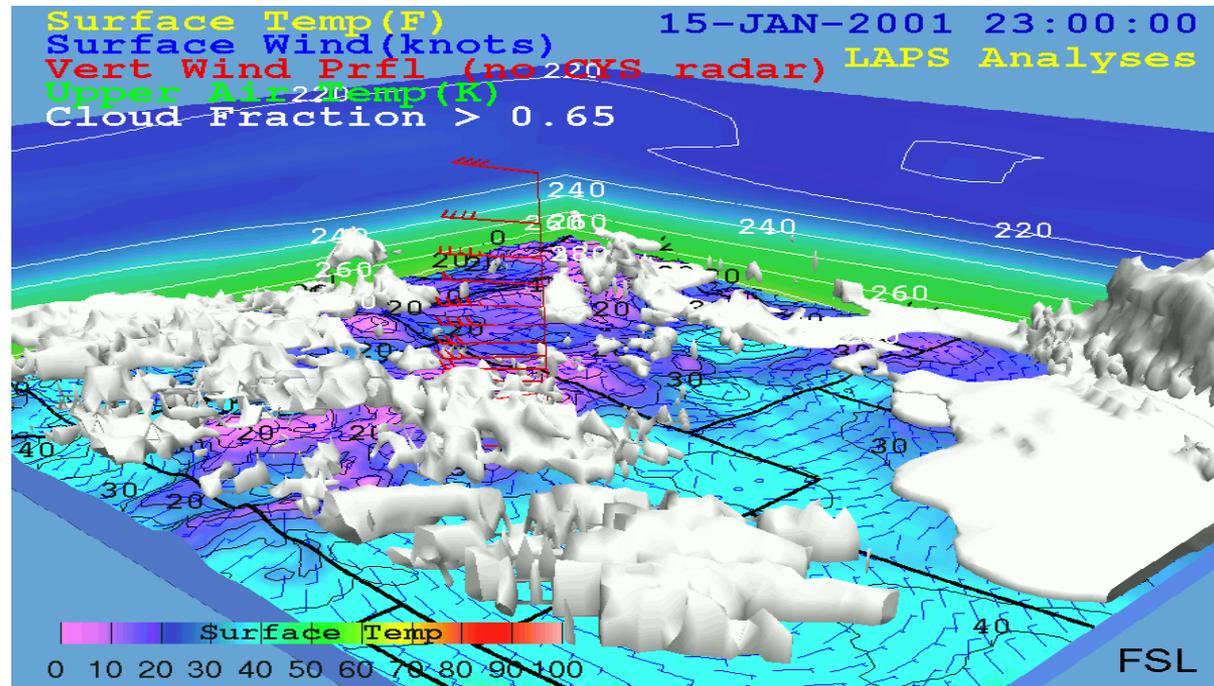


# 2<sup>ND</sup> LAPS USER WORKSHOP

Zoltan Toth

Global Systems Division  
NOAA/OAR/ESRL



Acknowledgements:  
Forecast Applications Branch



23-25 October 2012, Boulder, CO

# OUTLINE

- Welcome returning and new participants
- LAPS user base
- LAPS scientific impact
- Review major recommendations from 1<sup>st</sup> Workshop
- Expectations from 2<sup>nd</sup> Workshop

# LAPS USER BASE



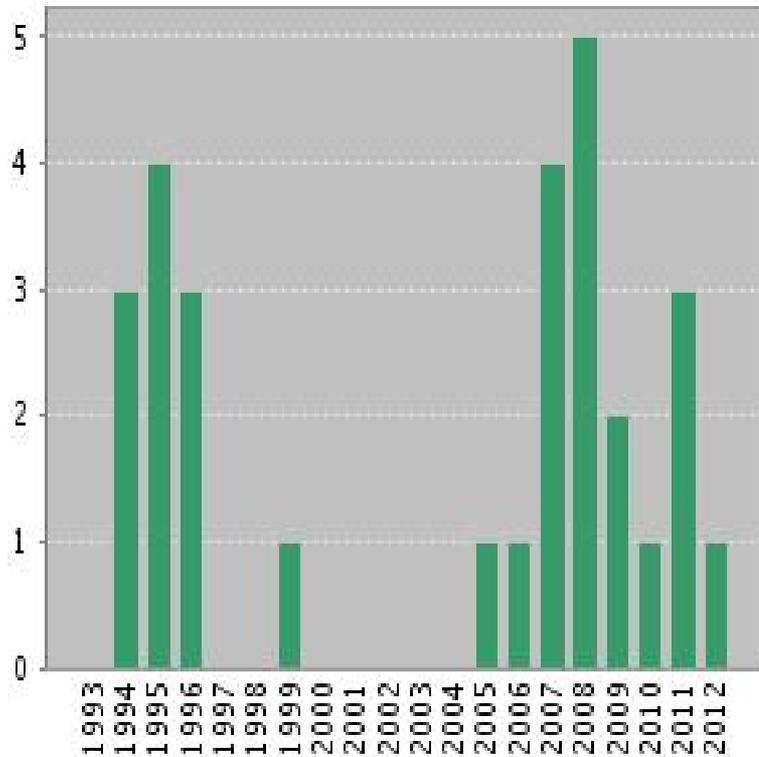
LAPS Downloads: Less than six months ago ● Less than two years ago ● More than two years ago ●

