CANSAC
California and Nevada
SMOKE AND AIR COMMITTEE

ANNUAL REPORT
2015

smoke & air

Background

In July 2002, the FIRESCOPE California Wildfire Agencies (CWA) approved a charter leading to the formation of the California and Nevada Smoke and Air Committee (CANSAC). The purpose of CANSAC was to develop and implement an operational mesoscale meteorology forecast facility for smoke and fire management at the Desert Research Institute (DRI) program for Climate, Ecosystem and Fire Applications (CEFA). The facility provides high-spatial resolution meteorological information, and value-added products including smoke and air quality forecasts. CANSAC products were developed for users of meteorological information related to fire weather, smoke and air quality.

Three-hourly forecasts out to 72 hours are now being made available twice daily on grids encompassing all of California and Nevada at 18-, 6- and 2-km spatial resolution initialized from the North American Mesoscale (NAM) Forecast System model. A limited set of 18-km forecast products out to 180-hours are initialized from the Global Forecast System (GFS) model. CANSAC began operations in May 2004 with the community MM5 mesoscale model. In May 2010 CANSAC began using the Weather Research and Forecast (WRF) model for most of the forecast products. The mesoscale model development community no longer supports MM5. However, CANSAC continues to run both MM5 and WRF at the request of the user community.

Three CANSAC oversight groups were formed as part of 2002 charter including the Board of Directors (provides general oversight and funding support), technical advisory group (TAG; provides science and technology support) and an operational applications group (OAG; provides product requirements and specifications). Committee meetings occur as warranted. The Board physically meets at least once per year, with some teleconference calls. The technical advisory committee provides science and technology support as needed, and is represented when the Board meets. The operational applications group has teleconference calls and email exchanges as needed to discuss requirements and specifications, and provide feedback to DRI-CEFA.

USDA Forest Service Region 5
National Park Service
Bureau of Land Management California
USFS Washington Office
California Air Resources Board
San Joaquin Valley Air Pollution Control District
Bay Area Air Quality Management District
Monterey Bay Unified Air Pollution Control District
San Diego Gas and Electric

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Accomplishments and Deliverables

CANSAC WRF products are publicly available at:
http://cansac.dri.edu/cansac_output.php?model=WRF

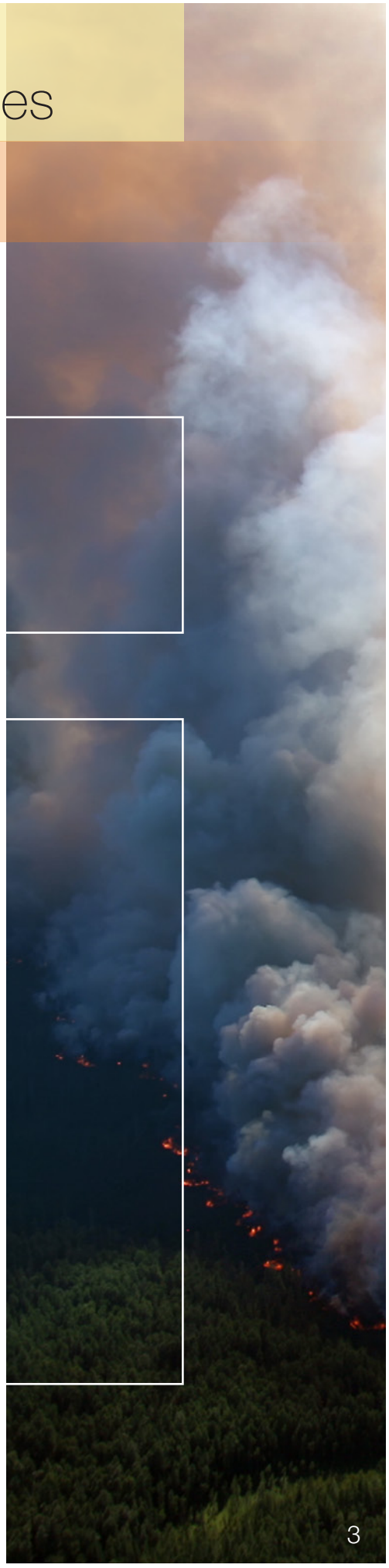
Typical operational requirements include maintaining hardware, software updates and security, and data feeds.

