4.4 IMPLEMENTATION, VISUALIZATION, AND VERIFICATION OF CANSAC PRODUCTS

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1. INTRODUCTION

The California and Nevada Smoke and Air Committee (CANSAC) is a consortium of fire weather and air quality decision-makers, managers, meteorologists and scientists in partnership to provide operational meteorological support for wildland fire and smoke management, and advance the scientific understanding of atmosphere and fire interactions. CANSAC is one of five regional Fire Consortia for Advanced Modeling of Meteorology and Smoke (FCAMMS) consortia established as part of the National Fire Plan, and is dedicated to fire and smoke management issues in the California and Nevada region. CANSAC's operational component is implemented at the Desert Research Institute (DRI) Program for Climate, Ecosystem and Fire Applications (CEFA) in collaboration with the CANSAC constituents, and some CANSAC related research is being undertaken via the USDA Forest Service Pacific Southwest Research Station as well as at DRI. A history of CANSAC is given in Brown et al (2003). This paper describes the methods and techniques developed to compose a fully operational weather and smoke forecast system and to verify and improve its components.

2. SYSTEM CONFIGURATION

Currently, the CANSAC operational numerical weather forecast center generates twice daily initialized (00 and 12 UTC) forecasts using the Fifth Generation Penn State/NCAR Mesoscale Model (MM5) (Grell et al., 1995). The model domain is set to enclose a greater area of the Western US and focus on California and Nevada in higher resolution (Fig. 1).

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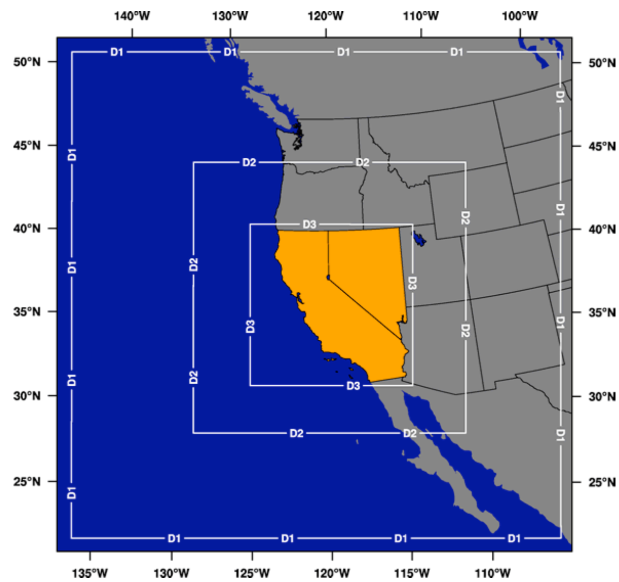


Figure 1. CANSAC MM5 forecast domain configuration.

Three nested domains are constructed over grids of 97x97x32, 154x154x32, and 274x274x32 cells with 36, 12, and 4 km grid spacing for the outer, nested, and innermost domains, respectively. The outer and nested grids output 72-hr forecasts, while the innermost grid has only 48-hr forecasts. The model is initialized with ETA forecast outputs (Grid 212 – 40 km resolution) and the observations are obtained from Unidata LDM data stream. Physics parameterizations used include:

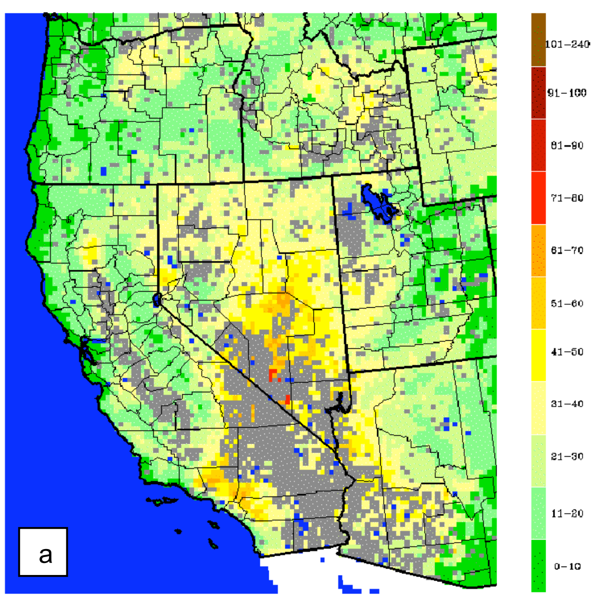
- ETA PBL scheme
- Grell cumulus parameterization
- Radiation FRAD=2
- Simple ice moisture scheme

