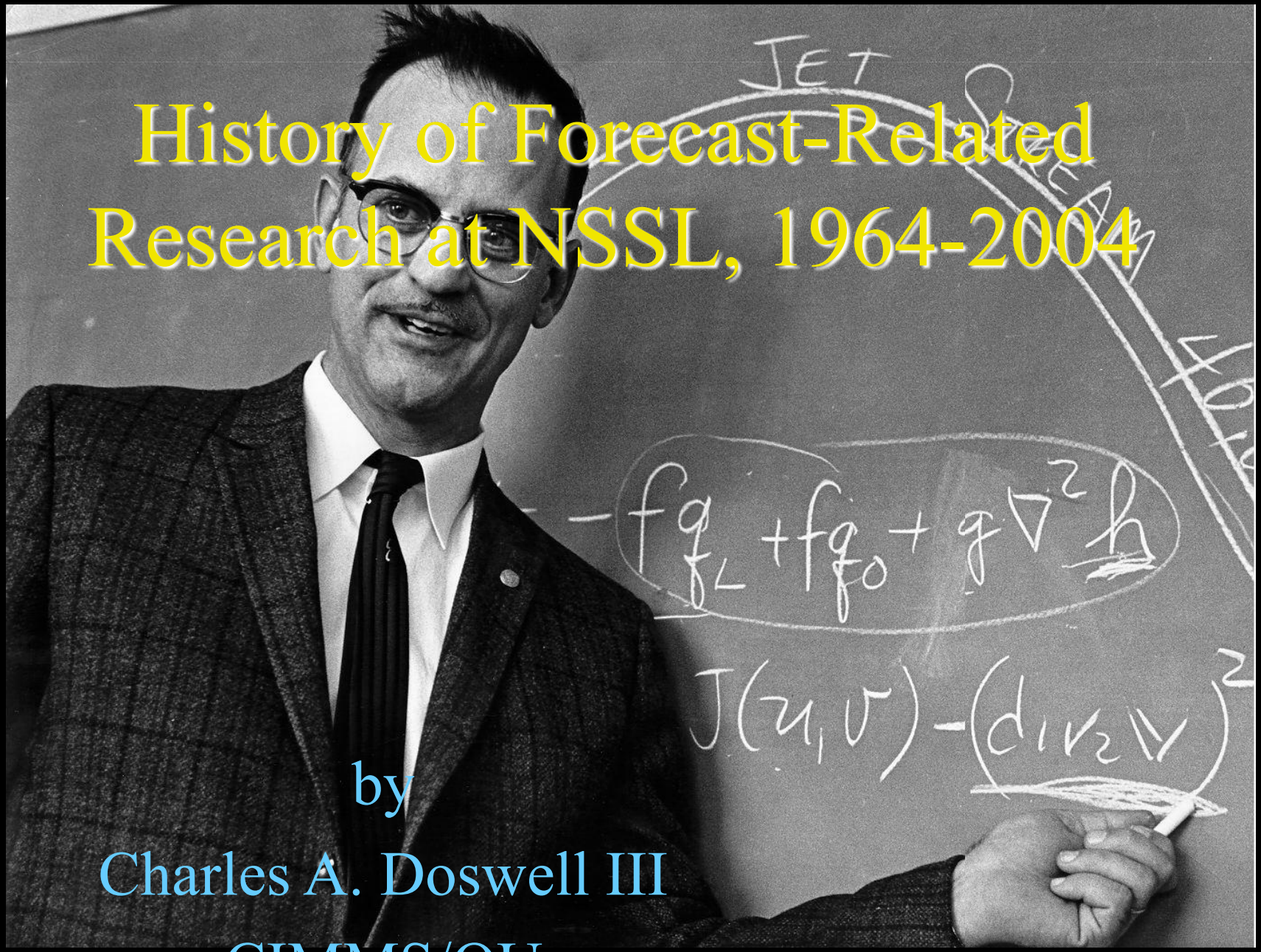
History of Forecast-Related Research at NSSL, 1964-2004



by

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What does "forecast-related" mean?