The list below highlights operational related CANSAC activities during 2015:

- Postprocessing scripts profiled and optimized for faster processing
  — Soundings broken into three subsets which are now run in parallel
  — Time-related file management simplified
  — DST switch tested and adjusted
- 18-km WRF-GFS set up to run after the WRF-NAM model
- Postprocessing set up for 18-km WRF-GFS
- WRF setup benchmarked with SGI and Dell to test possible new hardware configuration

The list below highlight new and updated operational products that were added during 2015:

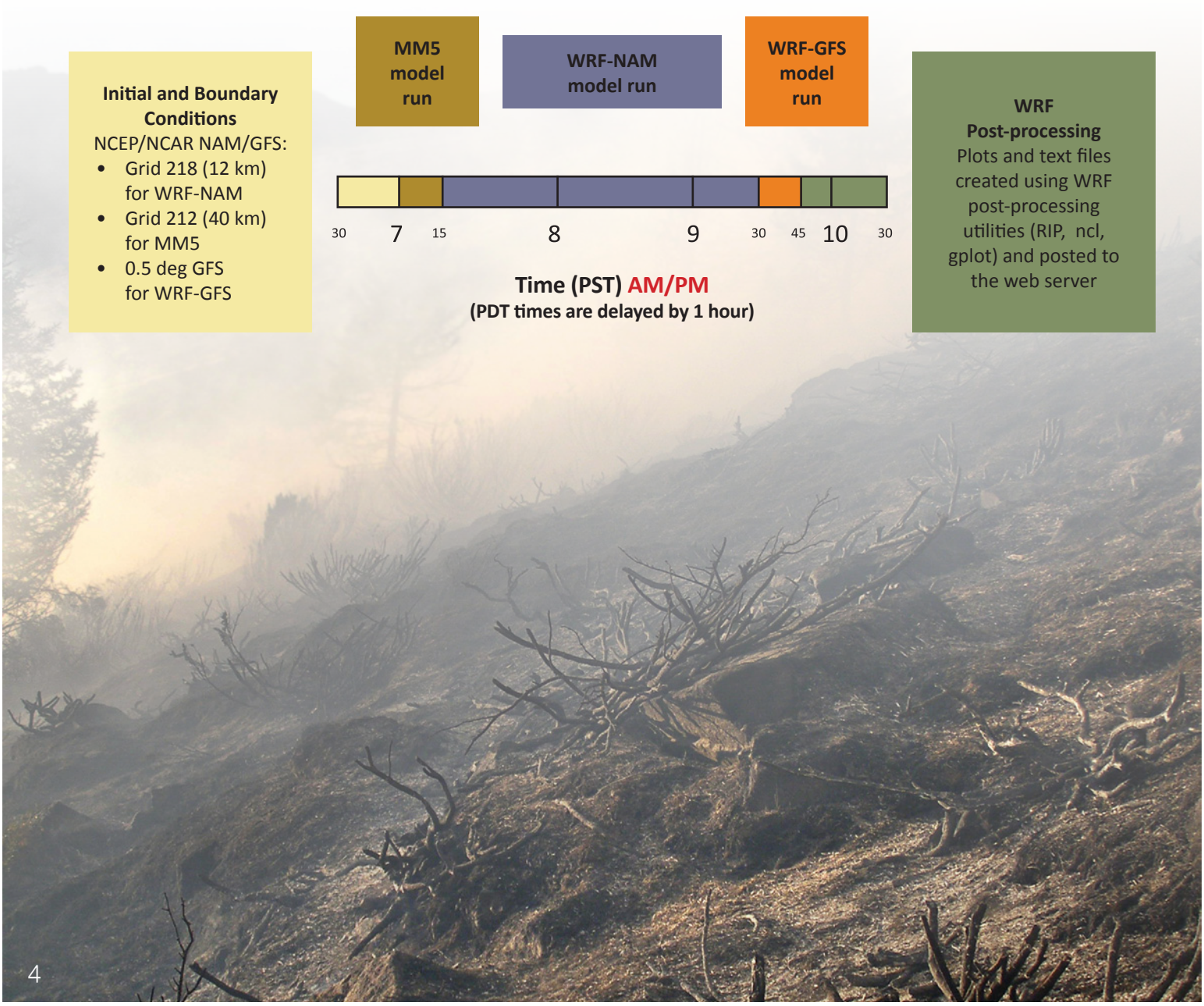
- New products (WRF-GFS):
  — 300MB Heights, Winds
  — 500MB Heights, Absolute Vorticity
  — 700MB Heights, Temps, Winds
  — 700MB Vertical Velocity, RH, and Winds
  — 850MB Heights, Temps, Winds
  — SLP, 20 ft Winds, 2 m Temps
  — Mixing Heights
- Web page set up for 18 km WRF-GFS
- On-the-fly soundings implemented
- New NCAL fire products:
  — MH-TKE
  — Sounding image
  — Sounding text
  — 10m winds
  — MH meteogram
- New 18-km WRF-NAM products:
  — Ventilation index
  — Transport winds
- New San Joaquin Valley products:
  — Meteogram and text products at Stockton, Modesto, Merced, Madera, Fresno, Hanford, Visalia, and Bakersfield
  — Vertical winds, temperature text and profiler at Tracy, Modesto, Pacheco Pass, Fresno, Cottonwood Pass, Visalia, Hanford, Ash Mountain (Kaweah Drainage), Bakersfield, and Tejon Pass
  — Cross-section up to 850MB at Modesto, Fresno, and Bakersfield