The CANSAC real-time forecast system is operated on an SGI Altix 3700 Linux machine with 32 processors (Itanium2 1.3 GHz) and 80 GB RAM. The system has 2.6 TB RAID and supporting tape drives for archiving. At the present, the machine workload is divided amongst the forecast runs, postprocessing, and development work.

In addition to the MM5 forecasts, the National Fire Danger Rating System (NFDRS) predictions and the BlueSky modeling framework have been incorporated into the CANSAC operational system.

3. NFDRS PRODUCTS

The National Fire Danger Rating System is was developed by the USDA Forest Service and is used by wildland fire management agencies for assessment of fire danger. The system is extensively used and provides quantification of risk elements that are critical for daily decisions such as resource placement, appropriate suppression responses, and strategic decisions at local area to national levels. This system is implemented in the CANSAC operational system utilizing meteorological fields from MM5 forecasts together with fuel information obtained from the USDA Forest Service to p predictions of next-day NFDRS indices. The NFDRS forecasts are initialized at 00 UTC daily and the fire danger indices are provided for the two nested domains (Fig. 2). In near future, predictions of these indices will be extended to multiple days.



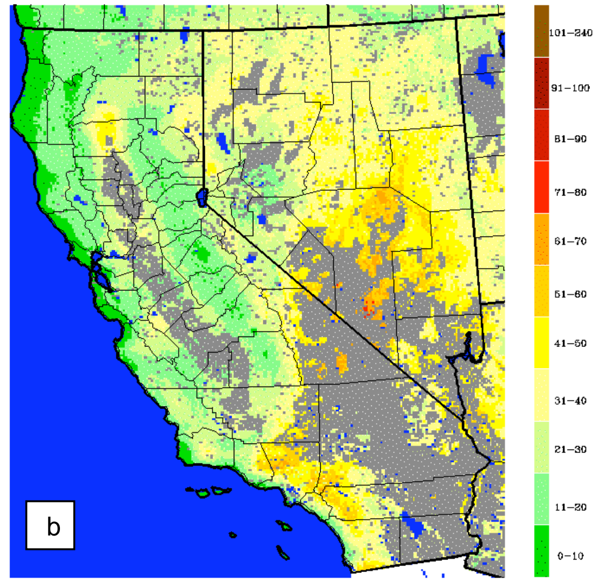


Figure 2. Example maps of NFDRS ignition component forecasts for the 12km nested (a) and 4km inner nested (b) domains.

