SOUTH AFRICAN WEATHER SERVICE

Regional Training Centre

Numerical Weather Prediction: Operational Applications

Learner Guide

Compiled by: Elelwani Phaduli
(SAWS)

Date of last revision:
March 2023

Document Control

Version and Amendment Schedule

Version	Version Date	Author	Description of Amendments
1	2 April 2012	Stephanie Landman	Document created
2	4 April 2013	Stephanie Landman	Document updated
3	20 March 2014	Stephanie Landman	Document updated
4	30 April 2015	Stephanie Landman	Document updated
5	1 February 2016	Stephanie Landman	Document updated
6	15 April 2016	Teke Ramotubei	Document updated
7	29 September 2016	Teke Ramotubei	Document updated
8	26 March 2017	Stephanie Landman, Lee-ann Simpson and Teke Ramotubei	Document updated
9	11 April 2017	Stephanie Landman and Lee-ann Simpson	Document updated
10	14 May 2018	Lee-ann Simpson	Content updated for 2018 course
11	28 March 2019	Stephanie Landman	Review and minor changes for 2019 course
12	25 April 2020	Stephanie Landman	Adapted for online teaching
13	8 March 2021	Elelwani Phaduli	Document updated
14	April 2023	Elelwani Phaduli	Document updated

Compliance Schedule

Compliance Type Checked	Compliance Approved by:	Responsibility	Signature	Date of Compliance Approval
Documentation Compliance	Ms. S.L. Mkatshwa	QMS Delegate		10/05/2023

Approval and Control Schedule

Approved By	Designation	Responsibility	Signature	Date Approved	Copy Status
Dr. W. Jordaan	Senior Manager: RTC	Course coordinator: SAWS		10/05/2023	E

NWP: Operational Applications

This module is an introduction to theory and applications of different numerical weather prediction models in operation at the South African Weather Service, their known behaviour and how they can be utilised in support and guidance to issue a forecast. The training is divided into two sections:

- Section A - NWP theory of global, regional and convective scale models. The theory also includes a review of honours degree work.
- Section B - NWP applications. Practical work on comparing different model outputs and the current state of the atmosphere, discussion on what information can be gathered through these comparisons and possible adjustments to be made before use in issuing a forecast. **This section will be covered in the forecasting practical modules (Aviation, Marine and Public weather forecasting practicals).**

The theoretical assessments will be done throughout the study period while the practical assessments will be covered in the forecasting practical tasks. All the relevant information needed to be known about the lecturers, continuous assessment, final assessment and final mark allocation can be found in the sections that follow:

LECTURERES RESPONSIBLE:

THEORY **:** Ms Elelwani Phaduli

PRACTICAL **:** Mr Jannie Stander

CONTACTS:

Elelwani Phaduli : Elelwani.phaduli@weathersa.co.za
:(012) 367 6200

Jannie Stander : jannie.stander@weathersa.co.za

Tel : (012) 367 6018

MARK ALLOCATION:

SEMESTER MARK:

Theory tasks will be given during the block week of lectures, during which feedback will be given.

Quiz : 20%

Assignment : 20%

Semester Test :60%

EXAMINATION MARK:

Exam will consist of a written theory for which mark allocation will be as follows.

Theoretical Exam :100%

FINAL MARK:

Semester Mark :50%

Examination Mark :50%

PASSING GRADES AND ASSESSMENTS

- All required tasks need to be completed and submitted.
- To qualify to write the exam a semester mark of at least 40% should be achieved.
- If the learner fails a theoretical exam with a mark between 40 – 49%, a re-exam will be granted.
- Only one re-exam will be allowed.
- The subject is failed if the final mark is less than 50% or if the exam mark is less than 50%.

LEARNING ASSUMED TO BE IN PLACE:

BSc Hon's in Meteorology/Pure BSC with 1 year Bridging Course including WKD 704 Numerical Weather Prediction – Applications/Agrometeorology covering the following topics:

- The process of observing the atmosphere and creating an initial atmospheric state for a Numerical Weather Prediction (NWP) model

- The fundamental aspects regarding NWP models, including different types of models.
- Post processing of numerical model output into a useable format for forecasters
- How to optimally use NWP model forecast guidance.
- Understand the dynamics and physics of NWP models.
- Basic verification and evaluation of objective and subjective forecasts

REQUIRED KNOWLEDGE

At the commencement of the course the learner should

- Be computer literate.
- Have a good command of the English language both written and oral.
- Have a basic understanding of numerical weather prediction processes.
- Have a basic understanding of limitations and uncertainties in numerical weather prediction.

LEARNING OUTCOMES:

Each training day has an outcome and subject matter to cover for the day which will ensure that the outcome is successful. Every afternoon of the first five days will cover the practical application of the theory covered in the morning.

Day 1: Learner will be able to utilize internal and external webpages to navigate between different NWP forecasts.

- Revision of honours WKD704 course.
- Introduction to Numerical Weather Prediction Modelling.
- NWP guidance is interpreted in order to produce subjective short- and medium-term forecasts.
- Introduction to the SAWS internal NWP suite:
    - Regional modelling – in-house models and displays.
    - Global model forecasts – global centres and websites.

Day 2: The learner will be able to evaluate NWP output against real time observational data.

- Introduction to available observational data.
- Verification or Evaluation of NWP forecasts.

- Discuss process to be followed to determine quality of NWP forecast.
- Statistical downscaling methods.
- Discuss procedure to be followed to work with model strength and or weakness.

Day 3: Learner will be able to interpret NWP output to determine the predictability of the atmospheric motion.

- Short-range products are interpreted in order to provide guidance for weather forecasting.
    - High temporal and spatial details are examined.
    - Specialised instability indices are explained.
- Medium-range products are interpreted to determine guidance for medium-range forecasts:
    - Differences between short-range and medium-range forecasts explained and discussed.

Day 4: The learner will be able to utilize Ensemble Prediction Systems (EPS) in order to indicate forecast uncertainty and probability of event. Learner will be able to issue event forecasts by interpreting ensemble output.

- Background to (EPS).
- Traditional EPS product output.
- EPS Products are explained (i.e. Meteograms, Box and Whisker Plots. EPS-grammes, etc.).
- Global Ensemble Forecast System (GEFS).
- Different types of EPS's are explained.
- Poor-man's ensemble.
- Convective Scale Ensemble Prediction System (MOGREPS).
- Short-Range Multi Model Ensemble Prediction System.

STUDY PERIOD

Determined by the roster.

ASSESSMENTS

- The learner is expected to complete all required tasks and assessments.
- The learner will complete a practical and a written examination.

LECTURE VENUE

Molalatladi, SAWS head office.