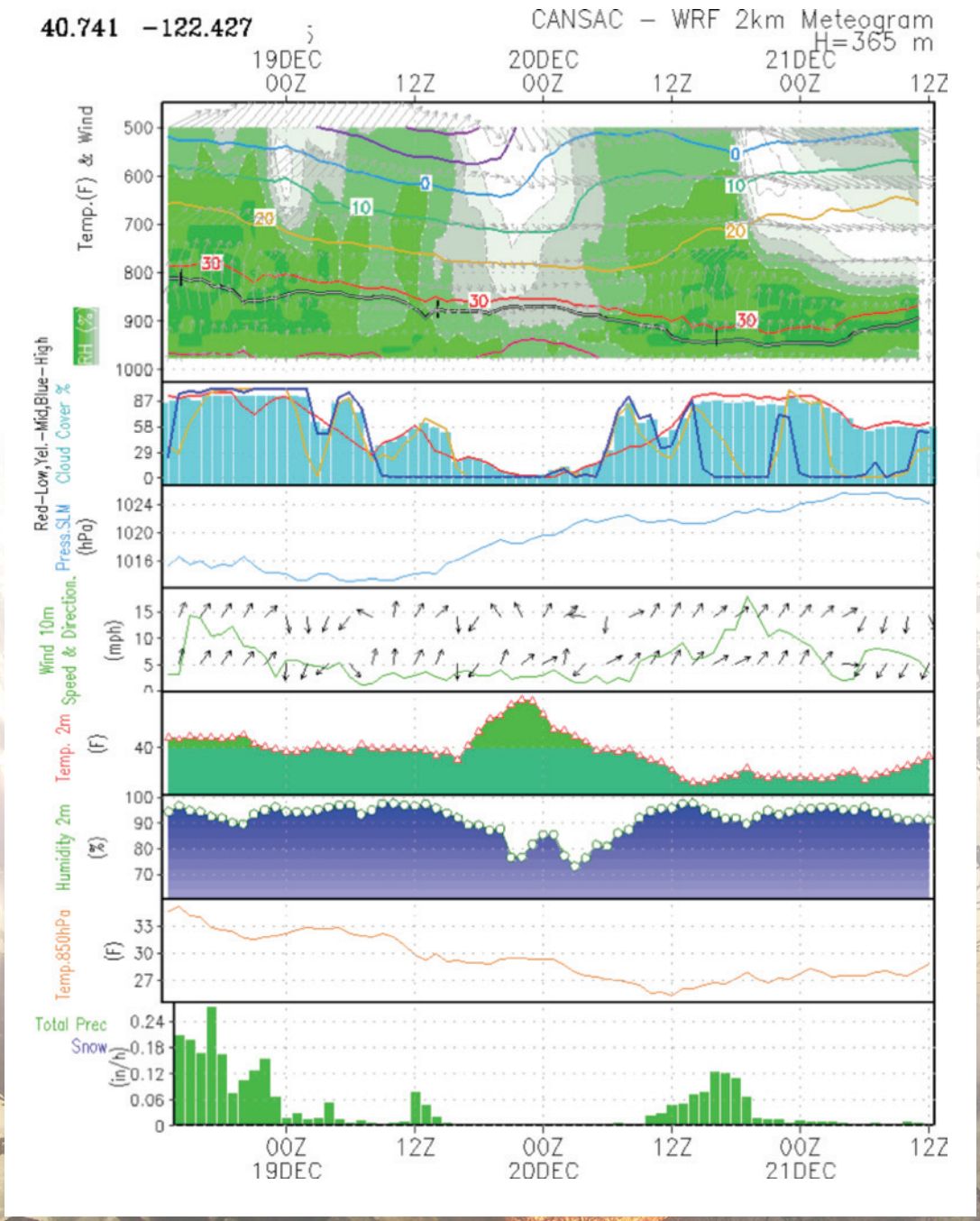
Operations

The primary CANSAC computing hardware is an SGI ICE 8200 with 64 Quad-Core 2.93 GHz Xeon processors, 384 GB RAM memory, and 20 TB disk space. The graphic below outlines CANSAC WRF real-time forecasting system timing.

