UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration/ERL
GEOPHYSICAL FLUID DYNAMICS LABORATORY
Princeton University
Forrestal Campus, US Route 1
Post Office Box 308
Princeton, New Jersey 08542

PHONE: 609-452-6510
FAX: 609-987-5063

May 18, 2001

Dr. Ellsworth Dutton
Climate Monitoring and Diagnostics Laboratory
Boulder, CO 80303.

Dear Ells:

It is very shocking and disappointing to hear that the BAO tower may no longer continue to function. This is also highly annoying because it took a long period to develop it as a highly accurate measuring facility, one that would be rigorous in maintaining not only high-quality measurements but also with a very high time sampling. These two features are particularly important for fixed site groundbased observations. It is only now that, with some years of data acquired at this site, one can contemplate the idea of long-term monitoring of radiation fluxes in an accurate manner, and examine what they are telling us about the climate system. It is these kinds of long-term, stable, carefully calibrated, accurate measurements that are so important for diagnosing climate variations - in this case, radiation flux variability which in turn drives surface variations. This is the kind of data that is so useful in evaluating models e.g., the kind of climate models we in GFDL are working at. There are a number of weather and climate issues that these data are useful for - indeed, this fact has already been demonstrated! The additional funds that you have listed as needed are simply not enough of a reason to kill this facility. It is not too much money considering the wealth of information that will be pouring out of examination of the long-term measurement record - simply because of the fact that continuity of a good dataset ensures a long-term record of excellent quality and of high utility.

I will list a couple of areas of climate where these data are directly relevant and in which we have expended a lot of research:

(1) Inference of the presence of aerosols through the direct flux observation. The temporal variation is one useful measure of aerosol optical depth variability. Further, this inference can be correlated with that at the top of the atmosphere information inferred from satellites.

(2) Verification of weather and climate model, direct and total solar and longwave fluxes at the surface, with the temporal record observed. There is simply no better opportunity to test the

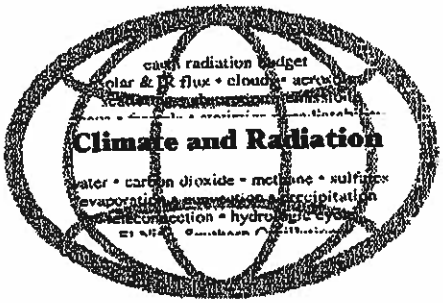
radiative fluxes reaching the land surface in that area. How else are we going to be able to comment on the fidelity of a weather and climate GCM's representation of surface heat balance?

I hope some way/ means can be found to maintain the facility and extend the length of the record obtained at that site. This is such a critical and basic element from the climate monitoring point of view. I will send a couple of appropriate figures showing the use of BSRN data in our research here.

Best regards,

V. Ramaswamy
Senior Scientist, NOAA/
Geophysical Fluid Dynamics Lab.
and
Lecturer with rank of Professor,
Atmospheric and Oceanic Sciences
Program, Princeton University

Dr. Warren J. Wiscombe
NASA Goddard Space Flight Center
Laboratory for Atmospheres
Climate & Radiation Branch
(*NASA, Code 913* is sufficient)
Greenbelt, MD 20771
wiscombe@gsfc.nasa.gov
(301) 614-6190 *but I prefer e-mail*



May 22, 2001

Dr. Ellsworth Dutton
NOAA/CMDL
Boulder, Colorado

Dear Dr. Dutton,

The region between small surface towers (typically 10 meters high) and typical research aircraft altitudes (typically 1 km and more) is a virtual no-man's land for radiation flux measurements, both in the solar and thermal IR regimes. Yet radiative fluxes in this altitude range are crucial for boundary layer processes which directly affect humans, including pollution dispersal, ground fog formation, cloud formation, and heating/cooling energy needs, to name only a few. It is shocking that we know so little about radiative fluxes in the boundary layer. The reason is the lack of suitable platforms from which to make the measurements.