- *Any* research contributing basic physical understanding is *potentially* relevant to forecasting
- A "warning" is really a *forecast* - one with a short lead time
- At NSSL currently and in the past, forecast and warning research have been distinct within the organizational structure

The Current NSSL Mission Statement

- *The mission of the National Severe Storms Laboratory (NSSL) is to enhance the National Oceanic and Atmospheric Administration's (NOAA) capabilities to provide accurate and timely forecasts and warnings of hazardous weather events (e.g., blizzards, ice storms, flash floods, tornadoes, lightning, etc.)*

- *The NSSL accomplishes this mission, in partnership with the National Weather Service (NWS), through a balanced program of research to advance the understanding of weather processes, research to improve forecasting and warning techniques, development of operational applications, and transfer of understanding, techniques, and applications to the NWS and other public and private sector agencies.*

Key concepts, as used here

- Connection to NWS operations
- *Forecasting* R&D as a distinctly separate topic from NSSL's warning-related work (primarily radar-associated research, engineering, and technique development)
- Research and technique development using operational tools - *not* field program data

Some pre-NSSL historical background

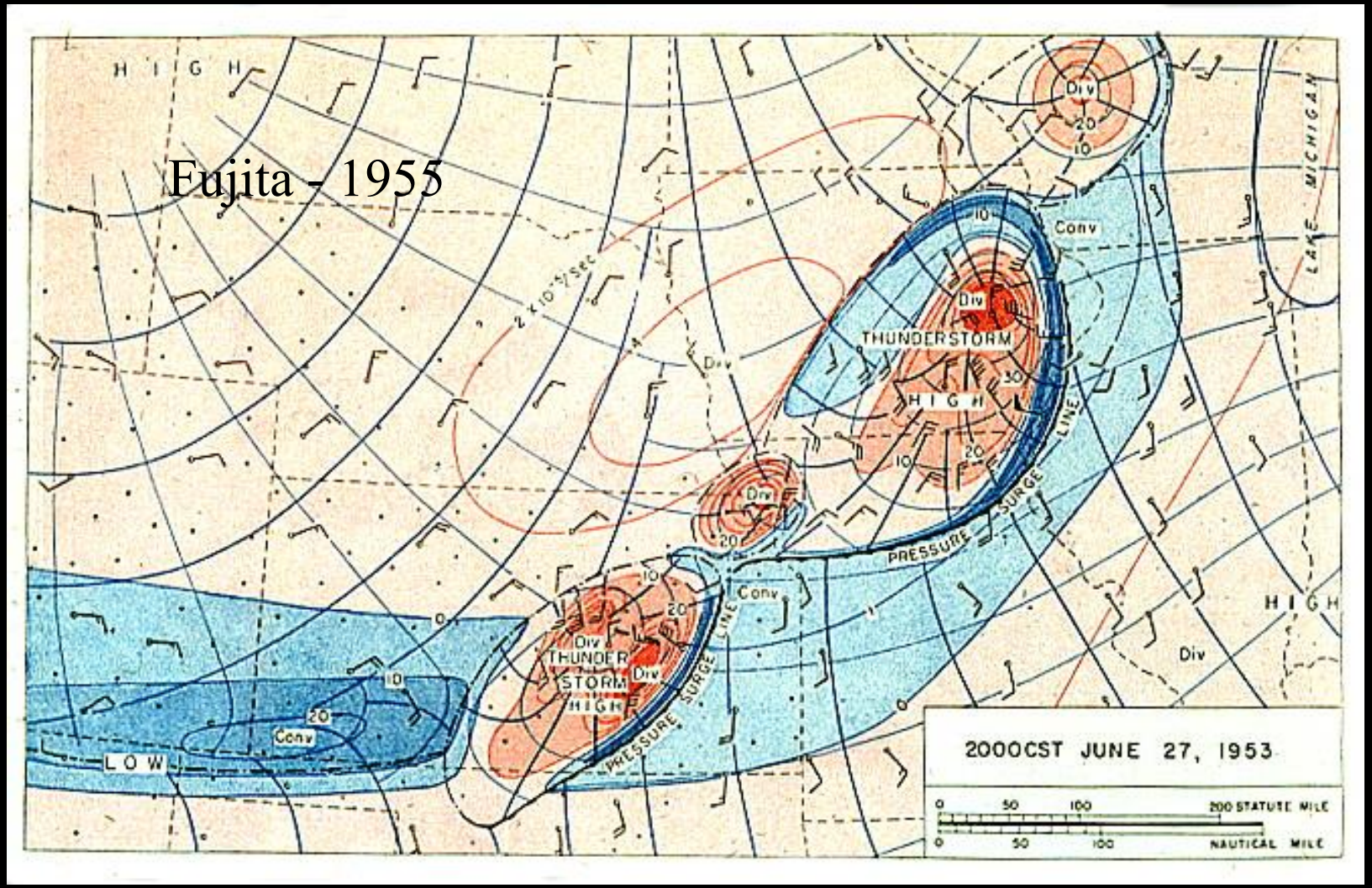
- Fawbush & Miller forecast of 1948 re-started tornado forecasting in U.S.
- Formation of the Severe Local Storms unit (SELS) in 1952/1953
  - Relocated from Washington, D.C., to Kansas City, MO in 1953
  - Don House became supervisor in 1953 - recognized a need for forecast-related research
  - SELS *Internal* research program - formalized as National Severe Storms Project (NSSP)

