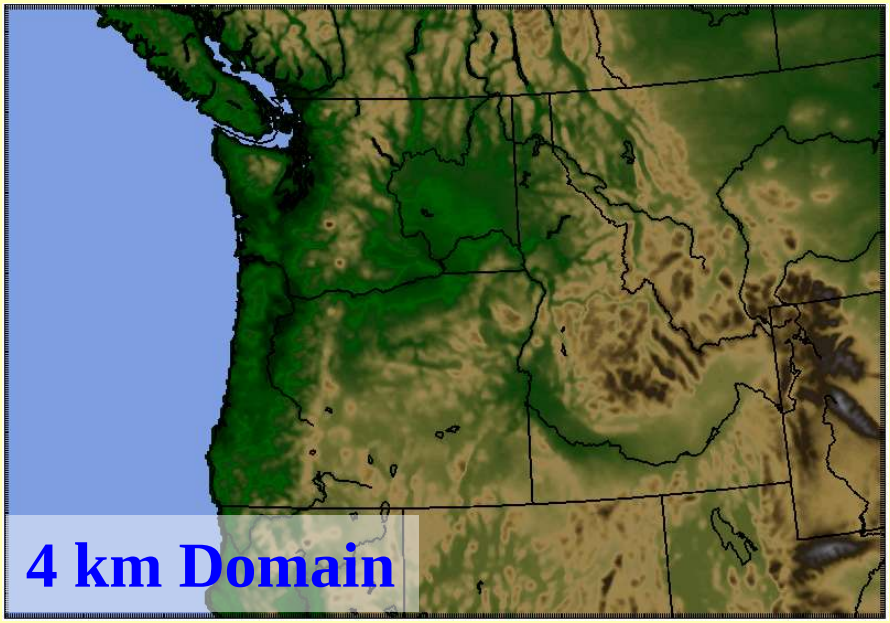
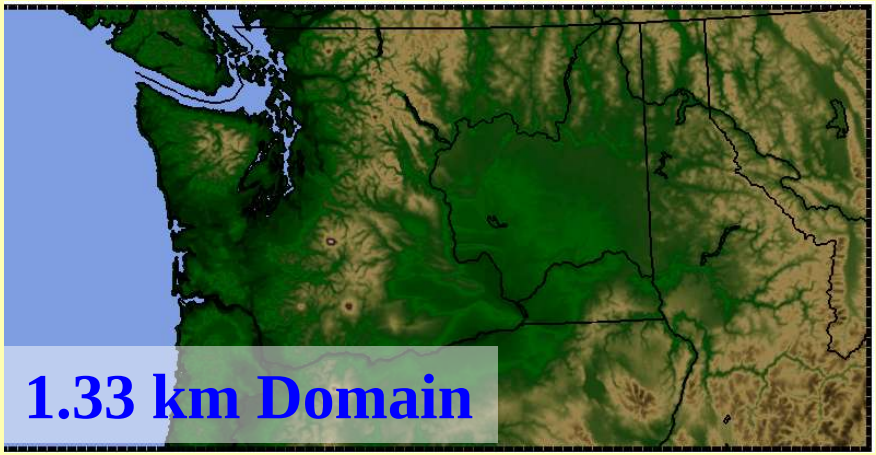
EPA Region 10