For many years, I have pitched ideas that would have the effect of putting towers out of business for such measurements. I have worked closely on tethered balloon ideas, and have strongly advocated kites and aerosondes (tiny unmanned aircraft). I have seen blimps used in field programs, and fail to work effectively. The problem, much as I hate to admit it, is that none of these platforms are yet even close to being able to replace towers for studying radiation fluxes in the boundary layer. It has proved devilishly difficult to *level* radiometers on these flimsy platforms, and also to develop lightweight radiometers for them that still measure accurately. And they can't provide long time series for studying weekly to annual effects. (With aerosondes, we are lucky to get a few hours worth of data, and with advanced kites, balloons, or blimps we might get a day's worth, no more.)

Thus, as long as the surrounding area is kept relatively free of suburban development, I feel strongly that the BAO radiation measurements are a unique

resource that ought not just to be preserved, but upgraded as needed.

The BAO tower is also unique for its field-of-view: from the top, about 1 km^2. This interpolates nicely between the surface view (a few m^2) and the satellite view which supposedly has resolution of 1 km^2 or better, but for *radiance* not flux. No one can get flux measurements for areas between a few m^2 and 100 km^2 because of the notorious angular modeling difficulties.

There are of course other towers which could be instrumented, like the Mt. Sutro tower in San Francisco, but the reason we do not do this is the lack of representativeness of the underlying terrain (almost always a suburban or urban setting). Looking at fluxes from man-made development is just not very useful for understanding the boundary layer. The BAO Tower is almost the only tower with a rural setting.

Sincerely Yours,

Warren Wiscombe

Warren Wiscombe
Senior Scientist

Atmospheric Sciences Research Center

251 Fuller Road
Albany, New York 12203

518/437-8700
Fax: 518/437-8758

UNIVERSITY AT ALBANY
STATE UNIVERSITY OF NEW YORK

18 May 2001

Ellsworth Dutton
NOAA,Climate Monitoring and Diagnostics Laboratory
325 Broadway
Boulder, Colorado 80305

Ells,

I'm back in New York and didn't get the email right away since you sent it to the PNNL address that I don't always check (use joe@asrc.cestm.albany.edu).

Anyway, I support keeping the BAO tower operational since it is unique in its ability to make a reasonable measurement of albedo over land. There are not likely to be places where this measurement capability will be duplicated in the future. If it closes, we will lose a one-of-a-kind facility for radiation work, but also other measurements that I'm sure are critical to boundary layer meteorology, for example.

Good luck with you effort.

Joe Michalsky

Joe Michalsky

Subject: BAO Tower and CERES
Date: Mon, 21 May 2001 10:04:21 -0400
From: "Bruce A. Wielicki" <b.a.wielicki@larc.nasa.gov>
To: "Ellsworth G Dutton" <Ellsworth.G.Dutton@noaa.gov>
CC: t.p.charlock@larc.nasa.gov, W.L.SMITH@larc.nasa.gov, d.p.kratz@larc.nasa.gov

Date: 5/21/01

To: Dr. Ellsworth Dutton, NOAA, Head Baseline Surface Radiation Network

From: Dr. Bruce A. Wielicki,
NASA Langley Research Center, Senior Scientist for Radiation Sciences
Clouds and the Earth Radiant Energy System (CERES), a NASA Earth Observing System Satellite Mission on 3 spacecraft.
Lead for CERES Science, Algorithm, and Validation Activities.

Ells:

This note is to support the utility and uniqueness of the BAO Tower measurements to constrain the understanding of how accurately we can remotely sense surface radiative fluxes from space. There are very few towers taking downlooking radiative energy measurements in the world, and most of those are on towers 30 to 50m high. This limited height means that the towers see a very small portion of land (50 to 100m), so small that it is difficult to match to satellite observations with any certainty or accuracy. The BAO tower is unique in the altitude of the down-looking measurement, and we expect the radiation sciences community to use it as the best test of net radiative energy flux (up and down) at any of the current sites around the world.