NSSL's Roots

- NSSP researchers increasingly alienated from operational SELS forecasters - shift work!
- Moved to a *different floor* in the building from the SELS forecasting unit in 1958
- Field operations
  - Tornado research aircraft
  - Mesonetwork (H. Wexler, M. Tepper, T. Fujita)
  - Weather Radar (WRL in Norman)

Tornado Research Project P-51

Weather Bureau Mesonetwork



Selected alumni of SELS-NSSP

- Dansy T. Williams
- Chester Newton
- Clayton Van Thullenar
- Jean T. Lee
- James Fankhauser
- Robert G. Beebe
- Charles F. Chappell

Creation of NSSL

- Exodus of research-oriented staff from SELS/NSSP to Norman (and elsewhere)
- NSSP Spring program came to be centered around WRL in Norman - NSSP moved in 1963, NSSL created in 1964
- NSSL Director, Ed Kessler, emphasized development of weather radar, particularly Doppler radar, for use in storm research - mostly related to the warning problem

Summary: Pre-NSSL

- Research originally an internal component of the operational arm
- A schism developed as a result of individual clashes and shiftwork
- Research drifted away from the forecasting side
- Ultimately embodied in physical separation

Events at SELS

- 1965 - Allen Pearson replaces Don House - focused on dissemination of forecasts, *not* forecast-related research - after 11 April "Palm Sunday" tornado outbreak
- 1974 - "Super" tornado outbreak on 3 April - Pearson later requests creation of research unit at SELS for operational forecasting-related research
- 1976 - Formation of Techniques Development Unit (TDU) - Joe Schaefer (Chief), Les Lemon, and Chuck Doswell are NSSL "alumni"

Techniques Development Unit ... 1976

Bull. Amer. Meteor. Soc., vol. 57, p. 1038

Forecast-Connected R&D: 1964-1982

- Jim Fankhauser studied storm motion in relationship to upper winds - NSSP TM 21 (1964)
- Fankhauser and Chester Newton developed a probability-based storm forecasting method - NSSP TM 22 (1964)
- Stan Barnes developed his objective analysis scheme for surface observations - *JAM* (1964)
- Barnes considered the sources for supercell rotation in the environmental wind profile - NSSL TM 38 (1968)

- Fankhauser studied storm-environment interactions - NSSL TM 39 (1968)
- Rex Inman (OU) developed objective methods for operational radiosonde error detection and correction at SELS - NSSL TM 40 (1968)
- Inman worked with Horace Hudson to implement operational low-level moisture convergence diagnostic for SELS - NSSL TM 45 (1970)
- Barnes enhanced his methods for surface objective analysis - NSSL TM 62 (1973)

- Chuck Doswell developed band-pass filtering analysis of *operational* surface data using the Barnes scheme - NSSL TM 79 (1976)
- Many NSSL staff participated in a multifaceted study of the 24 May 1973 Union City tornado - NSSL TM 80 (1976)
- Carolyn Kloth and Bob Davies-Jones explored the relationship between tornado occurrence and the 300 mb jet stream - NSSL TM 88 (1980)
- Regular forecasting support for spring field operations - D. Burgess, C. Doswell, J. Weaver, et al.

