



# Renewable Energy Mapping

ESMAP Knowledge Exchange Forum – The Hague  
November 2013

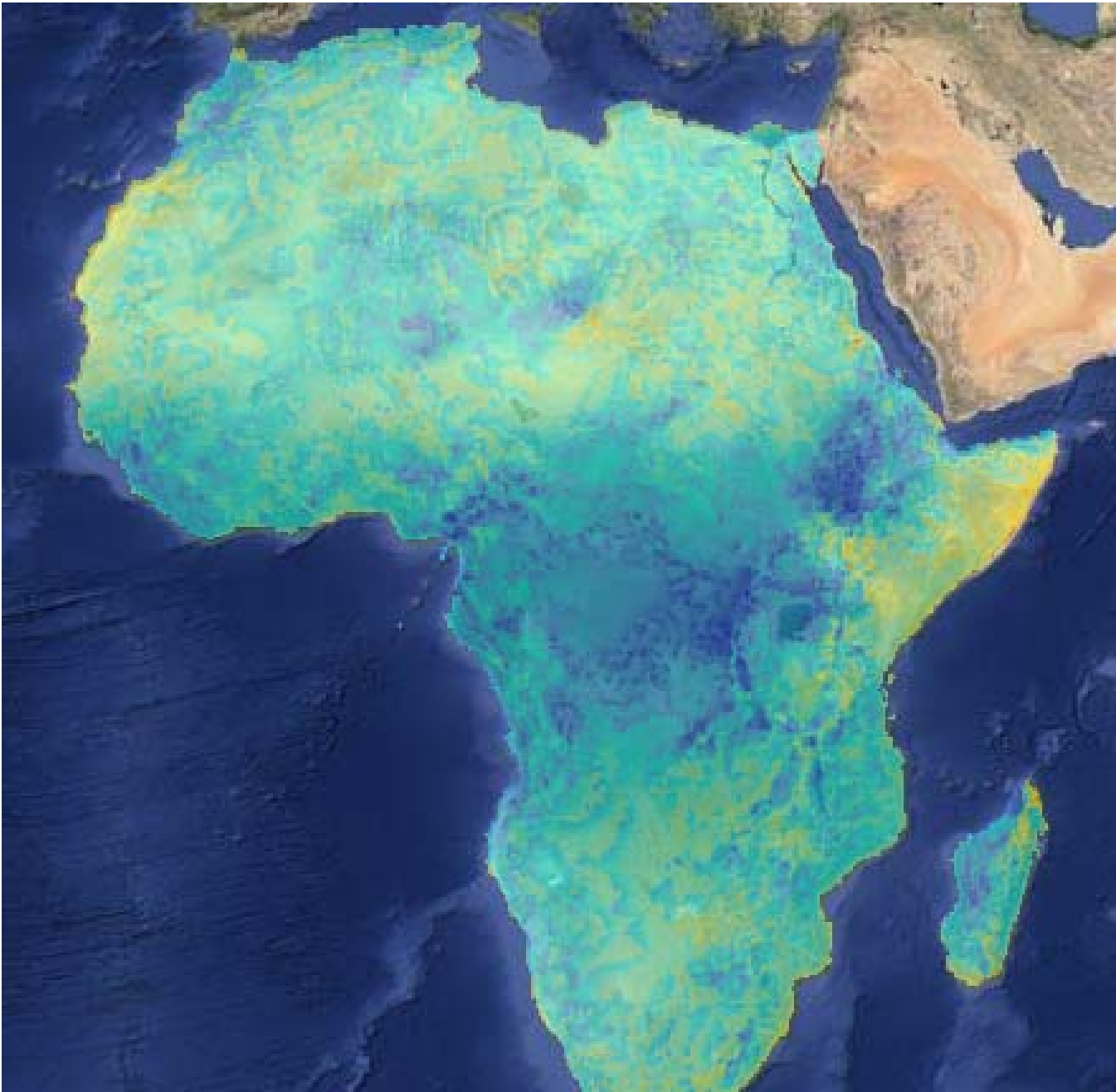