In addition to this satellite validation utility, it remains exceedingly difficult to maintain climate records of any type. They are not sexy, and the ultimate critical utility of their data only appears after decades of continuous careful measurements. The BAO tower represents a unique example of this type of measurement for up, down, and net radiative fluxes over a land surface. As a science community we are struggling to keep such long-term measurements alive, but I feel that these same measurements are the ones that scientists will turn to decades from now as they verify the accuracy of the latest climate model predictions. A month of observations to a climate model is like a day of observations to a weather model. The seasonal cycle is like a single storm system passing through. Long-term measurements will be critical in assessing the accuracy of these climate models, and the BAO tower record when considered in the context of less accurate but global view satellite data, will be one example of how to boot-strap key comparisons to constrain both global observations by satellite and global climate model predictions.

I strongly support any efforts to save the BAO tower measurements and to continue them as one small but key and unique component of a global climate measurement system. As yet we have no U.S. national "climate mission" or true climate observing system. Instead we have the efforts to many to keep alive many individual components of climate data, data whose value will only be fully appreciated by our children decades from now. My own analogy is that this is a bit like the monks of the dark ages, working to copy and save the ancient manuscripts which contained the knowledge of past civilizations, knowledge that would be needed once again in later generations.

I hope you are successful in continuing the BAO tower record.

(CYTED)

BROOKHAVEN
NATIONAL LABORATORY

Managed by Brookhaven Science Associates
for the U.S. Department of Energy
www.bnl.gov

Atmospheric Sciences Division
Environmental Sciences Department
Building 815E
Brookhaven National Laboratory
Upton, NY 11973-5000
Phone 631 344-3100
Fax 631 344-2887
ses@bnl.gov
www.ecd.bnl.gov/steve/schwartz.html

April 23, 2001

STATEMENT REGARDING BOULDER ATMOSPHERIC OBSERVATORY

I am pleased to provide input to a decision regarding the continued operation of the NOAA Boulder Atmospheric Observatory (BAO) and associated 300-m tower.

This facility is nationally and internationally renowned for providing a unique platform for measurement of atmospheric and radiometric data pertinent to weather, radiation, and climate. The loss of this facility and the continuity that it provides, even if it were to be replaced elsewhere (at great cost, I would add), would be a severe setback to the community concerned with research into atmospheric radiation and climate change. I would explicitly note that while satellite data can provide widespread coverage, these data require supplementation by in-situ measurements. The Boulder facility is ideally suited to provide such supplementation, and its loss would have repercussions beyond the local measurements insofar as it is used to provide ground-truth for satellite measurements.

Let me add a personal observation. It has recently been necessary for me to undergo a series of medical diagnostic procedures, including bone-scan and MRI. I inquired of the technicians regarding the cost and utilization of the equipment. The bone scan device cost some $600,000, eight years ago when it was purchased. It is one of their "older" instruments. It is in continuous use all day and most evenings. There are similar instruments (but different it detail) up and down the corridor (in a teaching hospital on Long Island). The MRI instrument cost upwards of $1M. It has continuously been upgraded since it was installed. As a beneficiary of society's investment in these instruments I am most appreciative. But I have to remind myself that these costly instruments are for the benefit of the health of individuals. I contrast the situation with that in scientific research that is examining the health of the planet, which is operating on a comparative shoe-string, and which is continuously struggling to maintain even that modest level of funding in place. Are we to lose the patient, in this case the planet, because of the short-sightedness of the cognizant officials to maintain the investment in research and facilities, such as the Boulder Atmospheric Observatory?

I hope that some means can be found to maintain this facility and to continue its high-quality and uniquely valuable operation.

Stephen E. Schwartz
Senior Scientist

Colorado State University
Knowledge to Go Places

Department of Atmospheric Science
Colorado State University
Fort Collins, Colorado 80523-1371

tel: (970) 491-8474
fax: (970) 491-8428
internet: randall@redfish.atmos.colostate.edu

May 25, 2001

Dr. Ellsworth Dutton
NOAA/CMDL
Mail Code R/CMDL1
325 Broadway
Boulder, CO 80303

Dear Dr. Dutton,

Concerning the scientific value of the NOAA Boulder Atmospheric Observatory (BAO) tower and the on-going radiation budget measurements being made there by NOAA/CMDL.