Forecast Centers, NWS AWIPS and Non-US (squares) ■, ■, etc  
Distributor locations (triangles) ▲, etc

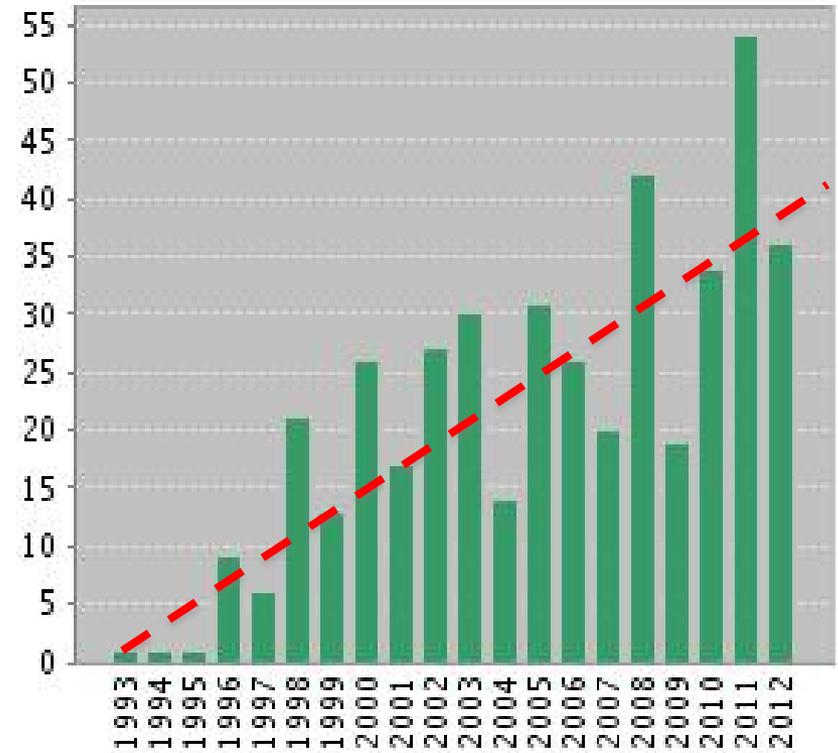
- **NOAA**
  - ~120 WFOs (via AWIPS), ARL, NESDIS
- **Other US Agencies**
  - DHS, DoD, FAA, CA DWR, GA Air Qual.
- **Academia**
  - Univ of HI, Athens, Arizona, CIRA, UND, McGill
- **Private Sector**
  - Weather Decision Tech., Hydro Meteo,
  - Precision Wind, Vaisala, Telvent
- **International agencies (10+ countries)**
  - KMA, CMA, CWB, Finland (FMI), Italy, Spain,
  - BoM (Australia), Canary Islands, HKO,
  - Greece, Serbia, Nanjing Inst. of Met.