**Oliver Knight**

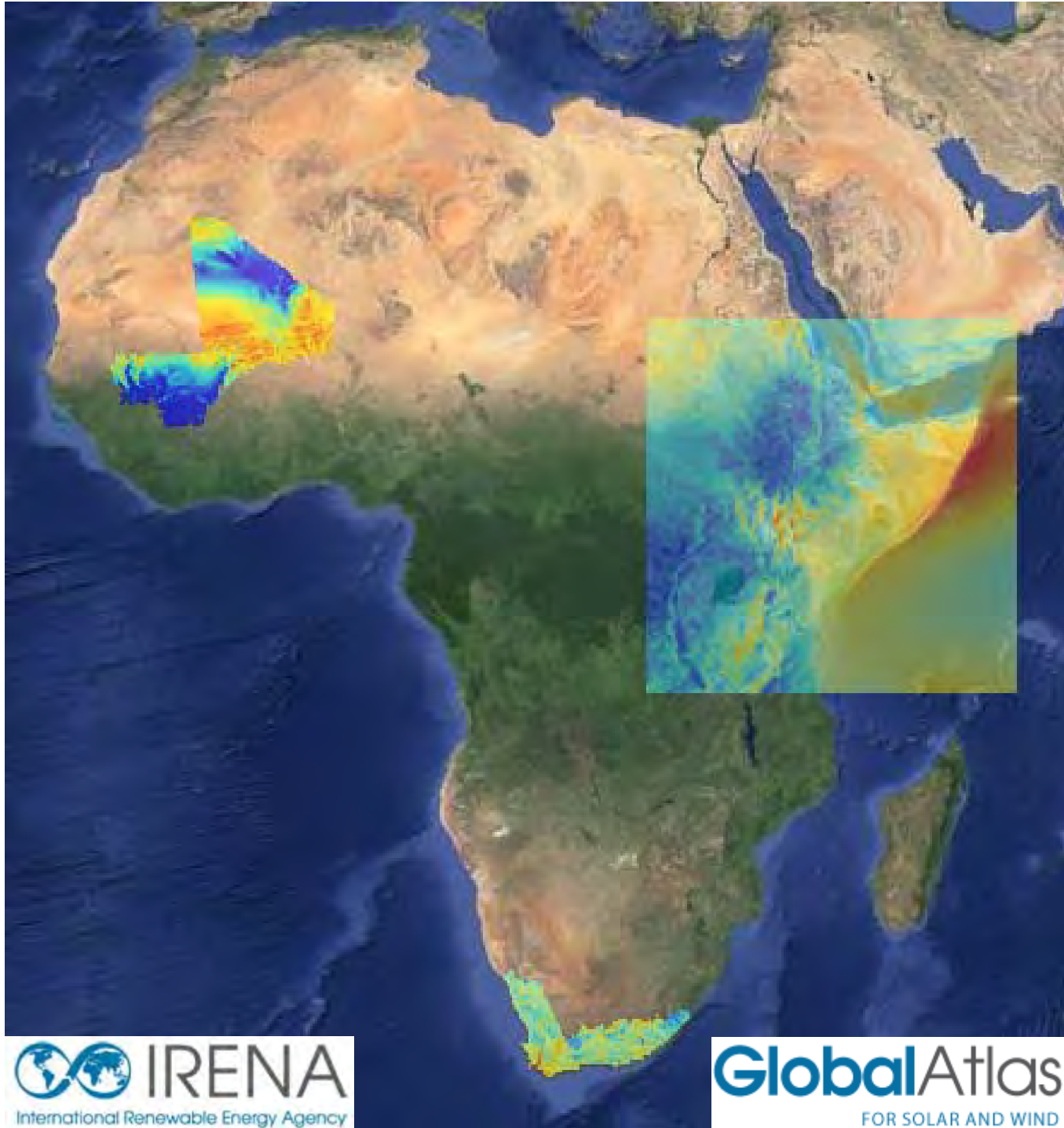
Senior Energy Specialist

Energy Sector Management Assistance Program (ESMAP)

