Warner Internship for Scientific Enrichment (WISE)

Educational Materials for the Analog Ensemble Technique

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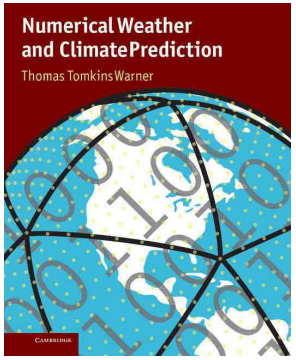
Project Summary

WISE Proposal

- Target audience
  - Upper level undergraduate students / Graduate students

- Develop approachable, concise teaching material on the AnEn technique including
  - Educational reading
  - Presentation slides for teaching the material
  - Lab: Hands on computing exercise



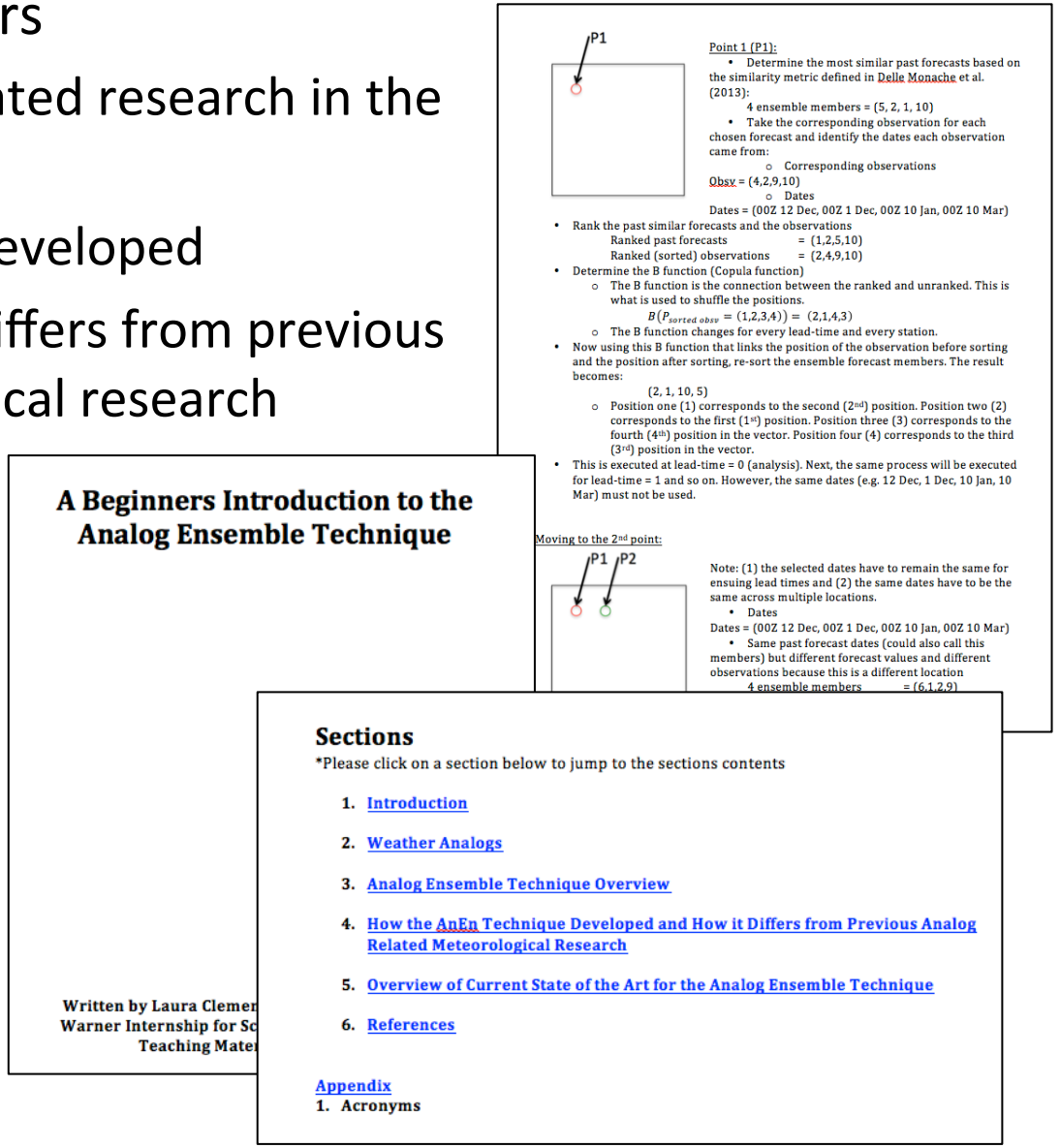
- Present this material to visiting undergraduate students