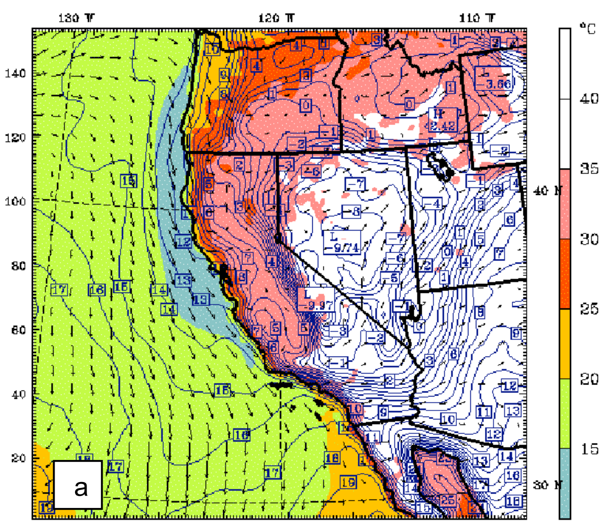
4. BLUESKY PRODUCTS

BlueSky is a modeling framework designed to predict impact of smoke from forest, agricultural, and range fires. The BlueSky modeling framework includes components of emissions, meteorology, and dispersion to generate the predictions of smoke impacts. The BlueSky system has been created and governed by the BlueSky consortium with the USDA Forest Service Air Fire Team that leads the related research. This system is currently being integrated into the CANSAC operational system and will provide information to determine smoke impact (ambient concentrations of $PM_{2.5}$) over California and Nevada from prescribed and wild fires.

4. VISUALIZATION AND VERIFICATION

The CANSAC system provides a wide range of processed products including meteorological, air quality and smoke related information. Postprocessing is done on the fly and the products are made available on CANSAC public web site (http://cefa.dri.edu/COFF/coffframe.php) as they arrive to the server. The MM5 model output is processed using an open source code (Read, Interpolate, and Process (RIP): available online at http://www.mmm.ucar.edu/mm5/documents/ripug_V4.html) with NCAR Graphics packages (available online at http://ngwww.ucar.edu). This visualization tool is continuously being modified with addition of new scientific and drawing modules to address the users' needs and provide better quality products in order to increase efficiency and usability. A selected list of these products include: upper layer (500, 700, 850, and 925 mb) winds, temperatures, geopotential height and relative humidity; surface fields; air quality and atmospheric stability indices such as ventilation index and lifted index; high resolution surface wind maps for California and Nevada; NFDRS indices; and station meteograms.

The long-term analysis of the forecast fields against the reanalysis revealed that a systematic cold bias occurs in the forecasted temperature fields (Fig. 3). This is a substantial issue considering that it affects the accuracy of overall products in particular soundings, air quality related products, and the NFDRS indices. This tends to happen more often for daytime forecasts than nighttime, and mostly pronounced over the land as the forecast progresses in time. Preliminary sensitivity study results with different PBL parameterization shows that there is an apparent improvement in the temperature predictions with Gayno-Seaman and MRF PBL schemes. Further studies are ongoing in order to improve the forecasts.



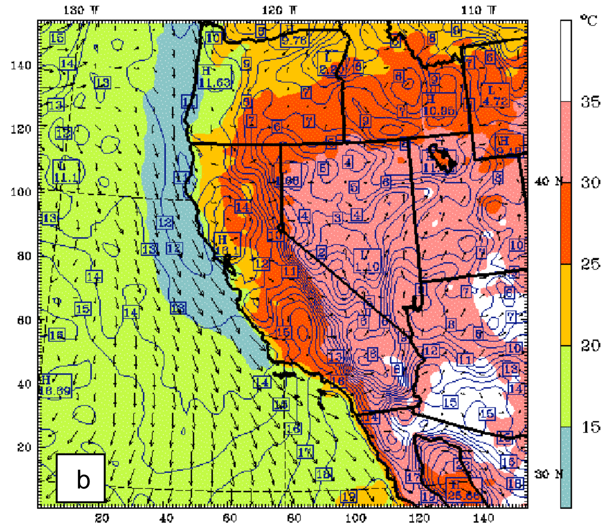


Figure 3. Example output maps of an analysis (a) and prediction (b) for surface temperatures and winds at forecast hour 72. Note the temperature discrepancy over the land.

5. SUMMARY

CANSAC operations and product development will continue for the foreseeable future. It is anticipated that relevant research conducted directly for CANSAC, or indirectly from other projects, will be utilized in the system. Expansion of product verification, implementation of BlueSky and testing of MM5 output with fire behavior models (e.g., FARSITE) are planned for the upcoming year.

REFERENCES

Brown, T.J., F. Fujioka, and C. Fontana, 2003: The California and Nevada Smoke and Air Committee - an interagency partnership to meet decision-making needs. *Proceedings American Meteorological Society Fifth Symposium on Fire and Forest Meteorology*, 6 pp.

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