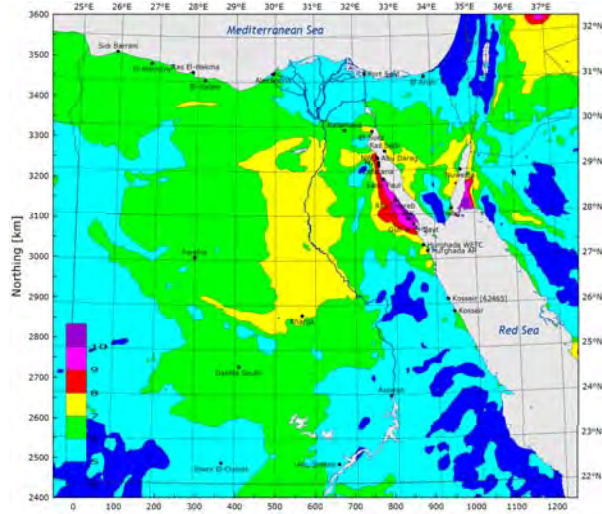
The World Bank

A BRIDGE TO A SUSTAINABLE ENERGY FUTURE

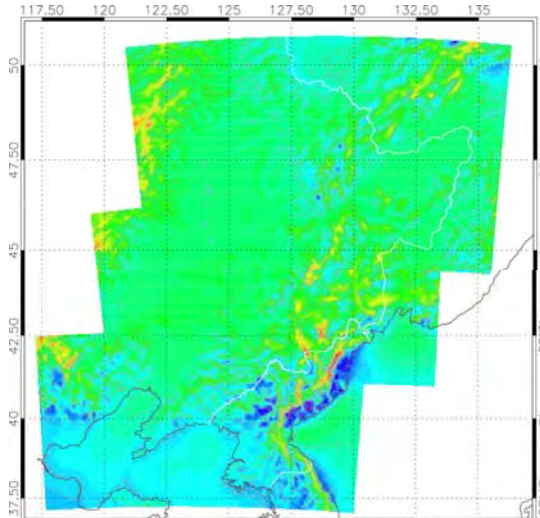
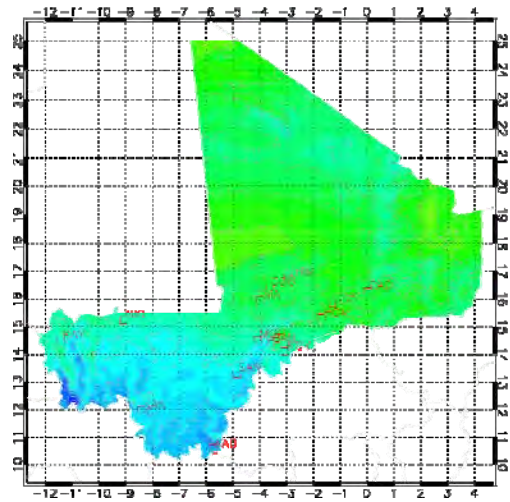




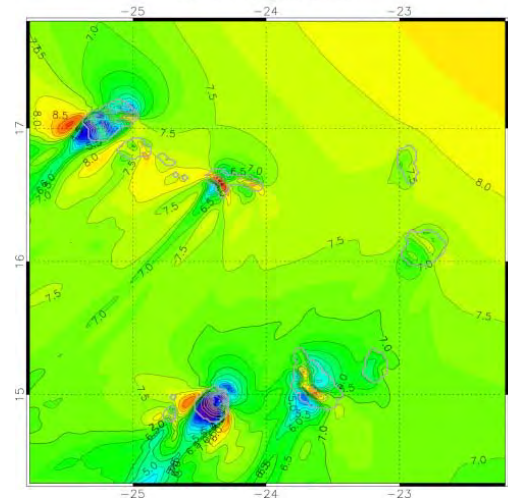
# Mesoscale modeling



Wind resource map of Mali: wind speed [m/s] at 50m a.g.l.  
V3575\_50\_latwa\_z50.75.wrm.u