Example New Products

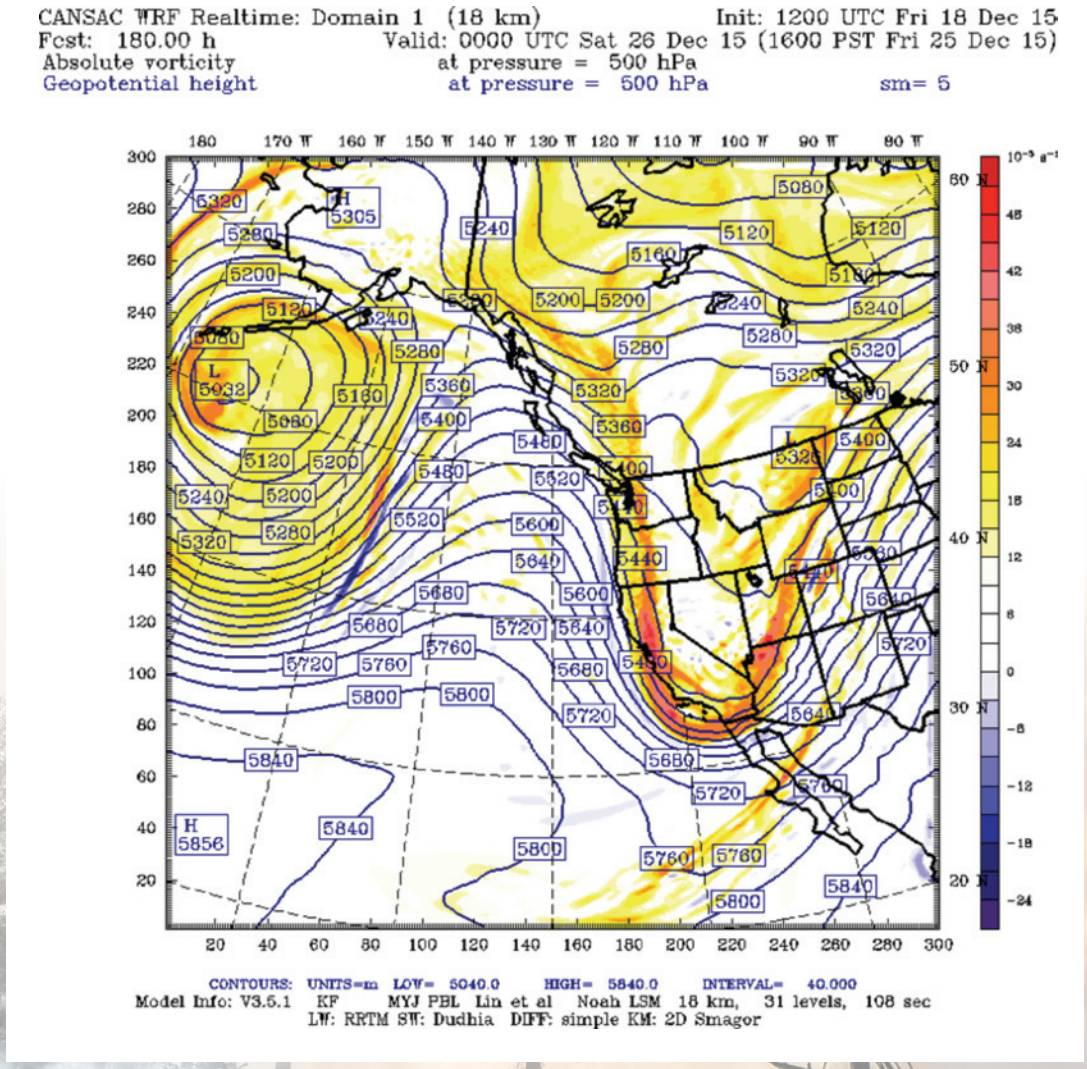


Example On-The-Fly Meteogram

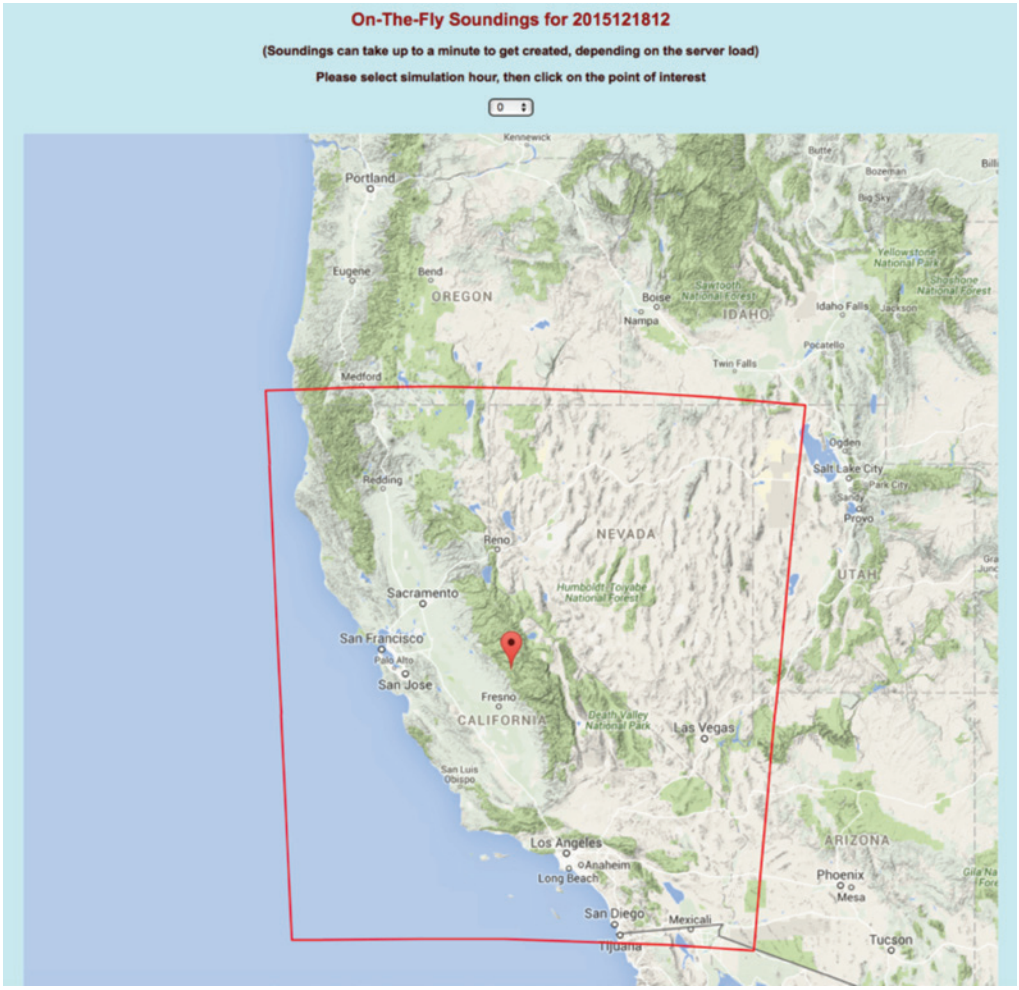


Example 500MB Map

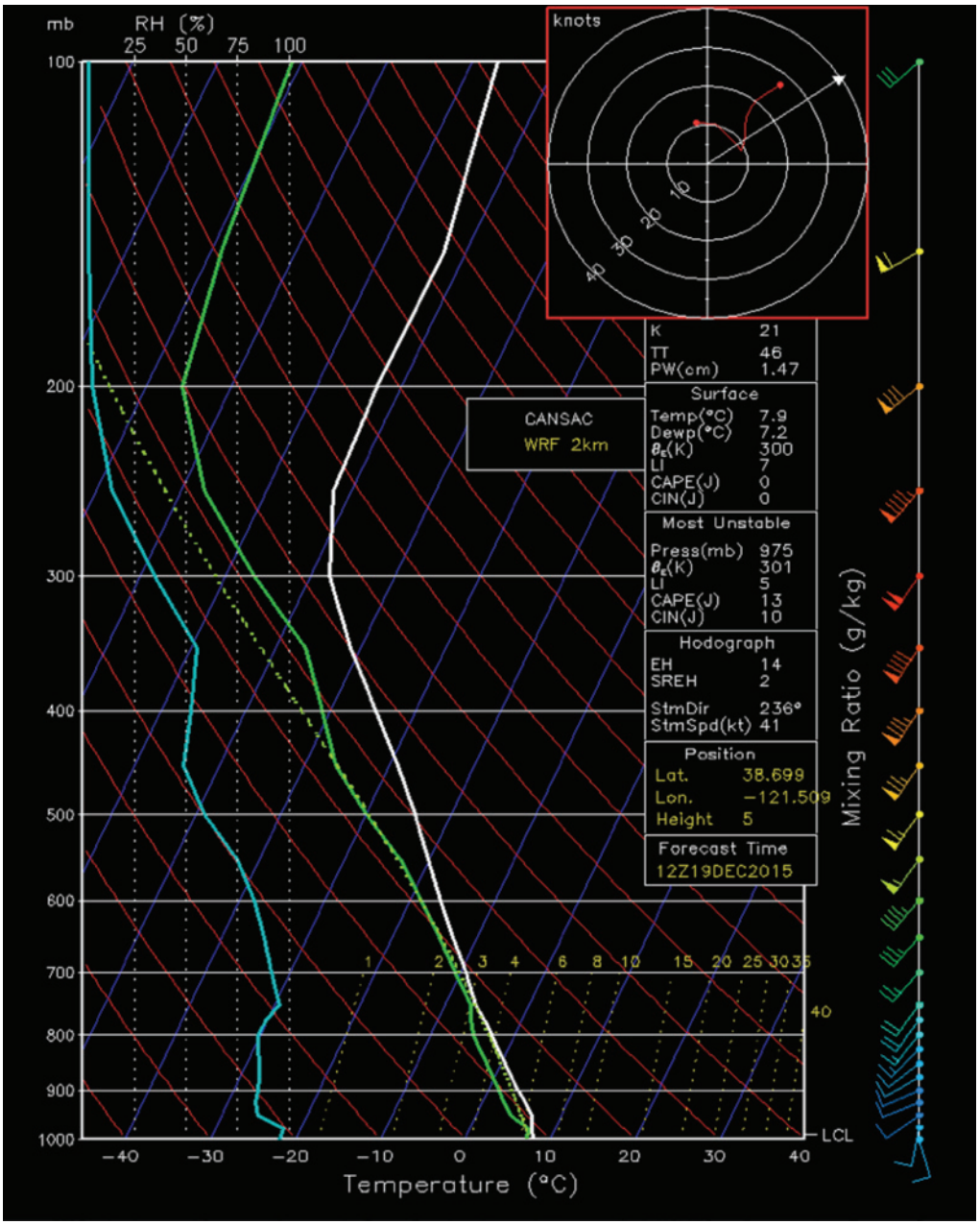
BASED ON GFS INITIALIZATION



Screen Shot of the New
ON-THE–FLY SOUNDING PROJECT



Example On-The-Fly Sounding



Report Period Expenditures

FOR 2015 REPORTING PERIOD

CANSAC requires agency support to maintain the system, update products, and develop new products.

Agency funds received:	$134,359
DRI cost-share:	
Expenditures for 2015 reporting period: *This included salary support, and the purchase of a post-processor computer.*	$285,113
Total CANSAC received funds 2002–2015: *This amount includes combined agency and cost-share contributions.*	$4,189,501
Estimated salary funding needs for 2016:	$345,000

For several years now, the estimated annual cost per agency has been $40K. Having eight or nine CANSAC members contributing at this level provides the desired level of support to not only maintain the system, but perform analyses to improve and advance the system.