Ties to graduate student ASP work

- Increase understanding of the point based AnEn technique
- Investigate a smart means of extending the search space for the point based AnEn technique
- Develop a spatially aware similarity metric for the AnEn technique

Educational Materials

- Educational Document covers
  - Brief history of analogs related research in the weather community
  - How the AnEn technique developed
  - How the AnEn technique differs from previous analog related meteorological research
  - How the technique works
  - Overview of the current state of the art applications of the technique



P1

Point 1 (P1):

- Determine the most similar past forecasts based on the similarity metric defined in Delle Monache et al. (2013):
  - 4 ensemble members = (5, 2, 1, 10)
- Take the corresponding observation for each chosen forecast and identify the dates each observation came from:
  - Corresponding observations

Obsv = (4,2,9,10)

  - Dates

Dates = (00Z 12 Dec, 00Z 1 Dec, 00Z 10 Jan, 00Z 10 Mar)

- Rank the past similar forecasts and the observations
  - Ranked past forecasts = (1,2,5,10)
  - Ranked (sorted) observations = (2,4,9,10)
- Determine the B function (Copula function)
  - The B function is the connection between the ranked and unranked. This is what is used to shuffle the positions.

$$B(P_{sorted\ obsv} = (1,2,3,4)) = (2,1,4,3)$$

  - The B function changes for every lead-time and every station.
- Now using this B function that links the position of the observation before sorting and the position after sorting, re-sort the ensemble forecast members. The result becomes:

(2, 1, 10, 5)

  - Position one (1) corresponds to the second (2nd) position. Position two (2) corresponds to the first (1st) position. Position three (3) corresponds to the fourth (4th) position in the vector. Position four (4) corresponds to the third (3rd) position in the vector.
- This is executed at lead-time = 0 (analysis). Next, the same process will be executed for lead-time = 1 and so on. However, the same dates (e.g. 12 Dec, 1 Dec, 10 Jan, 10 Mar) must not be used.

Moving to the 2nd point:

P1 P2

Note: (1) the selected dates have to remain the same for ensuing lead times and (2) the same dates have to be the same across multiple locations.

- Dates

Dates = (00Z 12 Dec, 00Z 1 Dec, 00Z 10 Jan, 00Z 10 Mar)

- Same past forecast dates (could also call this members) but different forecast values and different observations because this is a different location
  - 4 ensemble members = (6,1,2,9)

A Beginners Introduction to the Analog Ensemble Technique

Written by Laura Clemer
Warner Internship for Sc
Teaching Mate

Sections

*Please click on a section below to jump to the sections contents

1. Introduction
2. Weather Analogs
3. Analog Ensemble Technique Overview
4. How the AnEn Technique Developed and How it Differs from Previous Analog Related Meteorological Research
5. Overview of Current State of the Art for the Analog Ensemble Technique
6. References