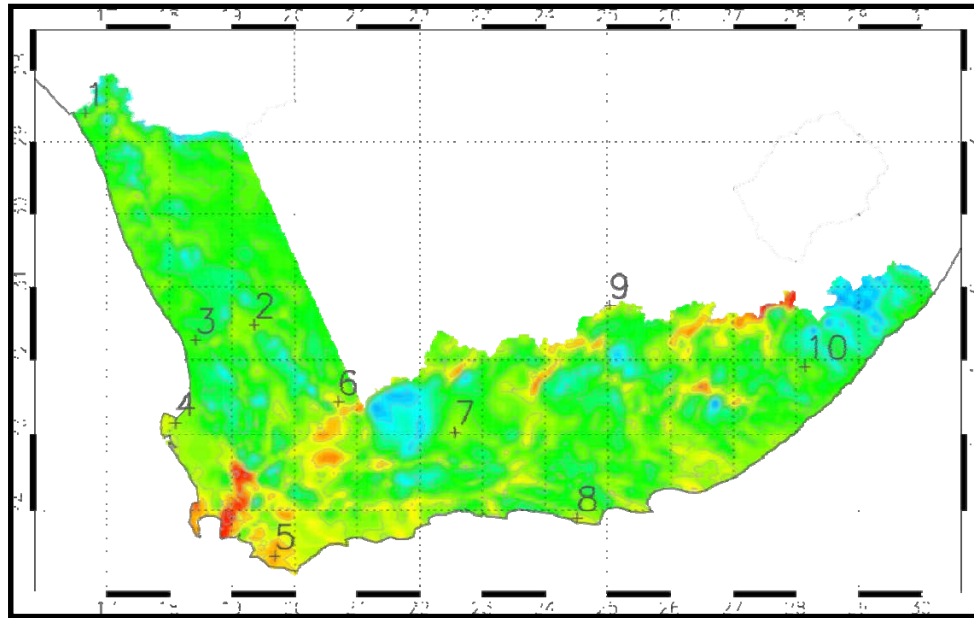


Cape Verde : mean simulated wind speed [m/s] at 50m a.g.l.  
cav25cc\_z50.2.5.wrm.u



Sources:  
 Egyptian Wind Atlas  
 Wind Atlas for Dongbei  
 Mali Wind Atlas  
 Cape Verde Wind Atlas

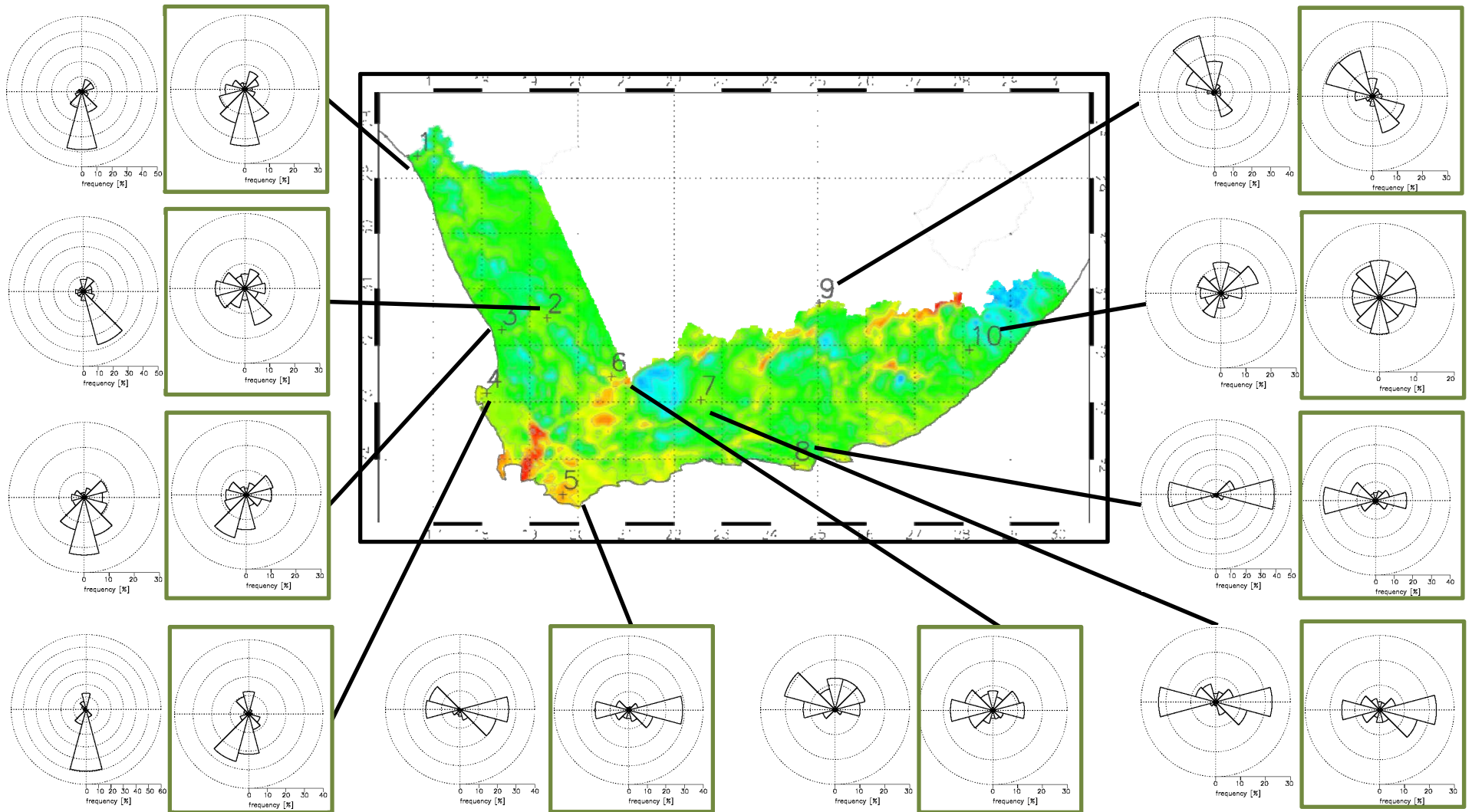
# Mesoscale modelling...only half the story