I support the continuation of the scientific measurements currently being made on the BAO tower and immediate surrounding area. In particular, the radiation budget measurements being made there take advantage of the unique opportunity presented by this facility by suspending instrumentation 300 meters above the ground and continually observing a substantially larger portion of the Earth's surface than is possible at other sites. These data are useful, and have been used, for several important applications where in the unique representativeness of the measurements is particularly valuable for comparison with satellite or climate model estimates similar quantities, which by nature are for extended, but even larger surface areas. The BAO measurements have received national and international attention and havehad a bearing on some of the more important questions being debated in the field today. In addition, the long-term records acquired at BAO uniquely define the evolution of surface radiation budget in the local area, and will serve as a baseline for climate research effort that need to extend the same type of information to much larger areas and to the globe has a whole. The eventual encroachment of urban development to within about one kilometer of the base of the tower will begin to interfere with measurements as originally intended, but the measurements will even then serve the purpose identifying the radiative effects of such areas.

Sincerely,

David A.Randall
Professor

NREL
National Renew ble Energy Laboratory

Fax

Date: 0 May, 2001

To: r. Ellsworth Dutton

Organization: OAA/CMDL, Boulder, CO

Fax: 03-497-5590

From: r. David Renné

Organization: IREL

Fax: 303) 275-4675

Total Pages:

For Questions Call: 303) 275-4648

Remarks:

Dear Ells,

trongly support the continuation of the measurements at the BAO tower site. here is a real dearth of quality, long-term solar radiation measurements around the orld. It is true that solar insolation is a difficult parameter to obtain as a "measure" climate change, but nevertheless the question keeps coming up as to what appens to the solar resource available to renewable energy development under uman-induced climate change, and what is the long-term interannual variability of is resource (an important question to investors as well as designers). Therefore, I elieve it is essential that we continue with the investments that have already been ade to obtain long-term good quality data, for purposes of monitoring climate trends nd interannual variability. For these types of studies,15 years simply is not long nough! And the fact that the BAO measurements are collocated with other nearby ng-term measurements (e.g. NREL's Solar Radiation Research Laboratory, and the easurements being obtained at the Broadway facility in Boulder) adds considerably the scientific value of continuing with the long-term measurement program at the AO tower.

Best regards,

David S. Renné

ETH Eidgenössische Technische Hochschule Zürich

Ecole polytechnique fédérale de Zurich
Politecnico federale di Zurigo
Swiss Federal Institute of Technology Zurich

Institute for Climate Research

Global Climate Modeling Group

Dr. Martin Wild
Teamleader Global Climate Modelling Group
Swiss Federal Institute of Technology
Institute for Climate Researc
Global Climate Modeling Group
Winterthurerstrasse 190
CH-8057 Zürich
Switzerland

Phone: +41 1 635 52 36
Secretary: +41 1 635 52 11
Telefax: +41 1 362 51 97
E-Mail wild@geo.umnw.ethz.ch

Zurich, June 5, 2001

To Whom It May Concern:

From my research work related to climate modeling, I can strongly affirm the importance of direct radiation observations for the validation of climate models. Such measurements are highly useful to constrain model errors, thereby contributing to improved and more reliable climate models and forecasts.

The Boulder tower provides a unique possibility to extend radiation observations well above the surface, thus allowing radiation flux divergence measurements within the atmospheric boundary layer. Such measurements are unique and allow detailed investigations of radiative transfer in the lower atmosphere. For example, the contribution of mineral dust to radiative flux divergence is still not well quantified, and the Boulder tower measurements can particularly well clarify this issue.

In light of the significant scientific benefits to be expected from continuos measurements over the coming years, I strongly recommend to maintain the Boulder tower operational.