# LAPS SCIENTIFIC IMPACT – REFEREED PAPERS

## Published Items in Each Year



## Citations in Each Year



- **30 refereed publications** by GSD/NOAA
  - 1-2 refereed papers per year

- **391 citations** in refereed papers
  - *~ 40 / year recently*

# LAPS SCIENTIFIC IMPACT – ALL PUBLICATIONS

## LAPS NOAA, local analysis and prediction system

– Query period: 1989 - 2012-10-11

• **432 Papers**

• **4163 Citations**

– Cites/year: 181.00

– Cites/paper: 9.64/0.0/0 (mean/median/mode)

– Cites/author: 1975.61

– Papers/author: 221.50

# 1<sup>ST</sup> LAPS WORKSHOP SUMMARY



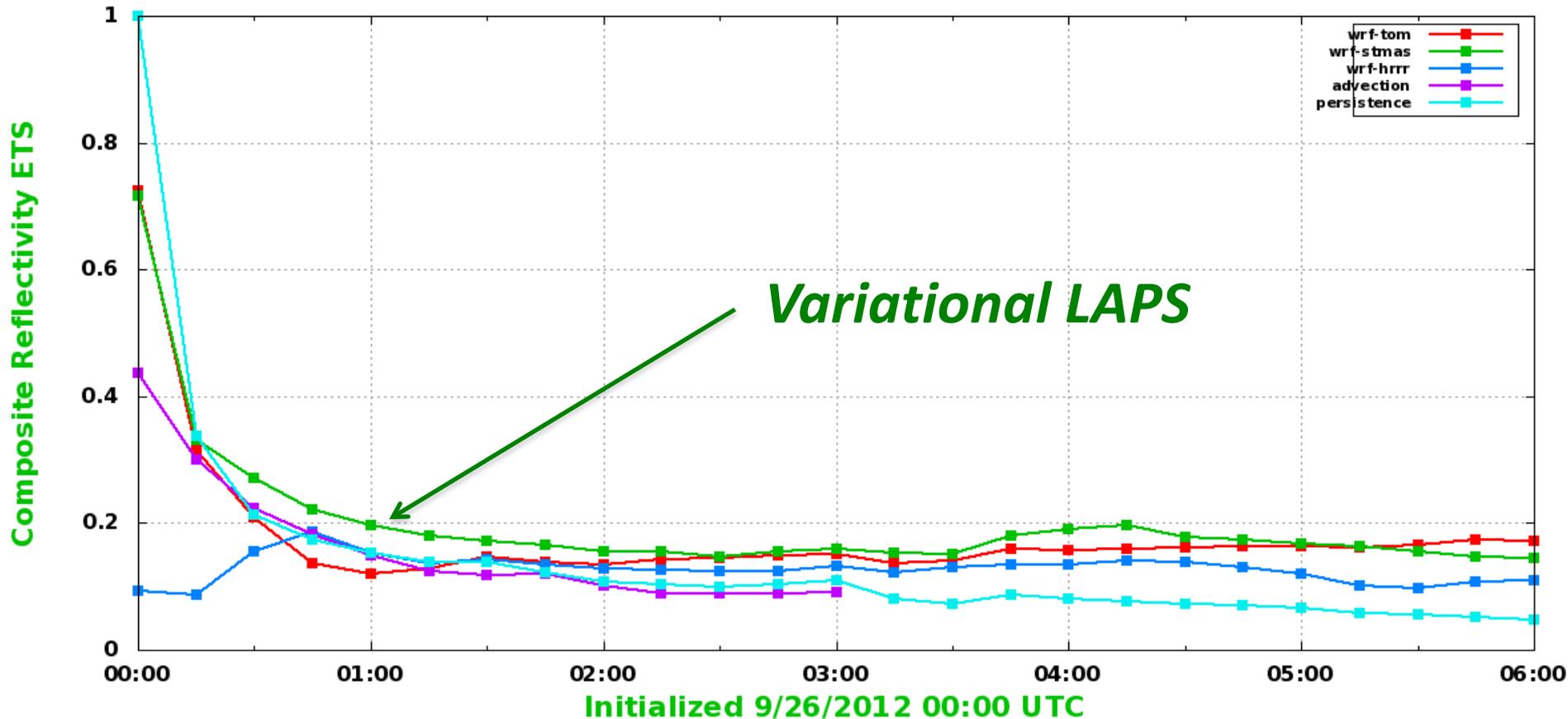
Oct. 25-27 2010, ESRL, Boulder, CO

# MAJOR RECOMMENDATIONS

- Continue development of LAPS
  - Situational awareness
    - Flow/terrain dependent surface analysis
    - HMT assessment
  - Warn-On-Forecasting
    - Variational humidity analysis
    - Radiance assimilation
- Further enhance unique features of LAPS
  - Fine scale, very rapid update, highly portable, easy to use
    - Transition to AWIPS2
    - Enhanced portability – observations
    - Improved parallelization