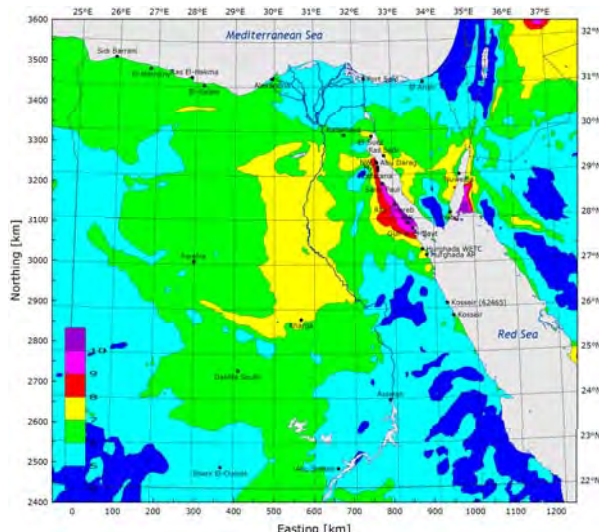


# Combine with verification ...makes a wind resource assessment



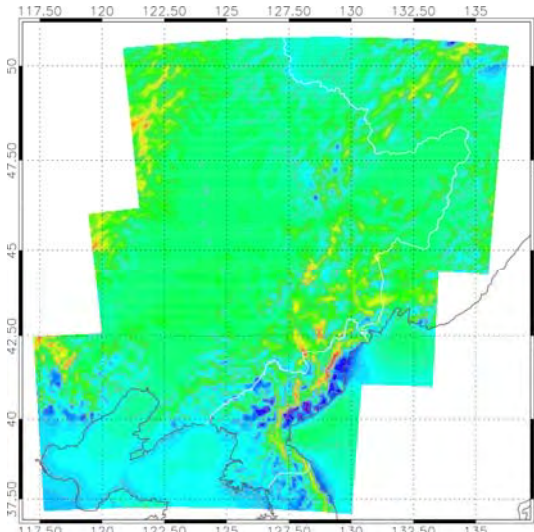
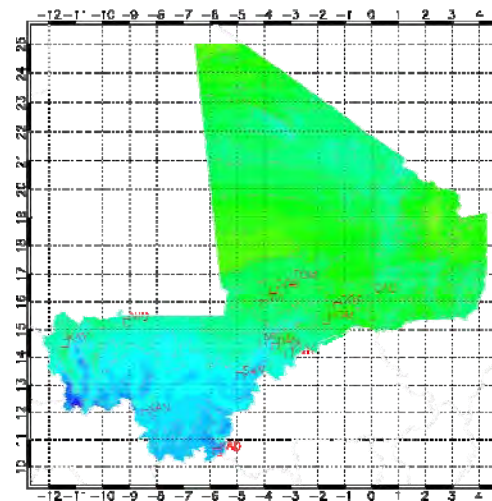
# Mesoscale modelling with uncertainty estimate of wind speeds