Appendix

1. Acronyms

Educational Materials

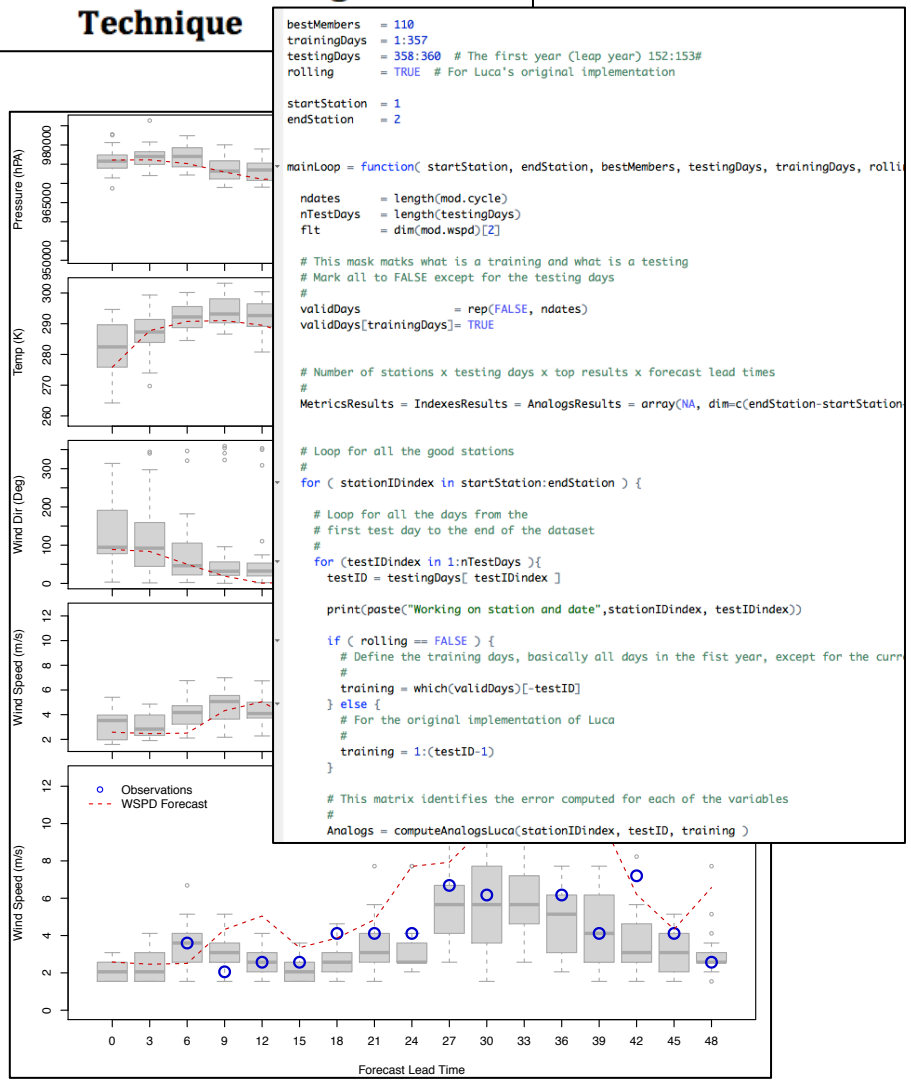
- Slides for teaching

- Lab Exercise
  - Hands on computing exercise experiments which help to understand analog selection, number of ensemble members, and training size
  - Stand alone R code that allows students to experiment with parameters

- Handout
  - Summary of previous research and applications using the AnEn technique

A Beginners Introduction to the Analog Ensemble Technique:

Hands on Exercise with the Analog Ensemble Technique



What's next ?

- RAL Seminar on the Analog Ensemble Technique
  - Tuesday, 25 July at 1pm (FL-2-001)

    Come learn about the AnEn!

- Obtain feedback from seminar, revise materials accordingly, provide revised version this Fall 2017 for Dr. Cervone's undergraduate course

- Fall 2017 Course Offerings at PSU will be using this material
  - Dr. George Young (undergraduate): Portions of this material will be used
  - Dr. Guido Cervone (undergraduate): This material will be expanded for a 2.5 hour class session

Thank you for the opportunity!

Special thanks to Dr. Sarah Tessendorf, Dr. Luca Delle Monache, and Dr. Sue Haupt!

Questions?