Wild

Dr. Martin Wild

Subject: Re: BAO tower
Date: Thu, 14 Jun 2001 12:59:05 -0600
From: "Patrick Reddy" <pjreddy@smtpgate.dphe.state.co.us>
To: <Daniel.Wolfe@noaa.gov>, "CHUCK Machovec" <cmmachov@smtpgate.dphe.state.co.us>
CC: <Jo.Hetherington@noaa.gov>, <Kent.L.Groninger@noaa.gov>, <Marty.Ralph@noaa.gov>, <Richard.Lataitis@noaa.gov>, <William.Neff@noaa.gov>, "Barbara Macrae" <btmacrae@smtpgate.dphe.state.co.us>, "Kevin Briggs" <krbriggs@smtpgate.dphe.state.co.us>, "Susan Newton" <sknewton@smtpgate.dphe.state.co.us>

Dan, I wanted to add to what Chuck has said about the importance of the BAO tower in air quality work at the State. NOAA was quick to provide BAO tower data to AlphaTrac, Inc., during the several-week long sarin nerve gas crisis at the Rocky Mountain Arsenal last winter. AlphaTrac's CAPARS modeling system, which was originally designed to track potential releases of plutonium at Rocky Flats, was used extensively during this crisis. It helped us forecast windows of opportunity for safe handling of the sarin munitions, and it provided an emergency response tool in the event of an atmospheric release of nerve gas.

The CAPARS system is a three-dimensional model with sophisticated puff dispersion using planetary boundary layer parameters and a diagnostic wind field model. The wind field and dispersion parameterization are driven by real-time monitoring data as well as model data from other sources, such as FSL's MAPs system. Once data from the BAO tower had been incorporated into CAPARS, its depiction of plume/puff behavior in and near the Arsenal improved significantly and was consistent with air quality and surface meteorological measurements in the area.

Many of us at the Air Pollution Control Division are attempting to move the State of Colorado to acquire the services of AlphaTrac or another company to provide state-wide emergency response modeling. The BAO tower data would be indispensable in such a system. Because of its height and proximity to population centers along the Front Range Urban Corridor, we would want to use this data set to improve the models' characterization of dispersion.

The issue of state-wide modeling came up recently during planning sessions for a possible outbreak of foot and mouth disease (FMD) in Colorado. Staff at the Governor's Office of Emergency Management expressed interest in using such tools for FMD and any other emergency that would involve atmospheric releases of harmful substances. The tower has already provided valuable data for modeling potential releases of plutonium and the deadly nerve gas sarin. With the increasing threat of bioterrorism and all the other risks associated with a growing population in an urban setting, I feel that the state and federal agencies should be in a position to use the modeling and monitoring technology that is now available to us.

The State of Colorado uses NCAR's MM5 and NOAA FSL's MAPS and MM5

models to assist with forecasting air pollution episodes during the summer and winter months. I would imagine that BAO tower data is used to initialize these models and improve their accuracy.

The EPA requires that the State use regulatory dispersion models to address air quality issues along the Front Range Urban Corridor. As Chuck mentioned, the new generation of models use planetary boundary layer parameters and require more detailed information about the vertical distribution of temperature and wind in the lower reaches of the atmosphere. The BAO tower can provide this kind of information.

Even if many of the tower's functions could be replaced by profilers, it plays a vital role in "ground-truthing" other data sets and is probably less vulnerable to interference and data losses. It has also played a key role in the Denver Brown Cloud studies and the Northern Front Range Air Quality Study. Future air quality studies for our growing Front Range Urban Corridor may require the high quality monitoring data that this platform provides. It might be useful, for example, to acquire ozone profiles at the tower. Most of our surface monitors are affected by nitrogen oxide titration of ozone within the nighttime and morning inversion. We are learning that storage of ozone in the troposphere above the nighttime boundary layer has an effect on ozone buildup during multi-day episodes.

The loss of the BAO tower would be significant. It plays an important role in State air quality research, modeling, forecasting, preparing for potential emergencies, and responding to actual emergencies.