6.7%



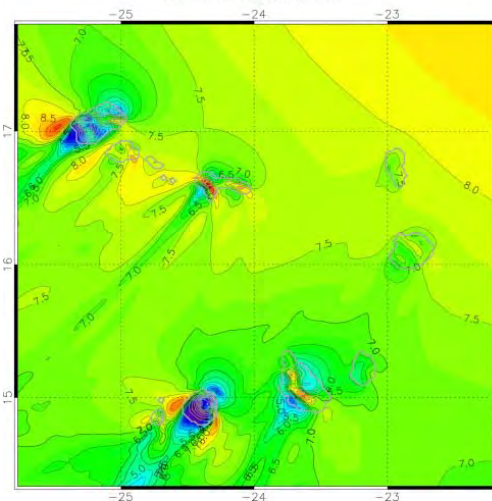
Wind resource map of Mali: wind speed [m/s] at 50m a.g.l.  
V357s\_50\_latwa\_z50.7.5.wrm.u.1

4.3%



Cape Verde : mean simulated wind speed [m/s] at 50m a.g.l.  
cav25cc\_z50.2.5.wrm.u

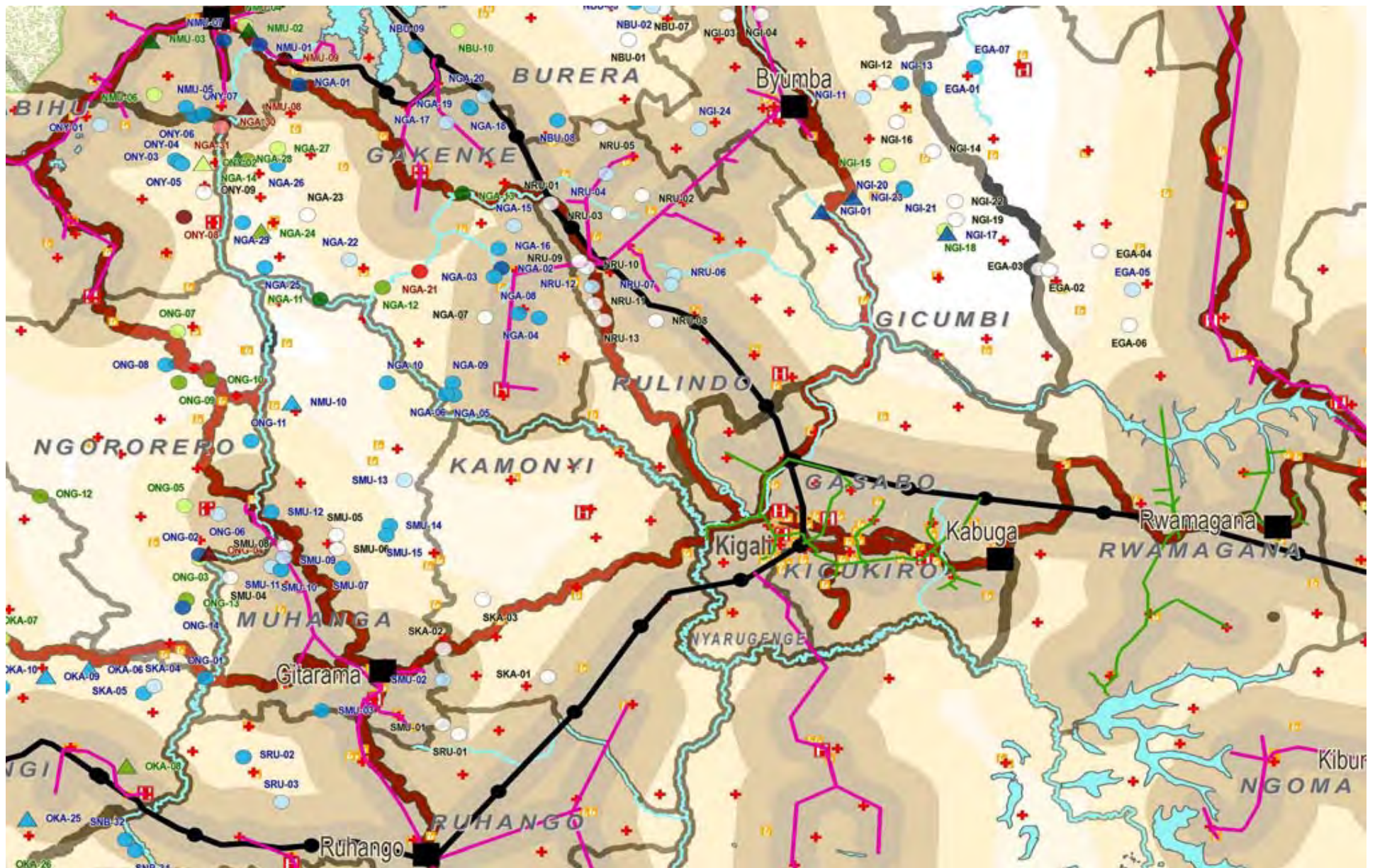
9.6%



5.6%

Sources:  
Egyptian Wind Atlas  
Wind Atlas for Dongbei  
Mali Wind Atlas  
Cape Verde Wind Atlas



