INTRODUCTION

- Agricultural production in South Africa is under rain-fed conditions in the semi-arid climate at a high altitude.
- Crops often suffer water deficit and water stress due to insufficient rainfall during growing season.
- Known gaps exist in technology transfer, including:
  - lack of climate outlook information and
  - lack of translation & interpretation - language & terminology used in advisories
- Main limitation to maize production is choice of planting dates due to low availability of accessible and accurate climate forecasts (Fisher et al. 2015).
- Hence, farmers need to know which decisions they make on a regular basis are dependent on which weather parameters.
- Therefore, important to assist farmers with agricultural information based on weather forecasts especially for planting decisions.

METHODS

- Held meetings with small-scale farmers & extension practitioners to assess needs of farmers about weather information for farming practices.
- Used this information to direct development of Agromet advisories following an action research methodology.
- After assessment of currently available weather forecasts & daily weather data, => decided to proceed with development of planting advisories & advice for spraying conditions for pests and diseases.
- Use medium-term weather forecast European Centre for Medium-range Weather Forecast (ECMWF) (https://www.ecmwf.int/en/forecasts) via South African Weather Service (www.weathersa.co.za) and HydroNet (https://www.hydronet.co.za/)
  - including, daily forecast of maximum & minimum air temperature, rainfall amounts, for 14 days on 15km grid across South Africa.
- Main maize growing areas of South Africa shown on map with long-term statistics for frost (0°C) calculated.
- Operation of knowledge engines (with agricultural criteria) were programmed in Python script,
- To access information from rainfall stations, weather forecasts & generate advisories for each grid cell across South Africa for each day.
- Information is transferred to HydroNet platform for distribution to AgriCloud mobile App (downloadable free from Google Play Store).
Main maize growing areas of South Africa shown on map.

- Long-term start & end dates for frost (0°C) calculated.
- Operation of knowledge engines (with agricultural criteria) were programmed in Python script.
- To access information from rainfall stations, weather forecasts & generate an output for each grid cell across South Africa for each day.
- Information is transferred to HydroNet platform for distribution to AgriCloud mobile App (downloadable free from Google Play Store).
- Or to be available via HydroNet platform by subscription.

Farmers’ requests for AgriCloud App
- With one-on-one questionnaire at Agromet information meetings
- Accessed several provinces in South Africa.
- About a third of rural small-scale farmers have access to an android smartphone.
- Mostly obtain weather information from radio or TV broadcasts (Phahlane et al. 2019).
- Farmers highlighted that currently available weather forecasts not for own locality.
- But know weather conditions, particularly rainfall, on own farms is different from stations reported.
- Farmers request more detailed weather forecast information for own location.
- They want to learn more about how to use such weather forecast information in their farming decisions.

Climate sensitive farm decisions
- This information drove researchers to investigate climate sensitive decisions in maize production farming systems used by dryland farmers in semi-arid areas.
- Leading to identification of few multifaceted processes in normal routine cropping programmes that are sensitive to variable climatic conditions.
- Including:
  - Critical stages in growth cycle of maize crop adversely affected by weather conditions.
  - Needs an intervention to be taken by such a farmer.
  - Just the knowledge is not helpful.
  - Also need some action that a farmer can take to change adverse effect of weather parameters.
- Develop criteria from historic climate data & a range of agricultural scientific studies with detailed information.

Knowledge engines
- All data sources & links to be identified.
- Gain access via negotiation with data owners.
- Steps are time consuming & laborious.
  - Much specific detail to be charted.
  - Use agreements negotiated.
  - Specific agricultural information formulated into knowledge engines.
  - Contains specific algorithms.
  - Relate farming decisions to weather parameters.
- In operation these are run on a daily basis to generate advisories from the current weather forecast information.
- Calculated on a grid across the country.
- Advisories accessed on 15km grid bases for each registered farmer.

Rollout use of AgriCloud App
- After beta test phase since May 2019.
- Rollout to extension practitioners & farmers across eastern summer rainfall part of the country via a number of workshops and training sessions.
- Steep uptake monitored by # downloads from the Google Play Store during first half of summer rainy season when rains were expected.

Monitoring success of AgriCloud App
- Return rates > 70%.
- Shows return to check planting information again.
- Younger farmers & extension workers = main users; mostly under 40 years old.
- Equal spread of both males (54%) & females (45%) using AgriCloud.

RESULTS AND DISCUSSION

RESULTS AND DISCUSSION

RESULTS AND DISCUSSION

RESULTS AND DISCUSSION

RESULTS AND DISCUSSION
Unique aspects of AgriCloud

1. AgriCloud advisories are available for a specific location selected by farmer on registration
   - Google type map to pinpoint exact location of farm.
   - Important feature as requested by farmers to be relevant for their farm locations.

2. Available in all 11 South African official local languages.
   - Distinct advantage to promote use in rural areas amongst semi-literate older community of small-scale farmers.
   - Select a preferred language to give info to farmers' mother tongue.

3. Information is updated on a daily basis.
   - Forecast advisory given for each day in upcoming 10 to 14 days.
   - Enables farmers to plan for their field operations more than a week in advance.
   - To check back closer to time for an updated forecast advisory.
   - Above implemented due to good testing of market prior to design & development.

Results and Discussion

Crowdsourcing

- A crowdsourcing mode is build-in
- For farmers & extension officers to provide feedback on the current weather conditions at their own farm
- Wind or rain or sunshine.
- In form of a selection of a simple pictorial record
- Focusing on weather hazards like thunderstorms, tornadoes, mist, frost, hail or flooding conditions.
- This collection of extreme weather conditions will help weather forecasting office to check their forecasts.

New Additions to Platform

- Wheat cultivar choice advisory (for seed purchase)
  - According to farm location in Western Cape
  - Last 5 years information from ARC-SG cultivar trials
  - Groups of cultivars according to yield potential.
  - Details of yields, protein content, hectolitre mass, 1000 kernel mass, Disease resistance or susceptibility etc
  - To be available in November 2019

- Heat Stress for cattle & poultry
- Bee hive management
- Heat units for crops

Conclusions

- Information needed by farmers is added to current weather forecasts on a routine basis to create agro-climate or Agromet advisories that address the specific farming systems in their own location.
- Agromet advisories are delivered by mobile app to supply farming relevant advice, in a local language on their phone in their hand and updated on a daily basis.
- Mobile Apps integrate information about cropping and livestock systems with current short-term and medium-term weather forecasts to give advice on decisions about planting and spraying to farmers for their specific farm location for the upcoming 2 weeks.

Acknowledgements

- Rain for Africa (R4A) Consortium Partners
- Netherlands Space Office for funding R4A project
- Thanks are expressed to all team members, farmers, and extension practitioners who contributed to the success of R4A project and development of AgriCloud App.
- Attendance at the ICID conference is funded through the University of the Free State, Bloemfontein, South Africa.
- Email: WalkerS@arc.agric.za