Pat Reddy
Senior Air Quality Meteorologist
Air Pollution Control Division
Colorado Department of Public Health and Environment
303-692-3239
patrick.reddy@state.co.us

Subject: **Support for the BAO tower**
Date: Wed, 09 May 2001 08:28:08 -0600
From: David Carlson <dcarlson@atd.ucar.edu>
Organization: NCAR / ATD
To: Kent.L.Groninger@noaa.gov
CC: anthes@ucar.edu, David Parsons <parsons@atd.ucar.edu>, cohn@atd.ucar.edu

Kent:

I provide below some information about NCAR/ATD's use and interest in the BAO tower. I hope this information comes in time to still prove useful.

ATD has used the BAO tower several times over the past three or four years during our wind profiler research and development. The tower provides a unique opportunity to compare remotely sensed data with in situ data, even if just at a single height. If the tower remains available, ATD would continue to use it periodically.

Given the local demand for telecommunications towers, it would seem that some sort of combined commercial lease with continued research access would work. Facing increased lease costs, driven by commercial developments, at our Jefferson County Airport site, we understand the difficulty of matching fixed or declining science funding to rising land values. If some combination of funding could result in a 'secure' (five year?) access plan for the BAO tower, I think ATD might commit some funds as a small partner.

We can not come up with any examples of when ATD has used the tower for a direct educational purpose. We could talk about some ideas for instrumenting the tower that might make educational uses more likely.

Hope this helps.

Dave Carlson
ATD Director

David J. Carlson
ATD Division Director

- **Internet Mail:** dcarlson@ucar.edu
- **Phone:** 303.497.8830
- **Fax:** 303.497.8770
- **Physical Mail:** NCAR; P.O. Box 3000; Boulder, CO 80307-3000

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Oceanic and Atmospheric Research Laboratories
Environmental Technology Laboratory
325 Broadway - David Skaggs Research Center
Boulder, Colorado 80303

3 April 2001

Dr. Richard Lataitis
Deputy Director
Environmental Technology Laboratory
325 Broadway
Boulder, CO 80305-3328

Dear Rich,

The Boulder Atmospheric Observatory (BAO) has been a site for an infrasonic observing system from its' inception as a resource for testing and verifying new remote sensing technologies. The recent evolution of this low frequency sound observing system has led to a new concept for detecting tornadoes using the sub-audible sounds generated. This exciting potential for providing improved tornado warnings is currently being evaluated using the BAO. The BAO was critical to this successful research and the meteorological tower is a key resource for developing further improvements in wind noise reduction. An example of one of the major field programs performed at the BAO was a microburst wind shear experiment that was instrumental in reducing commercial aircraft accidents from this cause.

The site has had worldwide exposure and research highlighted has frequently appeared on local, national, and international television (e.g. ABC, CBS, NBC, Disney Channel, Discovery Channel, Learning Channel, Weather Channel, and numerous affiliates, as well as the BBC and other international stations). NBC is planning a visit in the near future. Numerous scientists in the atmospheric and remote sensing sciences have used the facility and its' data because of the unique resources that can be assembled their at reasonable cost and in a timely manner.

The BAO can also offer K-12 educational opportunities for the local community, which to date have not been fully explored. However, numerous high school and college interns have worked at the site.

I hope that the unique capabilities of the BAO can be preserved and its' impact on the community enhanced. I envision that the site will soon be providing data to forecasters that will be invaluable for issuing regional tornado warnings.

I certainly will be willing to work with you to make the past impact and potential future value of the site to the State of Colorado and the nation more evident.

Please let me know if I can provide anything more.