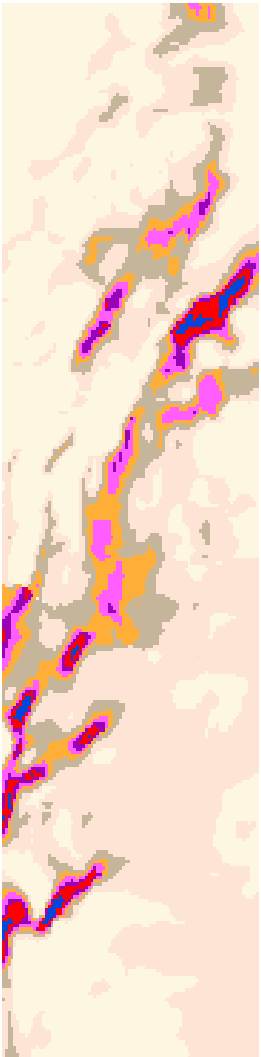




# RE Mapping Initiative



- Approved by CG in 2012
- Announced June 2013
- Initial budget of \$11.6m
- Nine country projects
- 10 mapping vendors



## **Governments**

- Better understand resource potential**
- Geospatial plan to guide development**
- Improved data for calculating feed-in tariffs**

## **Commercial Developers**

- Information on high potential areas**
- Government zoning reduces uncertainty**
- Source of validation data for site assessment**

## **Expert Community**

- Contribute to IRENA Global Atlas**
- Meteorological data useful for other purposes**
- Methodological and modeling improvements**





Coordinate with other donor-funded programs

Collect and generate geospatial data

Initial outputs inform WB-Client policy dialogue

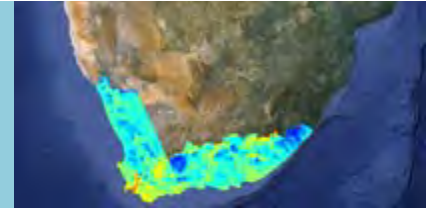
Provide training and capacity building

Build country and global partnerships

Disseminate via open data repository and GIS portal

Phase 1

Scoping and preliminary mapping output based on satellite and global atmospheric and meteorological data



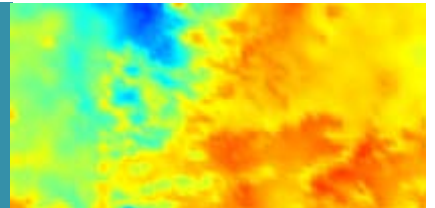
Phase 2

Ground-based data collection (12-24 months)



Phase 3

Production of validated resource atlas based on satellite and ground-based data



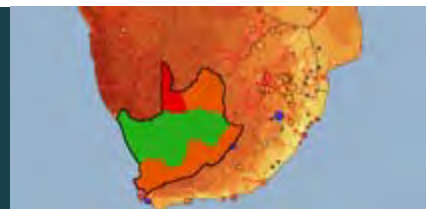
Phase 4

Geospatial planning (GIS) and strategic environmental assessment



Phase 5

Develop and agree policy framework to support investment





# Current ESMAP Pipeline

Country	Biomass	Small Hydro	Solar	Wind
Indonesia	✓	✓	✓	✓
Lesotho (IFC)				✓
Madagascar	✓	✓	✓	✓
Maldives			✓	✓
Pakistan	✓		✓	✓
Papua New Guinea	✓	✓	✓	✓
Tanzania	✓	✓	✓	✓
Vietnam	✓	✓	✓	✓
Zambia		✓	✓	✓

**Likely new additions:** Lebanon

**Waitlisted pipeline:** Morocco, Niger, Pacific Islands, Tunisia

**Possible interest also from:** Bangladesh, Honduras, Kazakhstan, Mongolia, Namibia, Nepal, Somalia, South Sudan

**WIND RESOURCE OF VIETNAM**

Mean Annual Speed at 20 Meters