WRF Model Domains

- **36 km and 12 km domains set up the finer-scale ones of more interest**

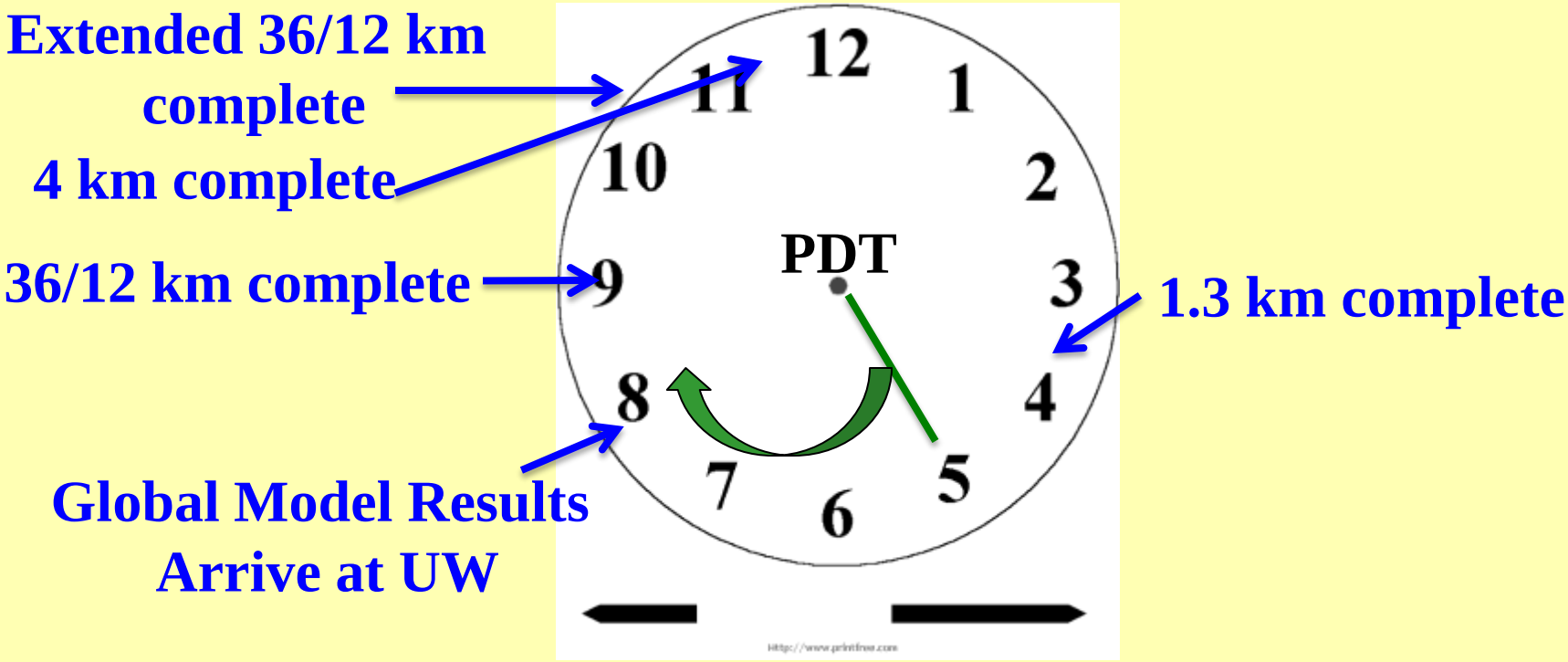






Recent WRF Modeling Changes

- **September 2013: switched to LSM and RRTMG**
  - **Dramatically slower model**
  - **4 km not available until 11:30 AM/PM PDT and 1.33 km not available until ~4 AM/PM PDT.**



SFY14 Contract Status

Run WRF at 36, 12, 4, and 4/3 km grid resolution. … Air quality products, including all the ventilation indices, are generated as the forecast progresses, rather than when the entire forecast is complete.	**Complete**. **Ventilation products are being produced on the fly**
The UW ensemble system will be maintained and run twice daily	**Ensemble is run and maintained. Cliff is not yet ready to make this our flagship model run.**
Maintain and improve the dissemination of the Northwest regional forecasts through the web and other means.	**Complete.**
Provide periodic assessments of which aspects of model science, if any, are deficient for meteorological modeling needs.	**Completed at triannual meetings.**
When changes to the model are made, model performance will be assessed for extended periods of several seasons. In addition, the changes will be tested for periods encompassing a wood smoke episode, a smoke management episode, and a summertime ozone episode. It is incumbent upon the air quality agencies to provide specifics on these episodes in order for this task to be completed.	**Despite repeated attempts to provide air quality episodes, the model changes are only minimally examined for our criteria.**
Continue assessment of PBL and LSM schemes in WRF.	**Being done, along with other aspects of the model.**
Refine trajectory graphics based on user feedback. Add a forward trajectory on the 4 km and 1.33 km domain for Anacortes.	**Exceeded requirement by adding extra trajectories throughout contract.**
Weak Wind Index AgBurn Outlook Deep Stable Layer	**PSCAA weak wind speed graphic is complete.** **The Deep Stable Layer Model is not complete. UW has information** **The Ag Burn outlook is not complete. UW has information.**
Further develop the UW EnKF modeling and move to a 1-hr cycle if computer resources are made available.	**Being developed. Computer resources have not been made available by funding agencies for this task and so 1-hour cycle has not happened.**
Air quality product descriptions	**Waiting for input from air quality agencies.**
97% reliability	**Complete** For the period 2013010100 to 2104061612 (1064 model runs) Model and Domains — Time Window in hours — Reliability — Missed Runs — Late Runs MM5-NAM 36/12 — 3.5 — 99.62% — 4 — 7 WRF-GFS 36/12 — 4.0 — 98.97% — 5 — 6 WRF-GFS 4 — 4.5 — 99.25% — 5 — 3 WRF-GFS 1.33 — 10.5 — 96.62% — 18 — 18
Provide ENVPREDSYS gridded data fields from the 00 UTC operational runs to Washington State University- AIRPACT and ClearSky predictions systems by 08Z	**Completed on a daily basis.**
Annual “state of the model” report must be provided to Project Sponsor for the contract period ending June 30, 2013.	**Complete.**

SFY15 Contract Items

1. **WRF at approximately 8AM/8PM Pacific Standard Time (36, 12, 4 km domains) or approximately 1PM/1AM (1.3 km grid) following the 1200 or 0000 UTC initialization times of the modeling system. Forecast products shall extend out to 180 hours for the 36 and 12 km resolutions, 84 hours for 4 km resolution, and 48 or 60 hours for the 4/3 km resolution.**
2. **The UW ensemble system …**
3. **Web page…**
4. **Assess the science and improve the model….**
5. **Verification…. Perform upper-air verification at as many near-surface levels as possible.**
6. **When changes to the model are made, model performance will be assessed. In addition, the changes will be tested for periods and locations as provided by the air quality agencies. It is incumbent upon the air quality agencies to provide specifics on these episodes in order for this task to be completed.**