Sincerely,

Dr. Alfred J. Bedard Jr.
Supervisory Physicist
Infrasonics Group Leader
NOAA, Environmental Technology Lab
Ocean Remote Sensing Division

Subject: Re: BAO tower
Date: Thu, 14 Jun 2001 12:59:05 -0600
From: "Patrick Reddy" <pjreddy@smtpgate.dphe.state.co.us>
To: <Daniel.Wolfe@noaa.gov>, "CHUCK Machovec" <cmmachov@smtpgate.dphe.state.co.us>
CC: <Jo.Hetherington@noaa.gov>, <Kent.L.Groninger@noaa.gov>, <Marty.Ralph@noaa.gov>, <Richard.Lataitis@noaa.gov>, <William.Neff@noaa.gov>, "Barbara Macrae" <btmacrae@smtpgate.dphe.state.co.us>, "Kevin Briggs" <krbriggs@smtpgate.dphe.state.co.us>, "Susan Newton" <sknewton@smtpgate.dphe.state.co.us>

Dan, I wanted to add to what Chuck has said about the importance of the BAO tower in air quality work at the State. NOAA was quick to provide BAO tower data to AlphaTrac, Inc., during the several-week long sarin nerve gas crisis at the Rocky Mountain Arsenal last winter. AlphaTrac's CAPARS modeling system, which was originally designed to track potential releases of plutonium at Rocky Flats, was used extensively during this crisis. It helped us forecast windows of opportunity for safe handling of the sarin munitions, and it provided an emergency response tool in the event of an atmospheric release of nerve gas.

The CAPARS system is a three-dimensional model with sophisticated puff dispersion using planetary boundary layer parameters and a diagnostic wind field model. The wind field and dispersion parameterization are driven by real-time monitoring data as well as model data from other sources, such as FSL's MAPs system. Once data from the BAO tower had been incorporated into CAPARS, its depiction of plume/puff behavior in and near the Arsenal improved significantly and was consistent with air quality and surface meteorological measurements in the area.

Many of us at the Air Pollution Control Division are attempting to move the State of Colorado to acquire the services of AlphaTrac or another company to provide state-wide emergency response modeling. The BAO tower data would be indispensable in such a system. Because of its height and proximity to population centers along the Front Range Urban Corridor, we would want to use this data set to improve the models' characterization of dispersion.

The issue of state-wide modeling came up recently during planning sessions for a possible outbreak of foot and mouth disease (FMD) in Colorado. Staff at the Governor's Office of Emergency Management expressed interest in using such tools for FMD and any other emergency that would involve atmospheric releases of harmful substances. The tower has already provided valuable data for modeling potential releases of plutonium and the deadly nerve gas sarin. With the increasing threat of bioterrorism and all the other risks associated with a growing population in an urban setting, I feel that the state and federal agencies should be in a position to use the modeling and monitoring technology that is now available to us.

The State of Colorado uses NCAR's MM5 and NOAA FSL's MAPS and MM5 models to assist with forecasting air pollution episodes during the summer and winter months. I would imagine that BAO tower data is used to initialize these models and improve their accuracy.

The EPA requires that the State use regulatory dispersion models to address air quality issues along the Front Range Urban Corridor. As Chuck mentioned, the new generation of models use planetary boundary layer parameters and require more detailed information about the vertical distribution of temperature and wind in the lower reaches of the atmosphere. The BAO tower can provide this kind of information.

Even if many of the tower's functions could be replaced by profilers,

it plays a vital role in "ground-truthing" other data sets and is probably less vulnerable to interference and data losses. It has also played a key role in the Denver Brown Cloud studies and the Northern Front Range Air Quality Study. Future air quality studies for our growing Front Range Urban Corridor may require the high quality monitoring data that this platform provides. It might be useful, for example, to acquire ozone profiles at the tower. Most of our surface monitors are affected by nitrogen oxide titration of ozone within the nighttime and morning inversion. We are learning that storage of ozone in the troposphere above the nighttime boundary layer has an effect on ozone buildup during multi-day episodes.

The loss of the BAO tower would be significant. It plays an important role in State air quality research, modeling, forecasting, preparing for potential emergencies, and responding to actual emergencies.