# WARN ON FORECASTING (WOF) – ARE WE GETTING THERE?

Composite Reflectivity 30dBZ ETS (laps conus domain)



- On occasion, *variational LAPS* superior to *advection* and *persistence*

# EXPECTATIONS FROM WORKSHOP

## *Interaction with and feedback from community*

### •LAPS users

- Tell us what's not working and what's working
  - Change control based on rigorous assessment with user input

### •LAPS developers

- Feed back your improvements to community system
  - Use revision control to allow community development
  - Part of NOAA DA repository

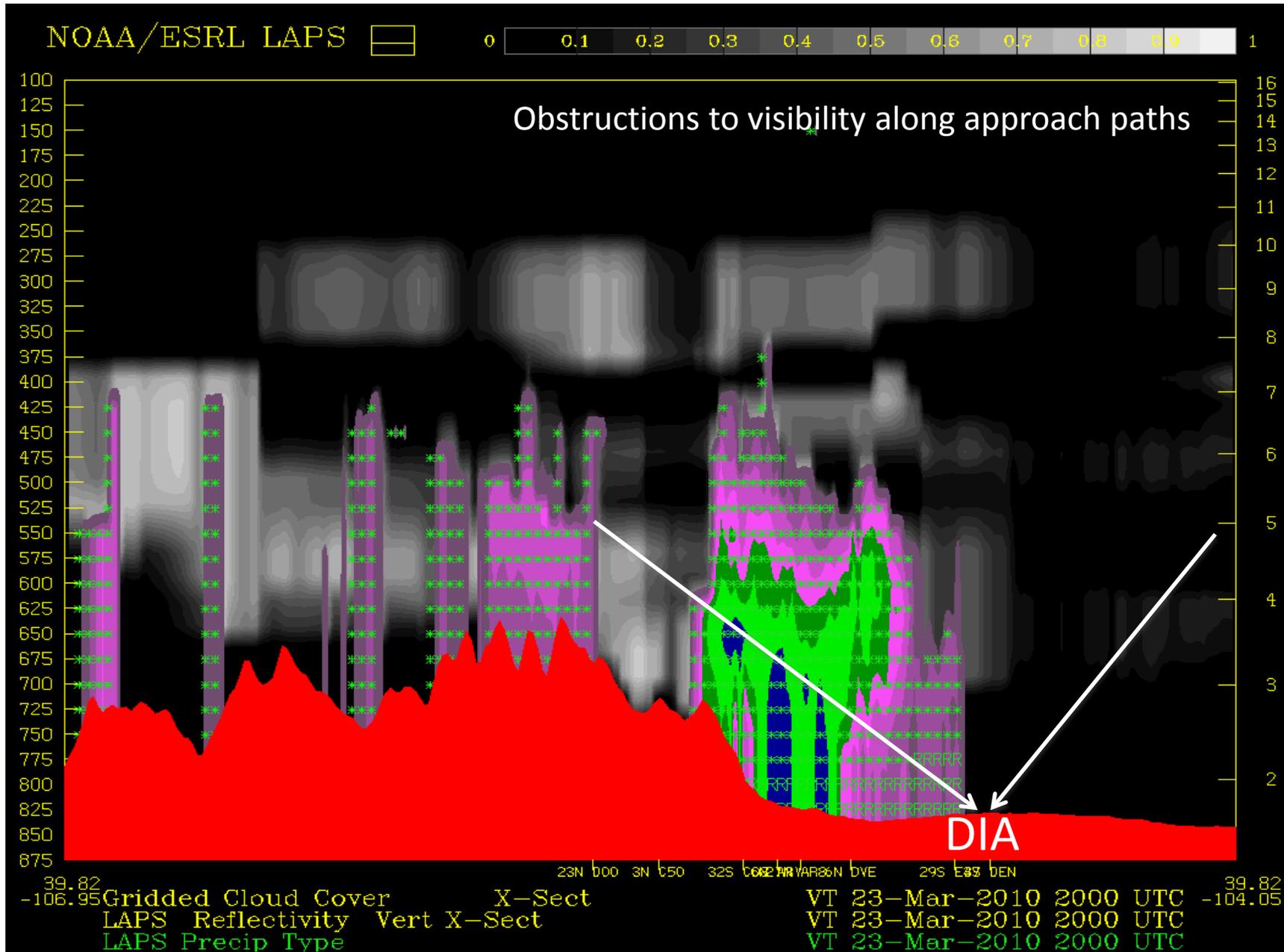
### •Broader DA research community

- Advise us on potential improvements
  - We consider all available research to build best performing system possible