Computing hardware:

In addition to salary needs, the maintenance contract expires on the current computing hardware in February 2016. To maintain one more year of hardware support, $20K is needed. After this one-year period, the hardware will be six years old, and a maintenance contract will be no longer available for purchase.

CANSAC is seeking new computing hardware to support future operations. The estimated cost is $300K.

Operating Plan for 2016

- ✔ **Purchase hardware maintenance ($20K)**
- ✔ **Purchase new computing hardware to be operational by the end of the year ($300K)**
- ✔ **Provide GRIB2 files to CA/NV NWS WFOs**
- ✔ **Develop a verification system**
- ✔ **Improve visualization graphics**
- ✔ **Update website**

CANSAC Related Research

From a project sponsored by the California Public Utilities Commission and in close partnership with CAL FIRE, a 10-year (2004–2013) hourly 2-km gridded dataset was generated to provide climate and weather data in inform wildfire hazard mapping for the state of California. The WRF model was used to generate the temporally and spatially complete dataset, including surface and 32 atmospheric levels for the same domains as operational CANSAC. The WRF model was run on the Department of Energy's Mira high performance computing system (5th fastest in the world) at Argonne National Lab, producing 120TB of output. Key fire weather elements emphasized for the project were surface temperature, relative humidity and wind speed, but all atmospheric outputs that WRF produces were run as part of the model. A project is anticipated in 2016 that will perform some assessment of the output including model bias correction.

How CANSAC Products Are Used

Both Predictive Services and the National Weather Service utilize CANSAC products to aid in decision-support forecast information. The list below describes some example uses of CANSAC products by Predictive Services. CANSAC products are regularly used by Predictive Services when providing fire weather and smoke forecast information. CANSAC products have been utilized for spot forecasts. Air quality agencies utilize CANSAC forecast information to help assess local and regional air quality conditions. CANSAC products are also emphasized during large incidents. During the 2015 northern California fires, special products were developed for the Area Command Incident Team.

1. USED BY PREDICTIVE SERVICES METS in Region 5 daily forecast and briefing Operations:

a) WRF images/loops used to help determine convective potential; e.g. assessing thunderstorm *probability of occurrence* (both in general and by PSAs for Days 1-3), *determining the degree of activity (LAL), time of onset, wetness or dryness* of cells, *cell movements* (both dir. and speed), *strength of cell outflow winds*, etc.

- From the **2-km res. domain, we commonly use** the: Surface 10M Wind Speed (NW Quadrant for NOPS); Surface Temp, Surface RH; Lifted Index; 3-hr Precipitation; 24-hr Precip; 925MB Temperature and Winds; 850MB Geo. Height, Temp, and Winds
- From the **6-km domain** products, we often use: 500MB Heights/Absolute Vorticity; Totals High (700–500MB); Mid Level Cloud Water Index; Lifted Index; 700MB Heights, Winds; 500MB Heights, Winds.
- From the **18-km domain**: 300MB Heights, Winds; 500MB Heights/Absolute Vorticity

b) For smoke dispersion forecasting, both for wildland and prescribed fire:

- From the **2-km domain**: Surface 10M Wind Speed; 3Kft Surface Temp Difference; 3000 foot Temperature and Winds; Surface Temp and Surface RH (for locating and assessing strength of low-level inversions); Lifted Index; 3-hour Precipitation; 24-hour Precip.
- From the **6-km domain**: Ventilation Index; Lifted Index; Haines Index (Mid and/or High Level); 700MB Heights, Winds
- From the **Mixing Heights/Transport Winds (2-km)**: Mixing Heights (NW Quadrant); Mean Transport Winds (NW Quadrant); and other maps needed for various locations; maps and/or loops within the CANSAC BlueSky Products section (2- and 6-km)

c) For prediction of gradient wind events coming with 'receptive' fuel dryness

- From the **2-km domain:** Surface 10M Wind Speed (NW Quadrant for NOPS); Surface RH; Surface Temperature; 925MB Temperature and Winds; 850MB Geopotential Height, Temperature, Winds
- From **6-km domain**: 700MB Heights, Temps, Winds; 850MB Heights, Temps, Winds; 850MB Heights, RH; 700MB Heights, Winds; 500MB Heights, Winds
- Various Day 4–7 charts in the WRF/GFS 18-km section

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