Pat Reddy
Senior Air Quality Meteorologist
Air Pollution Control Division
Colorado Department of Public Health and Environment
303-692-3239
patrick.reddy@state.co.us

Subject: BAO tower data uses
Date: Tue, 17 Jul 2001 11:32:01 -0600
From: John Ciolek <jciolek@alphatrac.com>
To: Daniel.Wolfe@noaa.gov
CC: Malone Emmett <emalone@alphatrac.com>

Daniel,

Emmett Malone wanted me to help describe our uses for the BAO tower data. I do not have any references for work using the tower data. However, you may want to contact J. Chris Doran. (I do not have his e-mail address but he is with the Pacific Northwest Laboratory.) He was director of the DOE sponsored Atmospheric Studies in Complex Terrain (ASCOT) organization and may have information on projects along the Front Range that used BAO tower data. Also, you may check in to past Front Range Air Quality studies.

The BAO tower is an important observing platform for defining the state of the atmosphere in the northern greater Denver, CO area. Temperature sensors at different heights on the tower help determine the stability of the lower atmosphere, which is crucial for estimating dispersion coefficients. The collection and dissemination of data in real-time is critical for emergency response atmospheric dispersion modeling systems such as the Computer Assisted Protective Action Recommendation System (CAPARS) used by the U. S. Department of Energy Rocky Flats Environmental Technology Site. The real-time data is also essential to initialize localized prognostic modeling systems such as the Local Analysis and Predictive System (LAPS) run by the Forecast Systems Laboratory. The BAO tower is unique since few meteorological towers in the region extend more than 30 meters.

The Colorado Department of Public Health and Environment (CDPHE) requested that AlphaTRAC Inc. use real-time BAO tower data for atmospheric dispersion modeling support during the 2001 sarin bomblet incidents at the Rocky Mountain Arsenal. AlphaTRAC, Inc. worked to obtain the data and
incorporate it into CAPARS and plans to continue using the data for real-time emergency response atmospheric modeling, odor control and source identification, and airborne disease modeling along the Colorado Front Range. AlphaTRAC, Inc. also plans to use the BAO tower data to help forecast high wind events for the Rocky Flats Environmental Technology Site to protect workers and facilities.

John Ciolek Jr.
Atmospheric Scientist
AlphaTRAC, Inc.
8670 Wolff Ct, Suite 120
Westminster, CO 80031
(303) 428-5670

5-20-2

STATE OF COLORADO

EXECUTIVE CHAMBERS
136 State Capitol
Denver, Colorado 80203-1792
Phone (303) 866-2471

Roy Romer
Governor

May 18, 1988

Dr. Vernon Derr
National Oceanic & Atmospheric Administration
Wave Propagation Laboratory, R/E
325 Broadway
Boulder, Colorado 80303

Dear Dr. Derr:

Colorado has worked with your staff to study the micrometeorology of Colorado's Front Range as it relates to the build-up and transportation of air pollution. Our Air Pollution Control Division contracted with Dr. William Neff for the past two winters to study the meteorology that leads to high pollution events. During this past winter, a substantial meteorological monitoring effort was conducted by Dr. Neff in association with Metro Denver Brown Cloud Study. The Air Division believes we have learned more about the critical meteorology involved in high pollution events in the past two years with our association with NOAA than we had gained over the previous 20 years.

The service supplied by NOAA has gone beyond the direct funds we have been able to provide. These projects would not have been possible without NOAA's directing discretionary research funds toward these projects.

As air pollution control strategies now are focusing on episodic predictions of high pollution events, the requirements for a more thorough understanding of the stagnation meteorology of the Front Range are even more pressing. Although we will continue to work toward funding these research efforts, I do not believe we will ever be able to match the full value of your services without continued support from NOAA.

I urge you to continue directing funds towards future meteorological research in Colorado's Front Range. We believe many key scientific questions still need to be addressed over the next two years before we develop the comprehensive picture needed to understand the impact of meteorology. This research offers direct benefits to Colorado citizens' health and welfare.

Thank you for considering Colorado's request for continued support. If you wish to discuss the issue further with my Air Pollution Division staff, please contact Bradley Beckham at 331-8500.

Sincerely,

Roy Romer

Roy Romer
Governor

cc: W. Gale Biggs, Ph.D