SFY15 Contract Items

7. **Continue assessment of PBL and LSM schemes in WRF. Assessment will be made for all areas of the domain and times of the year, but particular attention will be paid for performance during wintertime stagnant conditions.**
8. **Refine trajectory graphics ….**
9. **On the PBL height graphics, make the color scale static so users can make comparisons between different forecast times.**
10. **Refine existing ventilation products…**
11. **Create web links …**
12. **Time-independent page, completed already. Explore feasibility of running the 00Z 1.33 km run out 60 forecast hours and the possibility of initializing with 6Z and 18Z forecasts instead of 0Z and 12Z forecasts.**

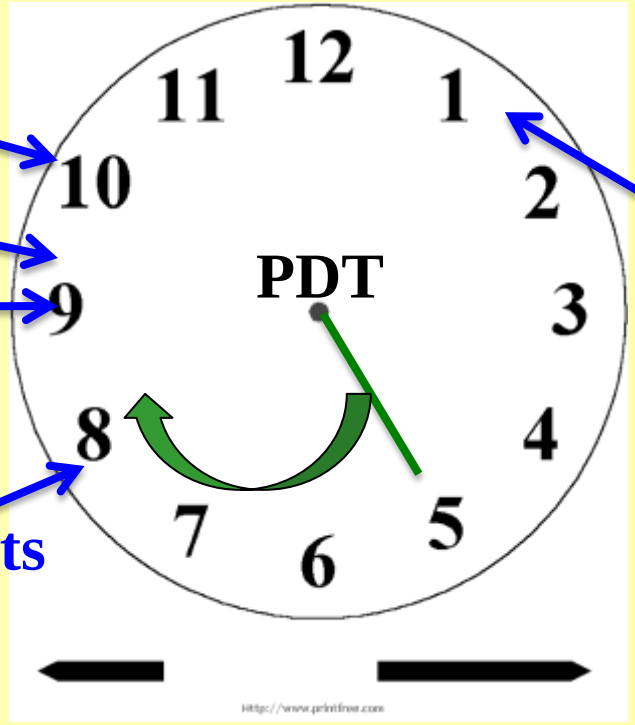
Future WRF Modeling Changes

- **New Hardware coming this summer**
  - **$40k from air quality agencies, $15k from USFS**
- **With new hardware:**

Extended 36/12 km complete

4 km complete

36/12 km complete

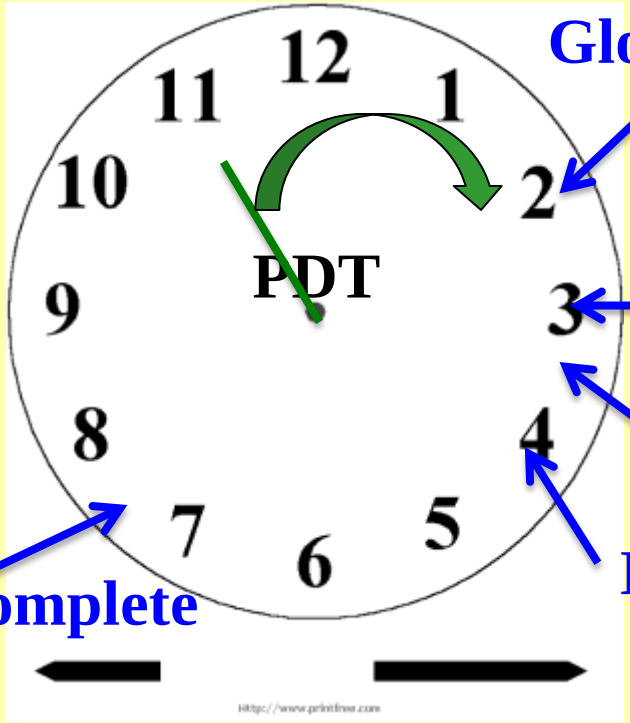


1.3 km complete

Global Model Results Arrive at UW

Shall We Shift Model Start Time?

- **With new models, UW can start at 6Z/18Z rather than 0Z/12Z**



Global Model Results Arrive at UW

36/12 km complete

4 km complete

Extended 36/12 km complete

1.3 km complete

Shall We Change "Global" Models?

- **Right now, the GFS model provides initial and boundary conditions.**
- **The Rapid Refresh model at NOAA outperforms GFS. Shall we switch to it for the first 18 hours of the forecast?**
  - **http://rapidrefresh.noaa.gov/**
- **UW will test WRF system using "Rap" this Summer. Decide at October Consortium meeting**

Shall We Change WRF Configuration?

- Rapid Refresh configuration of submodels is so compelling that UW is going to test in UW-WRF
- Why not just use Rap and forget UW?
  - Rapid Refresh only out 18 hours
  - 13 km domain is coarse
  - High Resolution Rapid Refresh (HRRR) does not go far enough north or west
  - Long-term benefit of regional focus
- UW will test WRF with Rap configuration
  - We need to make sure testing is done with AQ episodes