Summary: 1964-1982

- Maintained physical separation between researchers and forecasters
- Individual scientists worked on topics related directly to forecasting
- New approaches evolved
  - *Doppler radar
  - Numerical cloud simulations
  - *Storm chasing (personal and scientific)

Developments at SELS/NSSL

- Fred Ostby named NSSFC Director - 1980
- Bob Maddox named NSSL Director - 1986
  - New emphasis on *operationally-oriented* forecasting research, nationwide
  - Enhanced collaboration with NWS/OUN and SELS
  - NSSL mission broadened to include other hazardous weather (e.g., winter weather, flash floods)
- PRE-STORM 85, DOPLIGHT 87, MAP 88/89, STORMTIPE 92 - projects with an experimental forecasting component

Operations-Connected R&D: 1982-1993

- *Experimental Forecast Center* (loosely patterned after original SELS/TDU) - several spring projects, typically operated from NWS/OUN
  - Experimental forecast products in addition to regular field experiment operations support
  - Multiple agency participation, including SELS and other guest forecasters
  - New approaches to severe weather forecast verification

Research relating to NWP

- Diagnosis of model output - Mark Antolik/ Chuck Doswell
- Mesoscale model initialization (cold pools), updated land use data input for boundary layer (Dave Stensrud)
- Short-range ensemble forecasting methods - (Harold Brooks, Stensrud)
- STORM-TIPE - Brooks, Doswell, {Lou Wicker}
- Thermodynamic retrievals - Carl Hane

Process-related research

- Dryline processes - Conrad Ziegler, Hane
- Flash floods - Doswell, Brooks, Phillip Spencer, Stensrud
- Tornadoes - Bob Davies-Jones, Brooks, Doswell
- Storm-environment interactions - Brooks, Doswell, Jeremy Cooper
- MCSs - Dave Jorgenson, Hane, Ziegler

Technology and methodology

- Profiler data analysis - Doswell, Phillip Spencer, Laurie Hermes
- Severe weather climatology - Brooks, Doswell
- Satellite data applications - Bob Rabin
- Lightning data - Ron Holle, Raul Lopez, Dave Rust, Don MacGorman, Doswell
- Forecast verification - Brooks, Doswell

Summary: 1983-1993

- Increased emphasis on research relevant to forecasting
- Development of closer ties between NSSL and SELS/NSSFC
- *Experimental Forecast Center* concept used to test ideas in a pseudo-operational mode

SELS/NSSL Developments 1994 - Present

- VORTEX Project - 1994/95
- SELS becomes the Storm Prediction Center (SPC) and Joe Schaefer named SPC Director - 1995
- SPC completes move to Norman - 1997
- Jeff Kimpel named NSSL Director - 1997
  - Emphasis on intra-Norman collaboration (the Norman Weather Center)

Forecast-related research 1994-present

- Derecho studies - Stensrud, Mike Coniglio
- Severe weather forecast parameters - Brooks, Doswell, Jeff Craven, Erik Rasmussen
- Analysis methodology - Spencer, Doswell
- Storms and Storm-Environment Interaction - Rasmussen, Lou Wicker, Xiegler, Hane, David Dowell, Ted Mansell, et al.
- Probabilistic forecasting - numerous

- NWP related research
  - Diagnosis of model output - Jack Kain, Mike Baldwin
  - Land use and initialization - Stensrud, Todd Crawford, Brooks, Stensrud, Xu, et al.
  - Ensemble forecasting - Stensrud, Brooks, Kim Elmore, Paul Nutter, Matt Wandishin, Mike Baldwin

- Winter weather - Dave Schultz, John Cortinas
- Synoptic and mesoscale processes - Schultz, Doswell, Ziegler, Hane, Jorgensen, et al.
- New technology and methodology - numerous
- Daily weather discussion with SPC
- SPC/NSSL Spring projects

Summary: 1994-present

- Tremendous growth in forecast-related research
- Development of numerous diverse collaborations outside of the traditional SELS-NSSL connection
- Reunion of severe storms forecasting and research in Norman
- Norman Weather Center

Overall Summary

- The Research-Forecasting (R-F) relationship has a checkered history
- The founding of NSSL was associated with a period of minimal R-F interaction
- The need for forecast-related research has *always* been present
- NSSL scientists have been associated historically with important research related to forecasting

- The reunion of the SPC with NSSL is a clear indication that *the old breach between research and forecasting has been healed*
- A measure of that is the rapid growth of R-F collaboration at NSSL/SPC
- The current explosion of forecast-related research at NSSL is likely to be fueled even more with the move to the Norman Weather Center on the OU campus