# BREAKOUT GROUP TOPICS

- **Scientific opportunities** for further development
  - Fully variational multiscale DA approach
  - Dynamical constraints consistent with WRF
- **Use of LAPS**
  - User feedback
  - Change control management
    - Test & evaluation
    - Role of NWS
- **Collaboration / data / software**
  - Shared algorithm / software development
  - Software to digest new types of data
  - LAPS repository

# Cloud / Reflectivity / Precip Type (1km analysis)



**BACKGROUND**

# BREAKOUT GROUP DISCUSSIONS

- 3 topics
  - LAPS research / development opportunities
  - LAPS software design, collaboration tools, data ingest
  - Use of LAPS
- 2 sessions – you can switch topics, sign up for both sessions
  - Wedn 3-5 pm
  - Thurs 1:20-3:20 pm
- Breakout groups report back in plenary after each session
- Plenary discussion Thurs pm
  - Workshop recommendations

# BREAKOUT GROUP 1

## *LAPS research / development opportunities*

Yuanfu Xie, Yong Hee Lee, notetaker: Seth Gutman

- Variational **cloud analysis** / moist initialization / hotstart
- **Dynamical constraints**
  - Consistency with model dynamics & physics (microphysics, etc)
- **Land surface DA**
- **Error variance estimation**
  - Analysis – use independent observations
  - Observations
  - First guess (incl covariance – ensembles)
  - Variational QC part of LAPS?
- Choice of **First Guess** (cycling)

# BREAKOUT GROUP 2

## *LAPS software design, collaboration tools, data ingest*

Steve Albers, Brent Shaw, notetaker: Ligia Bernardet

- **Rules of engagement for collaboration**
  - Feed back off-site development to common repository
  - Give credit to external developers (co-authorship, etc)
  - Do not redistribute codes
- **Code repository**
  - One or two for LAPS?
  - Link with /use of other repositories (CRTM, NOAA DA repository, etc)
- **Use revision control**
  - New types of observational data
  - Dual polarization radar, etc
- **New types of observational data**
  - Dual polar radar, radiation measurements, etc
  - Make interfaces part of LAPS repository?
  - How to promote exchange of data / metadata (AMS committees?)
- **Code parallelization** – needs of various users?
- **Role of verification in LAPS package**
  - Link with LAPS data interfaces / QC?
  - Link with community tools (MET)?

# BREAKOUT GROUP 3

## *Use of LAPS*

Hongli Jiang, Brian Motta, notetaker: Kirk Holub

- **User needs / requirements / requests?**
  - Quality, ease of use, AWIPS2 interfaces, etc
  - AWIPS2 needs / missing functionality?
- **Change control management**
  - Formal assessment of 1-2 upgrades per year
    - Quantitative assessment of quality – current vs proposed version
      - Comparison with RTMA?
    - Subjective evaluation by NWS forecasters
    - Near real-time tests over CONUS for 2-4 wks?
      - Hourly analysis, 4/day 0-6 hr forecast?
  - Make variational LAPS default option now?
    - After documentation prepared/distributed?
    - Stop traditional, accelerate variational version development
- **Strengthen link with user groups**
  - Set up LAPS user advisory group?
    - NWS focal point(s) from each region – formal evaluation, feedback
- **LAPS in various testbeds**
  - HWT
  - Satellite proving ground

**BACKGROUND**

# CITATION RESULTS

Results found: 30

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Sum of the Times Cited [\[?\]](#): 428

Sum of Times Cited without self-citations [\[?\]](#): 391

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Citing Articles [\[?\]](#): 348

Citing Articles without self-citations [\[?\]](#): 331

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Average Citations per Item [\[?\]](#): 14.27

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h-index [\[?\]](#): 10

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# SUMMARY & RECOMMENDATIONS

Fine scale LAPS analyses and forecasts are widely used for

- Situational awareness
- Warn-On-Forecasting

- Continue development and support of LAPS
  - Serves a unique need within NWS, private sector, and internationally with 150+ total users worldwide

Unique combination of features

- Fine scale, very rapid update, highly portable, easy to use

- Further enhance unique features of LAPS

LAPS analysis system